

# Juan C. Medina

Postdoctoral Research Associate  
Civil and Environmental Engineering  
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## Education

- Ph.D. Civil and Environmental Engineering - Transportation Systems. May 2013  
University of Illinois at Urbana-Champaign.  
Thesis: "MASTraf: a Decentralized Multi-agent System for  
Network-wide Traffic Signal Control with Dynamic Coordination".  
Advisor: Dr. Rahim F. Benekohal.
- M.Sc. Civil and Environmental Engineering - Transportation Systems. May 2005  
University of Illinois at Urbana-Champaign.  
Advisor: Dr. Rahim F. Benekohal.
- B.Sc. Civil Engineering. Feb 2001  
Pontificia Universidad Javeriana. Bogotá, Colombia.

## Main Interests

Traffic control systems, intelligent transportation systems, transportation safety, connected vehicles, artificial intelligence and agent-based control.

## Research Experience

Postdoctoral Research Associate Oct 2012 - Present  
Department of Civil and Environmental Engineering.  
University of Illinois at Urbana-Champaign.

### *Significant Contribution on Externally Funded Projects:*

- Guideline and course on the estimation of work zone performance measures. FHWA Safety Grant. Mar 2014 - Present
- Accident Prediction Models using Macro and Micro Scale Analysis. Roadway Safety Institute UTC. Aug 2014 - Present
- Adaptive signal control technologies. Illinois DOT. Oct 2013 - Present
- Analysis of railroad grade crossing accidents. Illinois DOT, ICC, NURail UTC. Oct 2012 - Present
- Development of LED roadway lighting specification. Illinois DOT. July 2014 - Dec 2014
- Evaluation of microwave-based vehicle detectors. Illinois DOT. Oct 2012 - Dec 2014
- Agent-based traffic management with explicit coordination. NEXTRANS UTC. Oct 2012 - May 2014
- Multi-objective traffic signal optimization at intersections. NEXTRANS UTC. Oct 2012 - May 2014

### *Additional Research Projects:*

- Traffic signal control in an environment with interconnected vehicles. Spring 2014 - Present
- Multi-modal decentralized agent-based traffic signal control. Fall 2013 - Present

Graduate Research Assistant Jan 2004 - Oct 2012

Department of Civil and Environmental Engineering.  
University of Illinois at Urbana-Champaign.

### *Projects:*

- Agent-based traffic management. NEXTRANS UTC. Feb 2011 - Oct 2012
- Evaluation of microwave-based vehicle detectors. Illinois DOT. Jan 2011 - Oct 2012

- LED Street lighting for roadway applications. Illinois DOT. Oct 2010 - Oct 2012
- Traffic signal control in oversaturated intersections. NEXTRANS UTC. Aug 2009 - Feb 2011
- Evaluation of solar-powered flashing beacons. Illinois DOT. Jul 2008 - Dec 2010
- Evaluation of the Sensys wireless vehicle detection. Illinois DOT. Jul 2008 - Dec 2010
- Evaluation of vehicular and pedestrian LED modules. Illinois DOT. Jul 2006 - Jul 2008
- Evaluation of video detection systems. Illinois DOT. Jul 2005 - Jul 2008
- Speed photo enforcement in Illinois work zones. Illinois DOT. Jul 2005 - Jul 2007
- Pedestrian safety study in big campus areas. University of Illinois. Jun 2005 - Jul 2007
- ITS data analysis for I-30 work zone. Science App. Intl. Corp. Sep 2004 - Feb 2005
- Identification of high-accident locations on highways. Illinois DOT. Jan 2004 - Jul 2004

Civil Engineer

*Jan 2001 - Jan 2003*

National Learning Service (SENA) - National Headquarters.  
Bogota, Colombia.

