

Tarun Rambha

Assistant Professor
Department of Civil Engineering
Indian Institute of Science, Bengaluru, India

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RESEARCH INTERESTS

Network Optimization and Game Theory:

Static and dynamic traffic equilibrium, Network games, Adaptive signal control

Real-time Control in Traffic Networks:

Dynamic congestion pricing, Stochastic shortest paths, Smart parking models

Shared Ride Systems:

Online vehicle routing and scheduling, Pricing and matching for ride-sharing and ride-hailing

Large Scale Evacuation Modeling:

Hurricane evacuation, Evacuation of pedestrian crowds

EDUCATION

Doctor of Philosophy (Ph.D.)

Department of Civil, Environmental & Architectural Engineering

Dissertation Title: Dynamic Congestion Pricing in Within-Day and Day-to-Day Network Equilibrium Models

Aug 2016

UT Austin

Master of Science (M.S.)

Department of Civil, Environmental & Architectural Engineering

Thesis Title: Adaptive Routing in Schedule Based Stochastic Time-Dependent Transit Networks

Aug 2012

UT Austin

Bachelor of Technology (B.Tech)

Major: Civil Engineering, *Minor:* Industrial Engineering

May 2010

IIT Madras, India

HONORS AND FELLOWSHIPS

The Fred Burggraf Best Paper Award, TRB, 2015

Kolodzey Travel Grant Award, 2015

Mary Kate Collins Memorial Endowed Presidential Scholarship, 2014-2015, 2012-2013

Special mention – The Stella Dafermos Best Paper Award, TRB, 2014

Robert Herman Endowed Scholarship in Engineering, 2013-2014

CUTC Milton Pikarsky Award for Outstanding M.S. Thesis in Science and Technology, 2012

PROFESSIONAL EXPERIENCE

Assistant Professor

Department of Civil Engineering

Indian Institute of Science

Oct 2017 – Present

Post-Doctoral Research Associate

Decision Support Tools for Hospital Evacuation during Hurricanes

Applying multi-stage stochastic optimization algorithms for a hospital evacuation problem using real-world hospital data from North Carolina and trajectories from Hurricane Isabel.

Cornell University

Sep 2016 – Sep 2017

Graduate Research Assistant

Dynamic Congestion Pricing models for Autonomous Vehicles (TxDOT)

Formulated a dynamic congestion pricing problem for an autonomous vehicles where prices change in real time and vehicles respond non-cooperatively using adaptive strategies.

The University of Texas at Austin

Jan 2015 – Aug 2016

Operational Analysis of Active Traffic Management Strategies (TxDOT)

Studied the effect of various active traffic management strategies on Texas freeways using dynamic traffic assignment models and microsimulation.

Jan 2015 – Aug 2016

Dynamic Signal Control in Transportation Networks (D-STOP)

Analyzed the effects of backpressure type algorithms for dynamic signal control in transportation networks to ensure stability of queues.

May 2014 – Aug 2016

Stochastic and Dynamic Hyperpath Modeling (NSF)

Jun 2013 – May 2014

Involved the application of stochastic shortest paths to model parking search process. Effects of information such as observed availability of parking spots was captured using an MDP model.

Game-theoretic Analysis of Dynamic Traffic Equilibria (SWUTC) Jan 2013 – Dec 2013
Explored the non-existence and non-uniqueness of equilibria in dynamic traffic networks and other modeling artifacts that may result in multiple equilibria.

Game theory and Traffic Assignment (SWUTC) Aug 2012 – Aug 2013
Investigated refinement approaches used in economics to study multiple equilibria and them to analyze the traffic assignment problem.

Algorithms for Adaptive Routing in Transit Networks May 2011 – Aug 2012
Studied adaptive routing in stochastic and time – dependent transit networks using novel state space reduction methods and a dynamic programming formulation.

Investigating Regional Dynamic Traffic Assignment for improved bottleneck analysis (TxDOT) Aug 2010 – May 2012
Modeled the Austin regional network using dynamic traffic assignment to study bottlenecks, mitigation strategies, and system wide impacts of improvements on route choice behavior.

Teaching Assistant **The University of Texas at Austin**
CE 311S – Introduction to Probability and Statistics Spring 2011, 2012, 2014, 2015
Conducted weekly discussions for an undergraduate course in Probability and Statistics in addition to grading and preparation of solutions to homeworks.

Undergraduate Research Assistant **Indian Institute of Technology, Madras**
Algorithms for Multiclass Equilibrium & Time Dependent Shortest Paths Aug 2009 – May 2010
Implemented algorithms for the Chennai regional network to model the dynamic nature of traffic and multiple vehicle classes and developed a web application for providing real time route information.

