Annual Report 2018

TRANSPORTATION RESEARCH BOARD
JOINT TRAFFIC SIMULATION
SUBCOMMITTEE

AHB45 (1)

SimSub

Chair's Message

SimSub Chair
Dr. Mohammed Hadi
Florida International University

Happy new year to all.

It is an exciting time to be a part of the simulation community as new methods, algorithms, and guidance are developed and implemented to support the planning, design, operations and management of the transportation system. With the increasing need to understand the impacts of transformative technologies on the transportation system, there is a need for significant advancements of simulation modeling research, development, and applications. This past year was a very active year in providing strong basis for these advancements. We will hear at the TRB about the state of the development of the Transportation System Simulation Manual (TSSM) and the role that we can play in future development and application of the TSSM. The TSSM development effort is expected to be an important focus of the simulation modeling community in the coming years and I encourage you to attend the SimSub meeting at the TRB annual meeting to hear more about it. This meeting will also provide an important review of national research efforts on simulation and on many other topics of interest. You can find the agenda of the program in this newsletter.

My sincere thanks to David Hale for preparing this newsletter. The time that he has devoted to this activity in recent years is greatly appreciated. A number of conferences and meetings related to simulation and advanced technology topics are occurring this coming year. Many of them are listed in the newsletter. I want to bring your attention to a workshop organized by our subcommittee, as part of the 2018 TRB annual meeting. Thanks to Jim Sturrock and John Halkias for their help in organizing the workshop. The workshop title is "Data Driven Simulation to Support Decision Making in the 21st Century: Barriers and Potential Benefits." You can find more details about the workshop and other related TRB annual meeting activities in this newsletter and the TRB annual meeting program.

I look forward to seeing you all and to our discussions at the TRB annual meeting.

Sponsor Committees

AHB45:	Traffic Flow Theory
AHB40:	Highway Capacity and Quality of Service
AHB20:	Freeway Operations
AHB25:	Traffic Signal Systems
ADB30:	Transportation Network Modeling
AHB55:	Work Zone Traffic Control
ADC20:	Transportation and Air Quality
AHB35:	Managed Lanes

Contents

SimSub Web Site

Alex Stevanovic, Webmaster **http://sites.google.com/site/trbcommitteeahb45**

U.S.Department of Transportation
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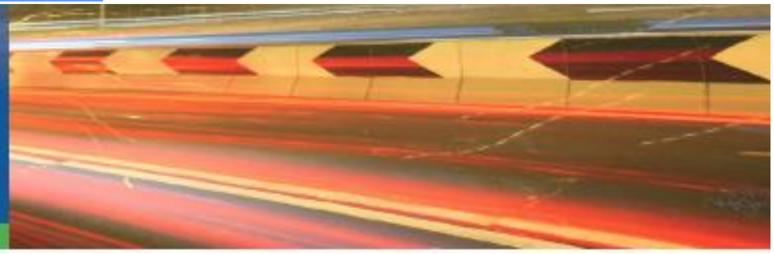

TRANSPORTATION SYSTEM SIMULATION MANUAL (TSSM)

This fact sheet outlines the need for TSSM, and the development of the first TSSM edition.

INTRODUCTION

As the transportation system environment grows in complexity, increasing pressure is placed on agencies to identify more innovative and efficient solutions to a wide range of issues. Simulation analysis has become increasingly vital for evaluating these solutions prior to implementation.

Several countries have developed simulation guidelines, but these have not gained recognition in the United States. Numerous State departments of transportation (DOTs) have produced their own simulation protocols, but none have gained nationwide acceptance. The Federal Highway Administration (FHWA) developed the content-rich Traffic Analysis Toolbox,[1] but this source has not achieved familiarity levels approaching those of the Highway Capacity Manual (HCM) or Highway Safety Manual (HSM). Agencies and States are now requesting the development of a national Transportation System Simulation Manual (TSSM) that can provide the necessary guidance to support 21st century traffic analyses.

BACKGROUND

The Saxton Transportation Operations Lab at FHWA's Turner-Fairbank Highway Research Center in McLean, VA, is working on addressing this need by developing the first ever TSSM. Funding is provided by the Traffic Analysis and Simulation Pooled Fund Study (TPF-5(176))[2] in collaboration with the Transportation Research Board (TRB) System Simulation Task Force (AHB80T). The team is receiving input from many stakeholders as demonstrated in figure 1. Informational webinars with stakeholders such as members of TPF-5(176) and of AHB80T, as well as other invited simulation experts are held regularly to discuss topics covered in the TSSM.