Peer-Reviewed Publications

Peer-Reviewed Papers in Journals

1. Medina, J.C., Benekohal, R.F. Macroscopic Models for Accident Prediction at Railroad Grade Crossings and Comparisons with the U.S. D.O.T. Accident Prediction Formula. Accepted for Publication in the Transportation Research Record. Jan, 2015.
2. Medina, J.C., Lo, E.G., Benekohal, R.F. Multi-Attribute Decision Making Methods for Optimal Selection of Traffic Signal Control Parameters in Multimodal Analysis. Transportation Research Record, National Research Council, Washington, D.C., In Press.
3. Medina, J.C., Benekohal, R.F. Dual Microwave Radar Vehicle Detection System at Quad Gate Railroad Grade Crossing. Transportation Research Record, National Research Council, Washington, D.C., No. 2458, pp. 110-117, 2014.
4. Medina, J.C., Hajbabaie, A., Benekohal, R.F. Effects of Metered Entry Volume on an Oversaturated Network with Dynamic Signal Timing. Transportation Research Record, National Research Council, Washington, D.C., No. 2356, pp. 53-60, 2013.
5. Medina, J.C., Ramezani, H., Benekohal, R.F. Evaluation of Microwave Radar Vehicle Detectors at Signalized Intersection under Adverse Weather Conditions. Transportation Research Record, National Research Council, Washington, D.C., No. 2356, pp. 100-108, 2013.
6. Medina, J.C., Avrenli, K., Benekohal, R.F. Field and Software Evaluation of Illuminance from LED Luminaires for Roadway Applications. Transportation Research Record, National Research Council, Washington, D.C., No. 2384, pp. 55-64, 2013.
7. Medina, J.C., Hajbabaie, A., Benekohal, R.F. Detection Performance of Wireless Magnetometers at Signalized Intersection and Railroad Grade Crossing under Different Weather Conditions. Transportation Research Record, National Research Council, Washington, D.C., No. 2259, pp. 233-241, 2011.
8. Hajbabaie, A., Medina, J.C., Wang M-H., Benekohal, R.F., Chitturi, M. Sustained and Halo Effects of Various Speed Reduction Treatments in Highway Work Zones. Transportation Research Record, National Research Council, Washington, D.C., No. 2265, pp. 118-128, 2011.
9. Medina, J.C., Chitturi, M., Benekohal, R.F. Effects of Fog, Snow, and Rain on Video Detection Systems at Signalized Intersections. Transportation Letters, Vol. 2, Issue 1, pp. 13-25, 2010.
10. Chitturi, M., Benekohal, R.F., Hajbabaie, A., Wang M-H., Medina, J.C. Effectiveness of Automated Speed Enforcement in Work Zones. Journal of the Institute of Transportation Engineers. Vol. 80 (6). 2010.
11. Chitturi, M., Medina, J.C., Benekohal, R.F. Effects of Shadows and Time of Day on Performance of Video Detection Systems at Signalized Intersections. Transportation Research Part C: Emerging Technologies, Vol. 18, Issue 2, pp. 176-186, 2010.
12. Chitturi, M., Medina, J.C., Benekohal, R.F. Testbed for Evaluation of Vehicular Detection Systems. Journal of Advanced Transportation. Vol. 44, Issue 3, pp.123-133, 2010.
13. Medina, J.C., Benekohal, R.F., Chitturi, M. Changes in Video Detection Performance at Signalized Intersections Over Different Illumination Conditions. Transportation Research Record, National Research Council, Washington, D.C., No. 2129, pp. 111-120, 2009.
14. Medina, J.C., Benekohal, R.F., Hajbabaie, A., Wang, M.H., Chitturi, M. Downstream Effects of Speed Photo Enforcement and Other Speed Reduction Treatments on Work Zones. Transportation Research Record, National Research Council, Washington, D.C., No. 2107, pp. 24-33, 2009.
15. Benekohal, R.F., Wang, M.H., Chitturi, M., Hajbabaie, A., Medina, J.C. Speed Photo-Radar Enforcement and Its Effects on Speeds in Work Zones. Transportation Research Record, National Research Council, Washington, D.C., No. 2096, pp. 89-97. 2009.

16. Benekohal, R.F., Chitturi, M., Hajbabaie, A., Wang, M.H., Medina, J.C. Automated Speed Photo Enforcement Effects on Speed in Work Zones. *Transportation Research Record*, National Research Council, Washington, D.C, No. 2055, pp. 11-20, 2008.
17. Kang, S., Medina, J.C., Ouyang, Y. Optimal Operations of Transportation Fleet for Unloading Activities at Container Ports, *Transportation Research Part B: Methodological*, Vol 42, No 10, 2008.

