

Nicholas Fournier, PhD

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EDUCATION

- 2019 University of Massachusetts, Amherst
PhD Civil Engineering – Transportation, GPA: 4.0
Dissertation: Equity and efficiency in multi-modal transportation systems
- 2018 MS Civil Engineering – Transportation & Master of Regional Planning
- 2011 BS Civil & Environmental Engineering

TECHNICAL SKILLS

- Areas of expertise: Machine learning and optimization [2]*, discrete choice and predictive econometric models [4], Bayesian networks [5], Markov chain Monte Carlo simulation [5], traffic flow theory [1], human factors [6], crash/risk analysis [10], and data visualization.
- Coding: Python, R, Django, L^AT_EX, git, and some C++, Java, SQL
- Other: Linux systems, Arc/QGIS, CAD, Postgres, Adobe Illustrator and InDesign

RESEARCH EXPERIENCE

- 2020- **Postdoctoral Scholar – University of California Berkeley,**
- **Travel Futures: Exploring the operational and equity benefits of a pre-pay dynamic tolling system [lead researcher]:** California State sponsored (SB1) project exploring a “futures” market mechanism augmenting dynamic toll pricing systems to optimize the price elasticity of demand and revenue collection. System uses Kernel Density Estimation to smooth traffic flow data for predictive travel forecasting and econometric pricing models. Currently developing an R-based analytical simulation model to explore the parameter relationships for revenue and traffic flow trade-offs [b].
 - **Complete Cities: Bicycle network connectivity evaluation methodology [lead researcher]:** Caltrans sponsored project developing a bicycle network connectivity performance measure using graph theory and user preference criteria (e.g., route choice models). Intended to be a Python-based tool for evaluating street networks in GIS.
 - **Erroneous High Occupancy Vehicle (HOV) Degradation:** Developed Python-based machine learning program to detect operational but mislabeled traffic sensors in Caltrans data using a variety of methods. Methods include supervised learning, such as k-Nearest Neighbor, Logistic Regression, and Random Forest; as well as unsupervised methods, such as Support Vector Machines, Local Outlier Factor, Isolation Forest, and Robust Covariance Anomaly Detection [a].
 - **Bicycle level of service measures for the CA State Highway System:** Caltrans sponsored UX research project to determine bicyclist’s infrastructure preferences using virtual reality bicycle simulator. Estimated using a Latent Class Choice Model capable of accounting for user heterogeneity. Results to align with “Complete Cities” project.
 - **Improved Analysis Methodologies and Strategies for Complete Streets:** Development of improved analysis methodologies through computer simulation and field testing in real-world complete street projects with emerging signal technologies. Developed R-based package for estimating Bicycle Level of Service using the Highway Capacity Manual’s methodology with proposed improvements [3] [c].
- 2019-2020 **Research Fellow – Monash University, Melbourne, Australia,**
- **Public Transport Research Group:** Deputy director of research group, advising a team of doctoral students conducting industry partnered research in public transportation, transportation policy analysis, and transportation economics [7,8].
- 2014-2018 **Graduate Research Assistant – UMass Amherst,**
- **Sustainable Travel Incentives with Prediction, Optimization and Personalization:** Developed novel combinatorial optimization algorithm in R and C++ to synthesize population data (demographics, spatial home-work locations, household groups, etc.) for 6 million people in the Greater Boston Area. Mixed-method techniques include Bayesian Networks, Markov chain Monte Carlo simulation, iterative fitting (matrix raking), robust regression, LASSO/Ridge regularization, and gradient descent optimization. This work was part of a large-scale agent-based simulation to lower energy consumption through user incentives in a joint project with MIT sponsored by the Advanced Research Projects Agency - Energy (ARPA-e) of the US Department of Energy [4,5] [e].
 - **Infrastructure Strategies for Safer Cycling: An evaluation of driver behavior using a driving simulator:** USDOT sponsored UX research project that used full-scale driving simulator to evaluate bicycle infrastructure effectiveness based on driver behavior and characteristics. Analyzed results using statistical inference techniques like ANOVA and interaction models in R [6,9,10].

* Numbered and lettered citations refer to relevant publications and github repositories.