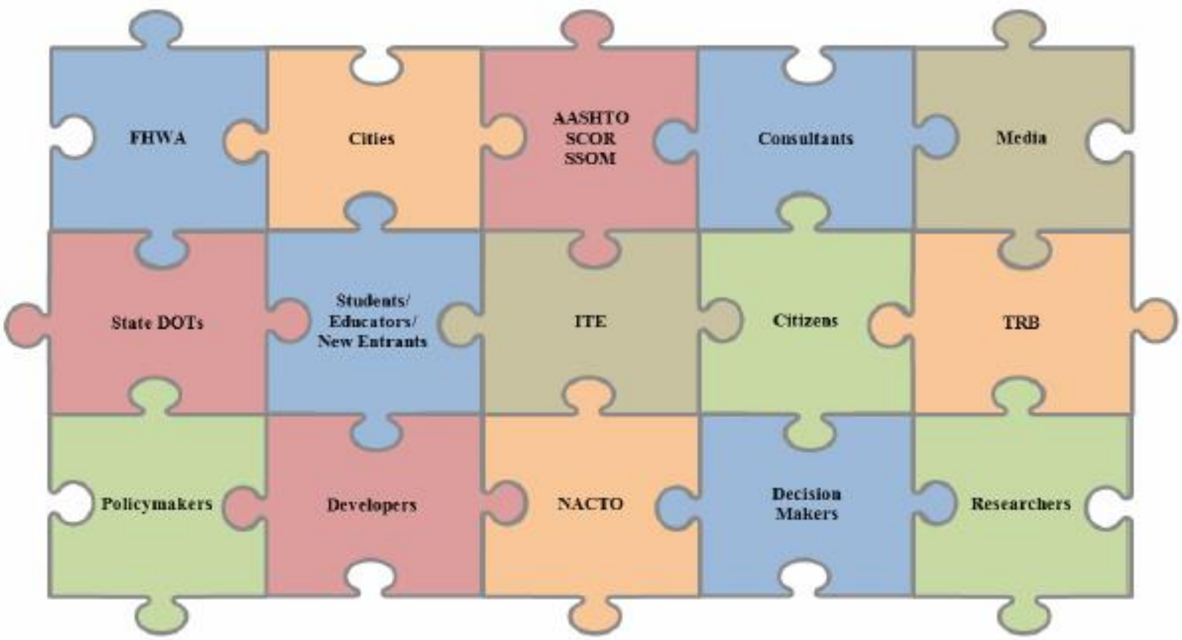

Figure 1. Stakeholders* involved in TSSM development *(source: FHWA)*

*AASHTO SCOR SSOM: American Association of State Highway and Transportation Officials Special Committee on Research and Innovation Subcommittee on Systems Operation and Management

ITE: Institute of Transportation Engineers

NACTO: National Association of City Transportation Officials

For more information, please contact:
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Office of Operations Research and Development | Transportation System Simulation Manual (TSSM)

THE MANUAL

Once finalized, the TSSM will consist of nine chapters to walk practitioners through scoping and applying transportation simulation.

VOLUME I. THE BASICS	
Chapter 1. What is Simulation	Chapter 3. Principal Ideas in Simulation
Chapter 2. What Options Exist	Chapter 4. Issues that Can Arise in Simulation

VOLUME II. MODELING GUIDANCE	
Chapter 5. Defining the Problem	Chapter 8. Verification, Calibration, and Validation
Chapter 6. Data	Chapter 9. Analysis and Presentation
Chapter 7. Creating the Model	Chapter 10. Post Project Validation

VOLUME III. SUPPLEMENTAL MATERIAL	
Chapter 11. Freeway System Models	Chapter 14. Multimodal Systems
Chapter 12. Arterial System Models	Chapter 15. Other Materials
Chapter 13. Freeway/Arterial System Models	

Figure 2. Outline of Chapters in TSSM *(source: FHWA)*

Volume I

The TSSM begins with an introduction to transportation system simulation, walking users through the analytical benefits, requirements, and underpinnings of simulation. The manual then helps users decide which traffic analysis model to use. Simulation might not always be the best option based on limitations and project stakeholder expectations.