#### Peer-Reviewed Papers in Conferences

1. Medina, J.C., Benekohal, R.F. Macroscopic Models for Accident Prediction at Railroad Grade Crossings and Comparisons with the U.S. DOT Accident Prediction Formula. Presented at the 94th Annual Meeting of the Transportation Research Board. Washington, D.C. 2015.
2. Medina, J.C., Benekohal, R.F. Simple Feature-based Function Approximation for Reinforcement Learning Traffic Signals in Oversaturated Networks. Presented at the 94th Annual Meeting of the Transportation Research Board. Washington, D.C. 2015.
3. Medina, J.C., Benekohal, R.F. Combination of Macroscopic and Microscopic Models for Analysis of Accidents at Railroad Grade Crossings. Presented at the Global Level Crossing – Safety and Trespass Prevention Symposium, Urbana, IL, 2014.
4. Medina, J.C., Benekohal, R.F., Shen, S. Microscopic Analysis for Accident Data at Railroad Grade Crossings. Presented at the TD&I Congress of the ASCE, Orlando, 2014.
5. Medina, J.C., Benekohal, R.F., Lo, E.G. Analyzing Pedestrian Behavior during Pedestrian Exclusive Phases for Improved Intersection Signal Timing. Presented at the TD&I Congress of the ASCE, Orlando, 2014.
6. Medina, J.C., Benekohal, R.F. Sensitivity of Reinforcement Learning Agents to Aggregated Sensor Data in Congested Traffic Networks. Presented at the TD&I Congress of the ASCE, Orlando, 2014.
7. Medina, J.C., Benekohal, R.F. Dual Microwave Radar Vehicle Detection System at Quad Gate Railroad Grade Crossing. Presented at the 93rd Annual Meeting of the Transportation Research Board. Washington, D.C. 2014.
8. Medina, J.C., Lo, E.G., Benekohal, R.F. Exploring Multi-attribute Decision Making Methods for Optimal Selection of Traffic Signal Control Parameters in Multimodal Analysis. Presented at the 93rd Annual Meeting of the Transportation Research Board. Washington, D.C. 2014.
9. Medina, J.C., Benekohal, R.F. Corridor-based Coordination of Learning Agents for Traffic Signal Control by Enhancing the Max-plus Algorithm. Presented at the 93rd Annual Meeting of the Transportation Research Board. Washington, D.C. 2014.
10. Medina, J.C., Hajbabaie, A., Benekohal, R.F. Effects of Metered Entry Volume on an Oversaturated Network with Dynamic Signal Timing. Presented at the 92nd Annual Meeting of the Transportation Research Board. Washington, D.C. 2013.
11. Medina, J.C., Ramezani, H., Benekohal, R.F. Evaluation of Microwave Radar Vehicle Detectors at Signalized Intersection under Adverse Weather Conditions. Presented at the 92nd Annual Meeting of the Transportation Research Board. Washington, D.C. 2013.
12. Medina, J.C., Avrenli, K., Benekohal, R.F. Field and Software Evaluation of Illuminance from LED Luminaires for Roadway Applications. Presented at the 92nd Annual Meeting of the Transportation Research Board. Washington, D.C. 2013.
13. Medina, J.C., Benekohal, R.F. Traffic Signal Control using Reinforcement Learning and the Max-Plus Algorithm as a Coordinating Strategy. Presented at the 15th International IEEE Annual Conference on Intelligent Transportation Systems. Anchorage, AK, 2012.
14. Medina, J.C., Benekohal, R.F. Q-learning and Approximate Dynamic Programming for Traffic Control: Case Study for an Oversaturated Network. Presented at the 91st Annual Meeting of the Transportation Research Board. Washington, D.C. 2012.
15. Medina, J.C., Hajbabaie, A., Benekohal, R.F. A Comparison of Approximate Dynamic Programming and Simple Genetic Algorithm for Traffic Control in Oversaturated Conditions – Case Study of a Simple Symmetric Network. Presented at the 14th International IEEE Annual Conference on Intelligent Transportation Systems. Washington, DC, 2011.
16. Medina, J.C., Hajbabaie, A., Benekohal, R.F. Evaluation of Wireless Magnetometers for Vehicle Detection. Presented at the TD&I Congress of the ASCE, Chicago, 2011.
17. Medina, J.C., Benekohal, R.F. Reinforcement Learning Agents for Traffic Signal Control in Oversaturated Networks. Presented at the TD&I Congress of the ASCE, Chicago, 2011.
18. Medina, J.C., Hajbabaie, A., Benekohal, R.F. Detection Performance of Wireless Magnetometers at Signalized Intersection and Railroad Grade Crossing Under Different Weather Conditions. Presented at the 90th Annual Meeting of the Transportation Research Board. Washington, D.C. 2011.
19. Hajbabaie, A., Medina, J.C., Wang M-H., Benekohal, R.F., Chitturi, M. Sustained and Halo Effects of Various Speed Reduction Treatments in Highway Work Zones. Presented at the 90th Annual Meeting of the Transportation Research Board. Washington, D.C. 2011.