- PUBLICATIONS
1. Rambha, T., L. K. Nozick, R. Davidson, W. Yi, and K. Yang. A Stochastic Optimization Model for Staged Hospital Evacuation during Hurricanes. In Review.
 2. Rambha, T., S. D. Boyles, A. Unnikrishnan, and P. Stone. Marginal Cost Pricing for System Optimal Traffic Assignment with Recourse under Supply-Side Uncertainty. *Transportation Research Part B* 110. 104-121.
 3. Sharon, G., M. W. Levin, J. P. Hanna, T. Rambha, S. D. Boyles, and P. Stone. (2017) Network-wide adaptive tolling for connected and automated vehicles. *Transportation Research Part C* 84. 142-157.
 4. Rambha, T., S. D. Boyles, and S. T. Waller. (2017) Adaptive Transit Routing in Stochastic Time-Dependent Networks. *Transportation Science* 50(3), 1043-1059.
 5. Rambha, T., and S. D. Boyles. (2016) Dynamic Pricing in Discrete Time Stochastic Day-to-Day Route Choice Models. *Transportation Research Part B* 92, Part A. 104-118.
 6. Boyles, S. D., and T. Rambha. (2016) A Note on Detecting Unbounded Instances of the Online Shortest Path Problem. *Networks* 67, 270-276.
 7. Tang, S., T. Rambha, R. Hatridge, S. D. Boyles, and A. Unnikrishnan. (2014) Modeling Parking Search on a Network Using Stochastic Shortest Paths with History Dependence. *Transportation Research Record: Journal of the Transportation Research Board* 2467, 73-79.
 8. Boyles, S. D., T. Rambha, and C. Xie. (2014) Equilibrium Analysis of Low-Conflict Network Designs. *Transportation Research Record: Journal of the Transportation Research Board* 2467, 129-139.

- BOOK CHAPTERS
1. Rambha, T., E. Jafari, and S. D. Boyles. Transportation Network Issues in Evacuation. In *Crisis and New Media* (forthcoming).
- TECHNICAL REPORTS
1. Boyles, S. D., C. M. Walton, J. Duthie, E. Jafari, N. Jiang, A. Khani, J. Li, J. Osorio, V. Pandey, T. Rambha, and C. Yahia. (2017) *A Planning Tool for Active Traffic Management Combining Microsimulation and Dynamic Traffic Assignment*. Texas Department of Transportation report FHWA/TX-17/0-6859-1.
 2. Boyles, S. D., C. Melson, T. Rambha, and J. Duthie. (2014) *Game-Theoretic Analysis of Dynamic Traffic Equilibria*. Southwest Region University Transportation Center report SWUTC/14/600451-00079-1.
 3. Rambha, T., and S. D. Boyles. (2013) *Game Theory and Traffic Assignment*. Southwest Region University Transportation Center report SWUTC/13/600451-00065-1.
 4. Duthie, J. C., Nezamuddin, N. Ruiz-Juri, T. Rambha, C. Melson, C. M. Pool, S. D. Boyles, S. T. Waller, and R. Kumar. (2013) *Investigating Regional Dynamic Traffic Assignment Modeling for Improved Bottleneck Analysis*. Texas Department of Transportation report FHWA/TX-13/0-6657-1.
- CONFERENCES
1. Sharon, G., M. Albert, T. Rambha, S. D. Boyles, and P. Stone. (2018) Traffic Optimization for a Mixture of Self-interested and Compliant Agents. In the Proceedings of the 32nd AAAI Conference on Artificial Intelligence (AAAI-18), New Orleans, LA.
 2. Rambha, T. (2017) Addressing Equity Issues Associated with Roadway Pricing. Urban Mobility India-Cooperation for Urban Mobility in the Developing World XVII Conference, Hyderabad, Telangana, India.
 3. Rambha, T., E. Jafari, and S. D. Boyles. (2017) Transportation network issues in evacuation management. New Agendas in Communication: Crisis Communication and New Media Conference, Austin, TX.
 4. Sharon, G., J. P. Hanna, T. Rambha, M. W. Levin, M. Albert, S. D. Boyles, and P. Stone. (2017) Real-time adaptive tolling scheme for optimized social welfare in traffic networks. 16th International Conference on Autonomous Agents and Multiagent Systems (AAMAS 2017), São Paulo, Brazil.
 5. Rambha, T., S. D. Boyles, and A. Unnikrishnan. (2017) Minimum Expected Revenue System Optimum Tolls under Supply-Side Uncertainty. 96th Annual Meeting of the Transportation Research Board, Washington, D.C.
 6. Rambha, T., S. D. Boyles, and A. Unnikrishnan. (2016) A Destination-based Algorithm for User Equilibrium with Recourse using Split Proportions. Annual Meeting of the Institute of Operations Research and Management Sciences, Nashville, TN.
 7. Sharon, G., J. Hanna, T. Rambha, M. Albert, P. Stone, and S. D. Boyles. (2016) Delta-tolling: Adaptive Tolling for Optimizing Traffic Throughput. 9th International Workshop on Agents in Traffic and Transportation (ATT 2016), New York, NY.
 8. Rambha, T., and S. D. Boyles. (2016) Reinforcement Learning Approaches for Dynamic Congestion Pricing in Day-to-Day Network Models. 95th Annual Meeting of the Transportation Research Board, Washington, D.C.
 9. Jafari, E., T. Rambha, A. Khani, and S. D. Boyles. (2016) The For-Profit Dial-a-Ride Problem on Dynamic Networks. 95th Annual Meeting of the Transportation Research Board, Washington, D.C.
 10. Rambha, T., and S. D. Boyles. (2015) Mechanism Design for Route Assignment in Traffic Networks. Annual Meeting of the Institute for Operations Research and Management Sciences, Philadelphia, PA.

