Mechanical Engineering Department Seminar

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1130 Mechanical Engineering
111 Church Street SE, Minneapolis, MN 55455

Mitigating Near-Road Air Pollution with Green Infrastructure: From Science to Practice

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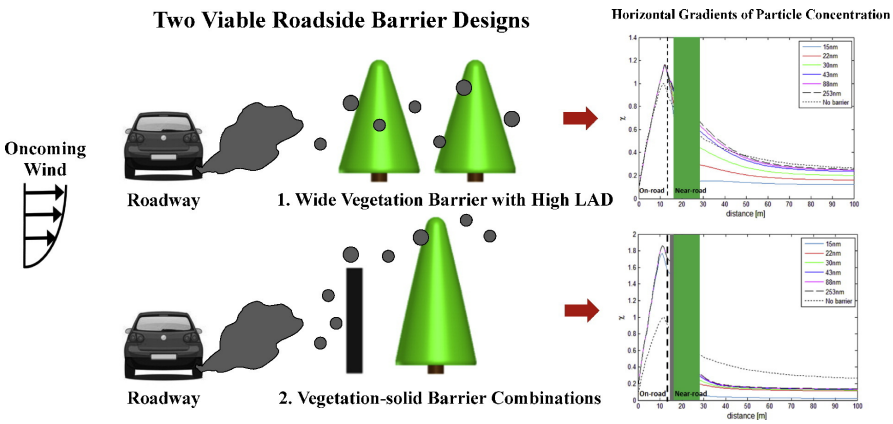
As epidemiological and toxicological studies worldwide have linked human exposure to traffic-related air pollutants near roadways with a wide range of adverse health effects, near-road air pollution is a widespread public health concern. While emission control technologies and programs to directly reduce air pollution emissions (referred to as "active" mitigation) are vital components of air quality management, a considerable amount of research has been carried out to identify, develop and evaluate "passive" mitigation strategies (solid barriers, porous barriers, alterative roadway configurations, etc.) to reduce exposure to near-road air pollution. This talk presents our research efforts in science-driven transportation green infrastructure (GI) designs as a passive mitigation strategy. Our goal is to create a predictive model to optimize GI designs to reduce near-road concentration of ultrafine particles, black carbon, NOx and other major pollutants. Based on computational fluid dynamics coupled with aerosol dynamics and gas chemistry, our simulations have identified two viable design options: 1) vegetation–solid barrier combinations, i.e., planting trees next to a solid barrier and 2) aerodynamically structured vegetation barriers. The common features of the two design options are to promote vertical mixing and enhance deposition. The research results have been incorporated into an EPA guideline on tree planting next to freeway. Through community engagement, the proposed design options are currently being implemented in a large-scale greening project in in Louisville, KY, with as many as 8,000 trees to be planted in four communities over the next five years.



Bio: Dr. Max Zhang is an associate professor at Sibley School of Mechanical and Aerospace Engineering, Cornell University. He received his PhD in Mechanical Engineering from UC-Davis. Dr. Zhang's research areas reside on the nexus of energy and environmental system engineering, and currently focus on passive mitigation of air pollution, renewable energy planning, and sustainable heating solutions in cold climate. Several of his recent publications on those topics have been rated as "Highly Cited Paper" by Web of Science. His research and community engagement efforts have been recognized by a number of local and national awards. Dr. Zhang currently serves on the Faculty Advisory Council and the Public Engagement Council, advising Engage Cornell, a $150 million initiative to establish community engagement and real-world learning experiences as the hallmark of the Cornell undergraduate experience.