

Engineering sustainability as an association

The Asphalt Institute recently hired Dr. Chaitanya (Chait) Bhat, Ph.D., LCACP as the association's first Sustainability Engineer.

One major project for Chait (rhymes with kite) will be to collaborate with AI members and agencies to guide AI's efforts to update and enhance our Life Cycle Assessment (LCA) models for asphalt binders, binder additives and modifiers.

What is your educational background?

I moved to the United States in 2015 after completing the Bachelor of Civil Engineering in India. My initial pursuit was to get a Master's in Structural Engineering focused on the vertical construction domain and I did complete a good portion of coursework for the same. However, my interests turned towards the application of environmental sustainability principles on pavement infrastructure after I took a course named "Infrastructure Life Cycle Engineering." This course was then taught by my potential Ph.D. advisor Dr. Amlan Mukherjee who seeded the fundamentals of critical thinking for solving complex problems. I received my Ph.D. degree from Michigan Technological University in late 2020 after working on various projects funded by the Federal Highway Administration (FHWA) that focused on developing the building blocks to support green public procurement policies.

What drew you to pavement sustainability?

I developed the passion to become a civil engineer looking up to my father who worked mostly on the design



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and construction of buildings. Two causes specifically shifted my interests towards the transportation sector: first, the high correlation of social welfare and economic growth with the pavement sector and second, the environmental impacts from the pavement sector. The above-mentioned causes provide a classic case of anthropogenic development and I started researching on ways to overcome this trade-off problem to the best extent possible. Upon further research on pavement sustainability, my interests expanded to both upstream and downstream supply chains of the pavement sector such as upstream electricity and fossil fuel refining sectors and downstream pavement-vehicle interaction and recycling activities.

What are the methods available to assess sustainability in a quantifiable manner?

As per the FHWA, sustainability encompasses the metrics of performance, environmental impact, costs, and social impacts from a product. Performance has been extensively researched and discussed on, so I would not touch on that. Also, at this time, methodologies to quantify social impacts have not been scientifically substantiated and standardized. Hence, I would like to provide insights on the standardized methodologies used to quantify the aspects of cost and environmental impacts. Life Cycle Cost Analysis (LCCA) is an engineering economic analysis tool that allows transportation officials to quantify the differential costs of alternative investment options for a given project. Specifically, LCCA quantifies the “costs” incurred by agencies responsible for construction and maintenance of pavements and by users due to delays, crash and others. Life Cycle Assessment (LCA) is a standardized methodology as per International Organization for Standardization (ISO) to quantify the “potential environmental impacts” from extraction and production, transportation, use and end of life stages of a product. Specifically, pavement LCA quantifies the “potential environmental impacts” from material extraction and production, transportation, construction, use, preservation, maintenance & rehabilitation, and end of life of pavement construction materials. An Environmental Product Declaration (EPD) is a third-party verified claim on the potential environmental impacts from a product. EPDs are currently being required to be submitted by material producers to inform on the various environmental metrics either post bidding or during bidding by public procurement policies. The difference between a cradle to gate (material extraction, production, and transportation) LCA and EPD is the rigor associated with the development of the latter. While an LCA is an intrinsic part of developing EPDs, an LCA by itself does not display the credibility associated with a reliably developed EPD.



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What topics do you look forward to researching in the future?

In my current role as a sustainability engineer at the Asphalt Institute, I am looking to lead projects identifying sustainable pathways from both upstream and downstream supply chains of the asphalt binder. This would support the Asphalt Institute members to display the innovations in crude oil extraction, refining and asphalt binder production processes and adhere with the top-down environmental sustainability initiatives being passed at the state and federal

levels. Potential research topics include updating Asphalt Institute's 2019 LCA study, supporting the development of a system that would enable each member to credibly communicate the potential environmental impacts from their products without compromising with their proprietary data, supporting research that would quantify energy, emission, and economic savings from the use of asphalt binder as a pavement material. In addition, I look forward to collaborating with National Asphalt Pavement Association (NAPA) on initiatives pertaining to the sustainability and resilience of pavements. ▲