Summary:
The aging infrastructure, increasing traffic demands, and changing climate will have a detrimental impact on the sustainability and resiliency of transportation infrastructure. A majority of current transportation infrastructure research assumes free flow traffic conditions, which significantly underestimates the impacts of traffic delays. Furthermore, the current transportation system design is driven by economics and in-place policies, while environmental impacts are rarely discussed. In light of the limitations of previous studies, we seek to provide a holistic understanding of the transportation system operation using dynamic and prognostic traffic and environmental assessment models. Such models will incorporate realistic traffic flow conditions and operational alternatives to capture the economic and environmental impacts of traffic delays.

This project is designed to implement/develop the state-of-the-art traffic flow model, which allows assessment of realistic traffic conditions and a holistic understanding of both environmental and economic impacts associated with traffic delays. The project scope will include development/implementation of a traffic flow model based upon a detailed historical data obtained from the Massachusetts Department of Transportation, including delays due to road maintenance, peak hourly volume, and other hypothetical scenarios will be simulated. The model developed using the above described approach could improve the accuracy of transportation infrastructure operational impact estimations and guide future sustainable transportation management.

Being part of developing the proposed model and assessment, a student fellow will gain valuable insights into systems thinking and sustainable design as applied to transportation infrastructures. The skills learned through this project will bring the student to the forefront of complex systems modeling and transportation system impact evaluations. Having this systems perspective is invaluable for the next generation of engineers and scientists. The application of tools and datasets learned through this project will substantially distinguish the student fellow from their peers.

Deliverables:
- A state-of-the-art literature review on the existing agent-based models for dynamic predictions of traffic flow
- An agent based traffic flow model for use in transportation life cycle assessment
- A brief user manual for use of the developed model
- Draft manuscript describing development of the model and application examples showing use of model in transportation LCA calculations
Impact:
The proposed project is on the cutting-edge of the scientific development in the field of transportation sustainability and resiliency. Combination of life cycle assessment with dynamic modeling of traffic flows could potentially advance the field of transportation planning and assessment. Life cycle assessment is a method which holistically characterizes the environmental impacts over the material extraction, manufacturing, construction, operation, and end-of-life of the transportation systems. Agent-based modeling, on the other hand, provides a way of predicting and simulating the real traffic conditions. These two models complement each other to provide a systematic understanding of the “true” costs and benefits of different transportation management strategies. The model developed in this study can be used to inform city planners, legislators, and road construction companies on the design, planning, and management of future roadway projects.

Location: University of New Hampshire, Durham NH
Time commitment: 40 hours per week, June 4-August 17, 2018
Compensation: $6000 stipend

Desired Qualifications:
- Enrolled in science or engineering field, with preference for civil engineering, computer science, systems engineering, industrial engineering.
- Experience with computer programming is required. Preference for flow modelling using Python, Netlogo or R. Experience in developing systems models is preferred.
- Proficient in technical and scientific reading and writing.
- Knowledge of traffic flow theories is preferred.

UNHSI Sustainability program eligibility:
Graduate students, exceptional undergraduate students, and recent graduates are eligible. We will encourage, but not require, an academic sponsor or reference for each fellow, and where possible we will ask that course credits are awarded.

Supervision, Training, Mentoring and Evaluation:
This fellow will receive supervision from Drs, Eshan V. Dave and Weiwei Mo, Assistant Professors, Civil and Environmental Engineering, University of New Hampshire, as well as mentoring and extensive professional development offerings from UNHSI.

Fellows will be expected to participate in the following MANDATORY events:
- A three-day, two-night orientation in Durham, NH, May 29-31. Lodging and meals will be provided. A limited number of travel scholarships will be available to assist with transportation to Durham.
- Weekly webinars during the course of the 10-week fellowship.
- Midterm project presentations to UNHSI staff, faculty and relevant project partners in Durham, NH, July 12. Travel support provided.
- Final project presentations to UNHSI staff, faculty and relevant project partners in Durham, NH, August 10. Travel support provided.

Apply by February 14 at www.sustainableunh.unh.edu/sustainability-fellows.