Volume II

If users decide that transportation system simulation is the right method, the critical need chapters (5 through 9) provide guidance on successful simulation. In chapter 5, users receive guidance on determining the scope and scale of their simulation project. Chapter 6 provides insights into the data requirements for various forms of simulation. Once the data are gathered, chapter 7 describes the data entry process, in which many real-world processes must be translated into numerical entries. Verification, calibration, and validation (VC&V) are the next steps, after the preliminary simulations are complete, to ensure the outputs are reflective of real-world behaviors and outcomes. When results are calibrated and finalized, users can share their results visually and analytically. It is important for users to properly interpret the results received from simulation and, ultimately, to make informed decisions based on those results. The final chapter in volume II, chapter 10, will address the necessary steps to conduct post-project validation—an under-appreciated and likely under-used source of crucial insights that can then be applied towards future simulation projects.

Volume III

The last TSSM section will consist of a series of freeway and arterial case studies. This includes detailed supporting files/documents as well as other helpful supplemental material. The case studies will exemplify the procedures and practices recommended within volume II. The current plan is for the TRB Task force on system simulation to develop the bulk of the material for volume III.

PROJECT STATUS

The research team is in the early stages of TSSM development. Stakeholder webinars are ongoing and chapters are in draft stages. The critical need chapters (5 through 9) will be drafted in November 2017 and finalized in January 2018. Intermediate need chapters (1 through 4; chapter 10) will be drafted in March 2018 and finalized May 2018. Completion of the TSSM is expected in fall 2018.

Once the TSSM is completed, the TRB task force will assume responsibility for maintaining and enhancing all chapters of the manual.

REFERENCES

1. FHWA. "Traffic Analysis Toolbox" (website). Available online: https://ops.fhwa.dot.gov/trafficanalysistools/index.htm. Last accessed October 20, 2017.

2. National Cooperative Highway Research Program (NCHRP). "Traffic Analysis and Simulation" (website). Available online: http://www.pooledfund.org/Details/Study/403. Last accessed October 30, 2017.

U.S. Department of Transportation
Federal Highway Administration

For more information, please contact:
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FHWA-HRT-18-013
HRDO-20/12-2017(200)E

AMS Update

Analysis, Modeling, and Simulation

Biannual Research Update

Volume 1: Nov 2017

U.S. Department of Transportation
Federal Highway Administration

Recent Accomplishments

- Researchers developed a hardware-in-the-loop (HIL) system to conduct field testing of connected and automated vehicle (CAV) applications. In October 2017, they completed HIL testing of the signalized intersection approach/departure (SIAD) application at Turner-Fairbank Highway Research Center (under "**Hardware-in-the-Loop Testing of Connected Automated Vehicle Applications**" project).
- In October 2017, "**Developing Analysis, Modeling, and Simulation (AMS) Tools for CAV Applications**" began. This project will develop and validate model logic for selected CAV applications—and conduct real-world AMS case studies of CAV implementation scenarios.
- In-house researchers submitted 10 papers to be considered for the upcoming 2018 Transportation Research Board (TRB) Annual Meeting. Seven papers have been accepted for presentation, and three are in review for publication in the *Transportation Research Record.*

Upcoming Notables

- The first release (a beta version) of the Federal Highway Administration (FHWA) Driver Model Platform will be available (on the OSADP) in January 2018. The platform houses and interfaces specialized driver models with existing microsimulation packages. It includes the FHWA Work Zone Driver Model (under "**Developing the FHWA Driver Model Software for Practical Application**" project) and will soon include in-simulation diagnostics and post-simulation analysis tools.
- A new effort, funded by the Traffic Analysis and Simulation Transportation Pooled Fund (TPF) (see TPF-5(176)), "**Trajectory-Level Investigation of Recurring Bottlenecks for Calibration and Cost-Effective Remedies**", will begin soon. Researchers will collect and analyze vehicle trajectories during the formation, continuation, and dissipation of congestion at freeway sites—to enhance microsimulation algorithms for improved accuracy and to seek less costly mitigation strategies.
- Draft "critical needs" chapters of the *Transportation System Simulation Manual* will be developed in November 2017 and finalized in January 2018. Please contact David Hale if you would like to be involved in the review process (under "**Development of a Transportation System Simulation Manual (TSSM)**" project).

News

- Chris Melson will be leaving FHWA in November 2017. He will become the Program Manager for the Transportation Consortium of South Central States (Tran-SET), located at Louisiana State University (LSU).