20. Medina, J.C., Hajbabaie, A., Benekohal, R.F. Arterial Traffic Control Using Reinforcement Learning Agents and Information from Adjacent Intersections in the State and Reward Structure. Presented at the 13th International IEEE Annual Conference on ITS. Madeira, Portugal, 2010.
21. Hajbabaie, A., Medina, J.C., Benekohal, R.F. Effects of ITS-based Left Turn Policies on Network Performance. Presented at the 13th International IEEE Annual Conference on Intelligent Transportation Systems. Madeira, Portugal, 2010.
22. Medina, J.C., Hajbabaie, A., Benekohal, R.F. Wireless Magnetometers for Traffic Data Collection at Signalized Intersections. Presented at the Traffic Flow Theory Committee Summer Meeting - Transportation Research Board. Annecy, France, 2010.
23. Hajbabaie, A., Benekohal, R.F., Chitturi, M., Wang, M.H., Medina, J.C. Comparison of Effects of Automated Speed Enforcement and Police Presence on Speeding in Work Zones. Presented at the 88th Annual Meeting of the Transportation Research Board. Washington, D.C. 2009.
24. Benekohal, R.F., Wang, M.H., Chitturi, M., Hajbabaie, A., Medina, J.C. Speed Photo-Radar Enforcement and Its Effects on Speeds in Work Zones. Presented at the 88th Annual Meeting of the Transportation Research Board. Washington, D.C. 2009.
25. Medina, J.C., Benekohal, R.F., Hajbabaie, A., Wang, M.H., Chitturi, M. Downstream Effects of Speed Photo Enforcement and Other Speed Reduction Treatments on Work Zones. Presented at the 88th Annual Meeting of the Transportation Research Board. Washington, D.C. 2009.
26. Medina, J.C., Benekohal, R.F., Chitturi, M. Changes in Video Detection Performance at Signalized Intersections Over Different Illumination Conditions. Presented at the 88th Annual Meeting of the Transportation Research Board. Washington, D.C. 2009.
27. Benekohal, R.F., Chitturi, M., Hajbabaie, A., Wang, M.H., Medina, J.C. Automated Speed Photo Enforcement Effects on Speed in Work Zones. Presented at the 87th Annual Meeting of the Transportation Research Board. Washington, D.C. 2008.
28. Medina, J.C., Benekohal, R.F., Wang, M.H., In-Street Pedestrian Crossing Signs and Effects on Pedestrian-Vehicle Conflicts at University Campus Crosswalks. Presented at the 87th Annual Meeting of the Transportation Research Board. Washington, D.C. 2008.
29. Medina, J.C., Chitturi, M., Benekohal, R.F. Illumination and Wind Effects on Video Detection Performance at Signalized Intersections. Presented at the 87th Annual Meeting of the Transportation Research Board. Washington, D.C. 2008.
30. Medina, J.C., Chitturi, M., Benekohal, R.F. Impact of Snow in Video Detection Systems. Fourth National Conference on Surface Transportation Weather. Transportation Research E-Circular No. E-C126. Indianapolis, 2008.
31. Medina, J.C., Kang, S, Ouyang, Y. Optimal Planning and Management of Transportation Fleet at Container Ports. Presented at the 86th Annual Meeting of the Transportation Research Board. Washington, D.C. 2007.
32. Benekohal, R.F., Wang, M.H., Medina, J.C. Pedestrian-Vehicle Interaction and Conflicts under Various Crosswalk Treatments. Presented at the International Conference on Road Safety and Simulation. Roma, 2007.
33. Chitturi, M., Medina, J.C., Benekohal, R.F. Accuracy of Video Detection Systems for Traffic Counting. Proceedings of the 2007 ITE International Annual Meeting and Exhibit, August 5-8, 2007.
34. Medina, J.C., Benekohal, R.F. Analysis of Drivers' Opinions on the Effectiveness of Traffic and In-Vehicle Receiver Control Devices at Rail-Highway Crossings. Presented at the 85th Annual Meeting of the Transportation Research Board. Washington, D.C. 2006.

