

Zachary Needell

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Education

- Spring 2015 - Summer 2018 **Doctorate in Interdepartmental Transportation**, *Massachusetts Institute of Technology*, Cambridge, MA.
Selected Classes: Demand Modeling • Transport Modeling • Optimization Methods • Environmental Justice • Statistical Learning and Data Mining • Public Transportation Systems • Comparative Land Use and Transportation Planning • Computer Modeling: Human Mobility and Networks
Research supervisor: Jessika E. Trancik
- Fall 2013 - Spring 2015 **Master of Science in Interdepartmental Transportation**, *Massachusetts Institute of Technology*, Cambridge, MA.
- Fall 2007 - Spring 2011 **Bachelor of Science in Physics**, *Haverford College*, Haverford, PA.
Selected Classes: Scientific Computing • Advanced Classical Mechanics • Advanced Quantum Mechanics • Linear Algebra • Real Analysis • Abstract Algebra
Research supervisors: Peter J. Love and Jerry P. Gollub

Relevant Experience

- Fall 2015 - Present **Energy Modeler: TRIPOD**, *Massachusetts Institute of Technology*, Cambridge, MA.
 - Primary researcher/developer of energy modeling component of a large scale agent-based transport simulation—predicting and evaluating energy requirements of trips for different modes, vehicle types, traffic conditions, and driving styles.
 - Tripod is a simulation-based platform to optimally distribute incentives to travelers via a smartphone app to minimize systemwide energy consumption, funded by DOE ARPA-E grant.
 - Work involves independent research on in determinants of energy consumption and representation of vehicle movement in transport simulations, as well as efficient implementation of methods in C++ within a large, parallel, agent-based simulation of the entire Boston region.
- Fall 2013 - Present **Graduate Researcher: Institute for Data, Systems, and Society**, *Massachusetts Institute of Technology*, Cambridge, MA.
 - Used large datasets to create an empirically tested statistical model of personal vehicle trips, their energy needs, and expected electric vehicle charging behavior.
 - Research focused on understanding travel behavior and energy use with data from travel surveys, in-vehicle GPS recordings, and historical weather records.
 - Evaluated electric vehicle range against real-world travel behavior by determining quantitative technology performance targets based on climate goals.
 - Estimated impact of widespread electric vehicle adoption on spatiotemporal electricity demand and interaction with renewable electricity generation under different weather, charging, and technological scenarios.
- Summer 2015 **Summer Intern, Foursquare Integrated Transportation Planning**, Rockville, MD.
 - Developed materials for public outreach and program evaluation of various transportation projects within the Washington, DC, metro area.
- Fall 2011 - Summer 2013 **Research Assistant, Smithsonian Center for Earth and Planetary Studies**, Washington, DC.
 - Used remote sensing and 3-d terrain data to compile a GIS database of Martian craters and their estimated ages and levels of degradation.
 - Researched the properties of Hawaiian Basaltic sands as an analogue to Martian surface materials. The research involved sorting and preparing samples for SEM study, fieldwork in the Kau Desert, HI, and writing image analysis software to study grain shape and size distributions.

- Summer 2010 - **Student Researcher: Department of Physics, Haverford College, Haverford, PA.**
- Summer 2011
- Did senior thesis research on the deformations of a two-dimensional amorphous granular material under shear, with the goal of understanding emergent collective motion of particles.
 - Research involved image analysis, data processing, experimental setup, and theory.
 - Presented results to various audiences and wrote undergraduate thesis on the results. Title: *Deformations of a sheared, cohesive granular material in two dimensions: Local order and rearrangements in an amorphous system.*
- Summer 2008 - **Student Researcher: Department of Physics, Haverford College, Haverford, PA.**
- Spring 2010
- Studied Dynamic Geometry Lattice Gas Automata - a way of simulating fluid dynamics on arbitrarily curved surfaces.

Publications

- Needell, Z. A.**, & Trancik, J. E. (2018). From peak demand to storage for renewables: shifting electric vehicle loads with workplace charging. *In Review*
- Needell, Z. A.**, & Trancik, J. E. (2018). Efficiently simulating personal vehicle energy consumption in mesoscopic transport models. Forthcoming in *Transportation Research Record: Journal of the Transportation Research Board*
- Miotti, M., **Needell, Z. A.**, & Trancik, J. E. (2018). Quantifying reductions in personal vehicle energy consumption due to driving style changes. *In Review*.
- Wei, W., **Needell, Z. A.**, Ramakrishnan, S., and Trancik, J. E. (2017). Potential for Increasing Electric Vehicle Adoption through Charging Infrastructure Expansion. *In Review*.
- McNerney, J.*, **Needell, Z. A.***, Chang, M. T., Miotti, M., & Trancik, J. E. (2017). TripEnergy: Estimating Personal Vehicle Energy Consumption Given Limited Travel Survey Data. *Transportation Research Record: Journal of the Transportation Research Board*, (2628), 58-66. (*Authors contributed equally)
- Needell, Z. A.**, McNerney, J., Chang, M. T., & Trancik, J. E. (2016). Potential for widespread electrification of personal vehicle travel in the United States. *Nature Energy*, 1, 16112.
- Klaes, A., Cianci, D., **Needell, Z.**, Meyer, D. A., & Love, P. J. (2010). Lattice gas simulations of dynamical geometry in two dimensions. *Physical Review E*, 82(4), 046705.

Computer Skills

Languages: Matlab, C++, Python, D3/JavaScript, SQL, R, Fortran, IDL.

Software: ArcGIS, qGIS, L^AT_EX, Biogeme, TransCAD, Cube

Awards

Best Paper: TRB Standing Committee on Transportation Energy (ADC70). *TripEnergy: Estimating Personal Vehicle Energy Consumption Given Limited Travel Survey Data* (2017).

Patents

Needell, Z. A., and Trancik, J. E. *System and Method for Estimating and Predicting Vehicle Trip Energy Consumption*. US patent application US20180045526A1.