ADDITIONAL WORK EXPERIENCE

2015–2017	Community Planner (Pathways Intern) , Volpe Transportation Center (U.S. DOT), Cambridge, MA
2013–2014	Design Engineer , Sandis Civil Engineers, Planners, Surveyors, Oakland, CA
2011–2013	Assistant Engineer , Benjamini and Associates, Inc., San Francisco, CA

SELECT GITHUB REPOSITORIES

- [a] <https://github.com/nick-fournier/hov-degradation>: Source code, working executable (.exe), and user manual for misconfigured HOV sensor detecting machine learning Python code.
- [b] <https://github.com/nick-fournier/travel-futures>: R source code and paper draft for “travel futures” simulation model and results.
- [c] <https://github.com/nick-fournier/MMLoS>: Source code for multi-modal level of service calculation tool in R.
- [d] <https://github.com/nick-fournier/ped-transit-priority>: R source code and paper draft for hybrid transit and pedestrian priority simulation model and results.
- [e] <https://github.com/nick-fournier/poptools>: R and C++ source code and paper draft for population synthesis. Ongoing project to create open source tool.
- [f] <https://github.com/nick-fournier/machine-learning-lab>: Lead a UC Berkeley class project to explore bicycle data and correct for bias by fusing data and using machine learning techniques in R.
- [g] <https://github.com/nick-fournier/Value-of-Time-Exploration>: Analyzed travel “value of time” by fusing travel survey data with travel time matrices and pricing tables for the Greater Boston Area. Estimated multinomial logit models in R with varying interaction terms [4].

SELECT PUBLICATIONS

- 2021 [1] Nicholas Fournier. Hybrid pedestrian and transit priority zoning policies in an urban street network: Evaluating network traffic flow impacts with analytical approximation. *Transportation Research Part A: Policy and Practice*, 152:254–274, 2021. ISSN 0965-8564. doi: <https://doi.org/10.1016/j.tra.2021.08.009>.
- [2] Nicholas Fournier, Eleni Christofa, and Eric J. Gonzales. A continuous model for coordinated pricing of mixed access modes to transit. *Transportation Research Part C: Emerging Technologies*, 128:103208, 2021. ISSN 0968-090X. doi: <https://doi.org/10.1016/j.trc.2021.103208>.
- [3] Amy Huang, Nicholas Fournier, and Alexander Skabardonis. Bicycle level of service: Proposed updated pavement quality index. *Transportation Research Board 100th Annual Meeting Transportation Research Board*, (TRBAM-21-01847):1–16, 2021. doi: 10.1177/03611981211026661.
- 2020 [4] Nicholas Fournier and Eleni Christofa. On the Impact of Income, Age, and Travel Distance on the Value of Time. *Transportation Research Record: Journal of the Transportation Research Board*, pages 1–14, November 2020. ISSN 0361-1981. doi: 10.1177/0361198120966603
- [5] Nicholas Fournier, Eleni Christofa, Arun Prakash Akkinenally, and Carlos Lima Azevedo. Integrated population synthesis and workplace assignment using an efficient optimization-based person-household matching method. *Transportation*, February 2020. doi: 10.1007/s11116-020-10090-3
- [6] Nicholas Fournier, Sarah Bakhtiari, Krishna Deep Valluru, Nicholas Campbell, Eleni Christofa, Shannon Roberts, and Michael Knodler. Accounting for drivers’ bicycling frequency and familiarity with bicycle infrastructure treatments when evaluating safety. *Accident Analysis & Prevention*, 137:105410, March 2020. doi: 10.1016/j.aap.2019.105410
- [7] Laura Aston, Graham Currie, Md. Kamruzzaman, Alexa Delbosc, Nicholas Fournier, and David Teller. Addressing transit mode location bias in built environment-transit mode use research. *Journal of Transport Geography*, 87:102786, July 2020. doi: 10.1016/j.jtrangeo.2020.102786
- [8] Graham Currie and Nicholas Fournier. Why most DRT/Micro-Transits fail – What the survivors tell us about progress. *Research in Transportation Economics*, page 100895, June 2020. doi: 10.1016/j.retrec.2020.100895
- 2017 [9] Nicholas Fournier, Eleni Christofa, and Michael A. Knodler. A sinusoidal model for seasonal bicycle demand estimation. *Transportation Research Part D: Transport and Environment*, 50:154–169, January 2017. doi: 10.1016/j.trd.2016.10.021
- [10] Nicholas Fournier, Eleni Christofa, and Michael A. Knodler. A mixed methods investigation of bicycle exposure in crash rates. *Accident Analysis & Prevention*, 130:54–61, September 2017. doi: 10.1016/j.aap.2017.02.004

AWARDS

2018	Eno Fellow
2015–2018	Dwight D. Eisenhower Transportation Fellowship
2016–2017	Outstanding Student of the Year
2015	Daniel B. Fambro Student Paper Award [9]

Eno Future Leadership Conference
U.S. Department of Transportation
U.S. Department of Transportation
International ITE