### Technical Reports

1. Benekohal, R.F., Gregerson, G., Medina, J.C. LED Street Lighting Evaluation - Phase II: LED Specification and Life-Cycle Cost Analysis. Illinois Center for Transportation. FHWA-ICT-15-001. 2015
2. Medina, J.C., Benekohal, R.F. Agent-Based Real-Time Signal Coordination in Congested Networks. Nexttrans University Transportation Center. Project No. 104IPY04. 2014.
3. Lo, E.G., Medina, J.C., Benekohal, R.F. Dynamic Multi Modal Multi-Objective Intersection Signal Priority Optimization. Nexttrans University Transportation Center. Project No. 102IPY04. 2013.
4. Medina, J.C., Benekohal, R.F., Ramezani, H. Field Evaluation of Smart Sensor Vehicle Detectors at Railroad Grade Crossings – Volume 3: Performance in Favorable Weather Conditions. Illinois Center for Transportation. FHWA-ICT-13-028. 2013.
5. Medina, J.C., Benekohal, R.F., Ramezani, H. Field Evaluation of Smart Sensor Vehicle Detectors at Intersections – Volume 2: Performance under Adverse Weather Conditions. Illinois Center for Transportation. FHWA-ICT-13-014. 2013.
6. Medina, J.C., Benekohal, R.F. Agent-Based Traffic Management and Reinforcement Learning in Congested Intersection Network. Nexttrans University Transportation Center. Project No. 072IY03. 2012.