11. Rambha, T., and S. D. Boyles. (2015) Applications of Dynamic Pricing in Day-to-Day Equilibrium Models. 94th Annual Meeting of the Transportation Research Board, Washington, D.C.
12. Boyles, S. D., T. Rambha, and J. Duthie. (2014) Demand uncertainty and optimism in planning forecasts. INFORMS Transportation Science and Logistics Workshop, Chicago, IL.
13. Rambha, T., and S. D. Boyles. (2014) Dynamic Pricing and Learning in Network Equilibrium Models. Annual Meeting of the Institute for Operations Research and Management Sciences, San Francisco, CA.
14. Boyles, S. D., T. Rambha, and C. Xie. (2014) Equilibrium Analysis of Low-Conflict Network Designs. 93th Annual Meeting of the Transportation Research Board, Washington, D.C.
15. Tang, S., T. Rambha, R. Hatridge, S. D. Boyles, and A. Unnikrishnan. (2014) Modeling Parking Search on a Network Using Stochastic Shortest Paths with History Dependence. 93th Annual Meeting of the Transportation Research Board, Washington, D.C.
16. Rambha, T., Y. Kai, and S. D. Boyles. (2013) Game-Theoretic Learning Models in Traffic Assignment. Annual Meeting of the Institute for Operations Research and Management Sciences, Minneapolis, MN.
17. Tang, S., T. Rambha, R. Hatridge, S. D. Boyles, and A. Unnikrishnan. (2013) Parking Search, Information, and Online Routing Problems. Annual Meeting of the Institute for Operations Research and Management Sciences, Minneapolis, MN.
18. Boyles, S. D., J. Duthie, C. Melson, and T. Rambha. (2013) Diverge Models and Dynamic Traffic Equilibria. Annual Meeting of the Institute for Operations Research and Management Sciences, Minneapolis, MN.
19. Rambha, T., S. D. Boyles, and S. T. Waller. (2013) Adaptive Transit Routing in Stochastic Time-Dependent Networks. 92th Annual Meeting of the Transportation Research Board, Washington, D.C.
20. Rambha, T., S. D. Boyles, and S. T. Waller. (2012) Adaptive transit routing under uncertainty. Annual Meeting of the Institute for Operations Research and Management Sciences, Phoenix, AZ.

TEACHING (Spring 2018) CE 272 Transportation Network Equilibrium

TECHNICAL SKILLS *Operating Systems:* Windows, Linux
Programming Languages: C, C++, Java, MATLAB
Software/Applications: GAMS, CPLEX, SPSS, SQL, JavaScript, html, PHP, L^AT_EX, ArcGIS, VISSIM, TransCAD

PROFESSIONAL AFFILIATIONS Transportation Research Board of the National Academies (TRB)
 Institute for Operations Research and Management Sciences (INFORMS)
 Intelligent Transportation Society (ITS) of America
 Institute of Transportation Engineers (ITE)

REFEREE Transportation Research Part C, Networks and Spatial Economics, IEEE Transactions on Intelligent Transportation Systems, Transportation Research Record (TRR), Transport Policy, Transportation Letters, Transportation in Developing Economies, The World Conference on Transport Research Society (WCTRS), Transportmetrica A: Transport Science