7. Medina, J.C., Benekohal, R.F., Ramezani, H. Field Evaluation of Smart Sensor Vehicle Detectors at Intersections – Volume 1: Normal Weather Conditions. Illinois Center for Transportation. FHWA-ICT-12-016. 2012.
8. Avrenli, K.A., Benekohal, R.F., Medina, J.C. LED Roadway Lighting, Volume 2: Field Evaluations and Software Comparisons. Illinois Center for Transportation. FHWA-ICT-12-013. 2012.
9. Avrenli, K.A., Benekohal, R.F., Medina, J.C. LED Roadway Lighting, Volume 1: Background Information. Illinois Center for Transportation. FHWA-ICT-12-012. 2012.
10. Hajbabaie, A. Medina, J.C., Benekohal, R.F. Traffic Signal Coordination and Queue Management in Oversaturated Intersection. Nextrans University Transportation Center. Project No. 047IY02. 2011.
11. Hajbabaie, A., Benekohal, R.F., Medina, J.C. Evaluation of Performance of Solar Powered Flashing Beacons at Severe Temperature Conditions. Illinois Center for Transportation. FHWA-ICT-11-084. 2011.
12. Medina, J.C., Benekohal, R.F., Hajbabaie, A. Evaluation of Sensys Wireless Vehicle Detection System: Year-After Evaluation and Off-Center Sensors. Illinois Center for Transportation. FHWA-ICT-11-083. 2011.
13. Medina, J.C., Benekohal, R.F., Hajbabaie, A. Evaluation of Sensys Wireless Vehicle Detection System: Results from Adverse Weather Conditions. Illinois Center for Transportation. FHWA-ICT-11-081. 2011.
14. Hajbabaie, A., Benekohal, R.F., Medina, J.C. Evaluation of Performance of Solar Powered Flashing Beacons at Room Temperature Conditions. Illinois Center for Transportation. FHWA-ICT-10-069. 2010.
15. Benekohal, R.F., Hajbabaie, A., Medina, J.C., Wang, M.H., Chitturi, M. Speed Photo-Radar Enforcement Evaluation in Illinois Work Zones. Illinois Center for Transportation. FHWA-ICT-10-064. 2010.
16. Medina, J.C., Benekohal, R.F., Hajbabaie, A. Evaluation of Sensys Wireless Vehicle Detection System: Results from the First Three Months. Illinois Center for Transportation. FHWA-ICT-09-059. 2009.
17. Hajbabaie, A., Benekohal, R.F., Medina, J.C., Chitturi, M. Evaluation of LED Vehicular and Pedestrian Modules. Illinois Center for Transportation. FHWA-ICT-09-043. 2009.
18. Medina, J.C., Benekohal, R.F., Chitturi, M. Evaluation of Video Detection Systems Volume 4 – Effects of Adverse Weather Conditions in the Performance of Video Detection Systems. Illinois Center for Transportation. FHWA-ICT-09-039. 2009.
19. Medina, J.C., Benekohal, R.F., Chitturi, M. Evaluation of Video Detection Systems Volume 3 – Effects of Illumination Conditions in the Performance of Video Detection Systems. Illinois Center for Transportation. FHWA-ICT-09-047. 2009.
20. Medina, J.C., Benekohal, R.F., Chitturi, M. Evaluation of Video Detection Systems Volume 2 – Effects of Illumination Conditions in the Performance of Video Detection Systems. Illinois Center for Transportation. FHWA-ICT-09-046. 2009.
21. Medina, J.C., Benekohal, R.F., Chitturi, M. Evaluation of Video Detection Systems Volume 1 – Effects of Configuration Changes in the Performance of Video Detection Systems. Illinois Center for Transportation. FHWA-ICT-08-024. 2008.
22. Benekohal, R.F., Wang, M.H., Medina, J.C. Crosswalk Signing and Marking Effects on Conflicts and Pedestrian Safety in UIUC Campus. FHWA-IL/UI-TOL-22. 2007.
23. Rodriguez, J., Medina, J.C., Benekohal, R.F., Black, R., Wang, M.H. Pedestrian Safety on Campus Crosswalks in Big Ten Universities. FHWA-IL/UI-TOL-21. 2007.
24. Benekohal, R.F., Medina, J.C., Roberts, C.D., Moroni, K., Wingo, L. Analysis of Pedestrians and Drivers Opinions on Crosswalk Safety at UIUC Campus. Volume 2 – Participants' Comments and Suggestions. FHWA-IL/UI-TOL-20. 2007.
25. Medina, J.C., Benekohal, R.F., Wang, M.H. Analysis of Pedestrian and Drivers Opinions on Crosswalk Safety at UIUC Campus. Traffic Operations Laboratory. FHWA-IL/UI-TOL-19. 2007.
26. Medina, J.C., Benekohal, R.F. High Tension Cable Median Barrier: A Scanning Tour Report. Traffic Operations Laboratory. FHWA-IL/UI-TOL-18. 2006.

### Teaching Experience

- Substitute lecturer for Highway Capacity Analysis (Graduate Course). 2010 – 2014
- Substitute lecturer for Traffic Flow Theory (Graduate Course). 2010 – 2014
- Substitute Lecturer for Highway Capacity Software Classes. 2010 – 2014

### Skills

- Specialized Software: VISSIM and COM Interface, SAS, HCS+, CORSIM, SYNCHRO.
  - Computer Programming: SAS, C++.
- Related courses: Applied statistical methods, data structures, genetic algorithm methods, artificial intelligence, programming for GIS, system methods and network techniques.
- Languages: English (Fluent), Spanish (Native), French (Basic).

## Honors and Awards

- C.E. Deleuw Travel Award. *Aug, 2010*  
Civil and Environmental Engineering, University of Illinois at Urbana-Champaign.
- ITE Student Paper Award. *Jan, 2009*  
Institute of Transportation Engineers - Illinois Section.
- Committed Students Award. *Apr, 2008*  
Engineering Council. University of Illinois at Urbana-Champaign.

## Service/Professional Affiliations

- Institute of Transportation Engineers (ITE).  
University of Illinois, Student Chapter.  
President (2007 - 2008), Vice-president (2006 - 2007), Secretary (2005 - 2006)
- Transportation Research Board (TRB).  
Reviewer for papers submitted to Annual Meeting.
- Institute of Electrical and Electronic Engineers (IEEE).  
Reviewer for papers submitted to ITS Society Conference and the IEEE Transactions.
- Reviewer for the International Journal of Engineering Management and Economics.

## References

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