Getting Involved

- These updates are associated with follow-up, biannual webinars. The first webinar is tentatively scheduled for November 27, 2017, from 2 to 3 p.m. (eastern standard time). A meeting invite will be sent out a week prior.
- Please provide feedback on what should be presented and/or discussed at this webinar by completing a short survey.
- Please provide feedback on what research we should be conducting by using this link. Feedback will be collected, analyzed, and summarized—and will help guide future research efforts.

Joe Bared (202) 493-3314	Concepts & Analysis Team Leader
Chris Melson (202) 493-3271	Research Civil Engineer
Peter Huang (202) 493-3484	Research Civil Engineer
Rachel James (202) 493-3205	Pathways Student

https://www.fhwa.dot.gov/research/tfhrc/projects/operations/ams/index.cfm

Publication No.: FHWA-HRT-18-006
HRDO-20/11-17(WEB)E

ANALYSIS, MODELING, AND SIMULATION (AMS) TOOLS FOR CONNECTED AND AUTOMATED VEHICLE (CAV) APPLICATIONS

Developing and validating model logic/algorithms for a selected set of CAV applications and conducting real-world case studies to better understand their impacts and inform implementation.

BACKGROUND

CAV technologies offer potentially transformative societal impacts—including significant mobility, safety, and environmental benefits. The Federal Highway Administration (FHWA) has led the development, research, and standards-making of these technologies, and is currently developing deployment approaches and guidance.

Deploying CAV applications require transportation agencies to quantify effectively and fully the impacts of such implementations, and to identify which application best addresses their unique transportation problem. However, current traffic analysis and planning tools are not well suited for evaluating CAV applications because of their inability to incorporate vehicle connectivity and automated features. It is necessary to adapt and re-engineer the existing set of tools available to agencies, validate these models/tools, and provide a mechanism to share these models/tools with public agencies.

To this end, FHWA initiated an effort to develop AMS tools for CAV applications and to conduct realistic case studies with these tools to help inform implementation and estimation of benefits.

STUDY OBJECTIVES

This project began in October 2017. The two primary tracks and focuses of the project are to:

1. Develop and validate model logic/algorithms for a selected set of CAV applications.
2. Conduct real-world case studies (practical implementation scenarios and real-world transportation networks) for a selected set of freeway-based CAV applications.

STUDY DESCRIPTION

Developing Model Logic/Algorithms

The project team will work with a variety of stakeholders—model developers, model users (State/local agencies and other practitioners), academia, and users and developers of CAV technology—to determine a selected set of CAV applications where validated model logic/algorithms are needed the most. For each of the CAV applications selected, the project team will:

- Create detailed data requirements for model development.
- Construct a comprehensive model development plan.
- If additional data is needed for model development and/or validation, make a data collection plan.

After these documents are prepared, two CAV applications will ultimately be chosen for model development, carefully considering: importance to the stakeholders, prevalence of model after development, feasibility of data requirements, timing and availability of required data, feasibility of collecting additional data, and other factors.

Each developed model component will be validated in a use case and publicly disseminated to practitioners. A report documenting the model, its development, and its validation will be published and disseminated.

Conducting Case Studies

As with the development of model logic/algorithms, the project team will work closely with a variety of stakeholders to select a series of case studies to conduct, carefully considering: their importance to the stakeholder group, commitment from the specific State/local agency at the selected site, availability of existing network data, type of facility, ability to draw broader conclusions, among others. These potential case studies may include CAV AMS components of current or recently completed FHWA-led projects.

For each selected case study, the project team will create detailed case study descriptions.

A subset of these selections (three test sites) will ultimately be chosen for analysis. For each selected case study, a report will be prepared and published. During the execution of the case studies, the project team will consistently interact with State and local agencies, helping ensure the case study assumptions are consistent with stakeholder needs and expectations.

www.fhwa.dot.gov/research/

For more information, please contact:
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CAV AMS Update

SUPPORTING EFFORTS

This project is part of a larger effort to provide necessary, adequate, and validated CAV-aware AMS tools to practitioners. It will utilize the AMS framework currently being developed in "Development of an Analysis/Modeling/Simulation (AMS) Framework for V2I and CV Environment".[1] A simplified framework is shown in figure 1.

This project will build-out model components identified in the framework, address current AMS gaps related to CAV technology, while fulfilling the needs/requirements of the users.

REFERENCES

1. FHWA Factsheet (2017). "Analysis, Modeling, and Simulation (AMS) Framework for Connected and Automated Vehicle (CAV) Applications". In production.

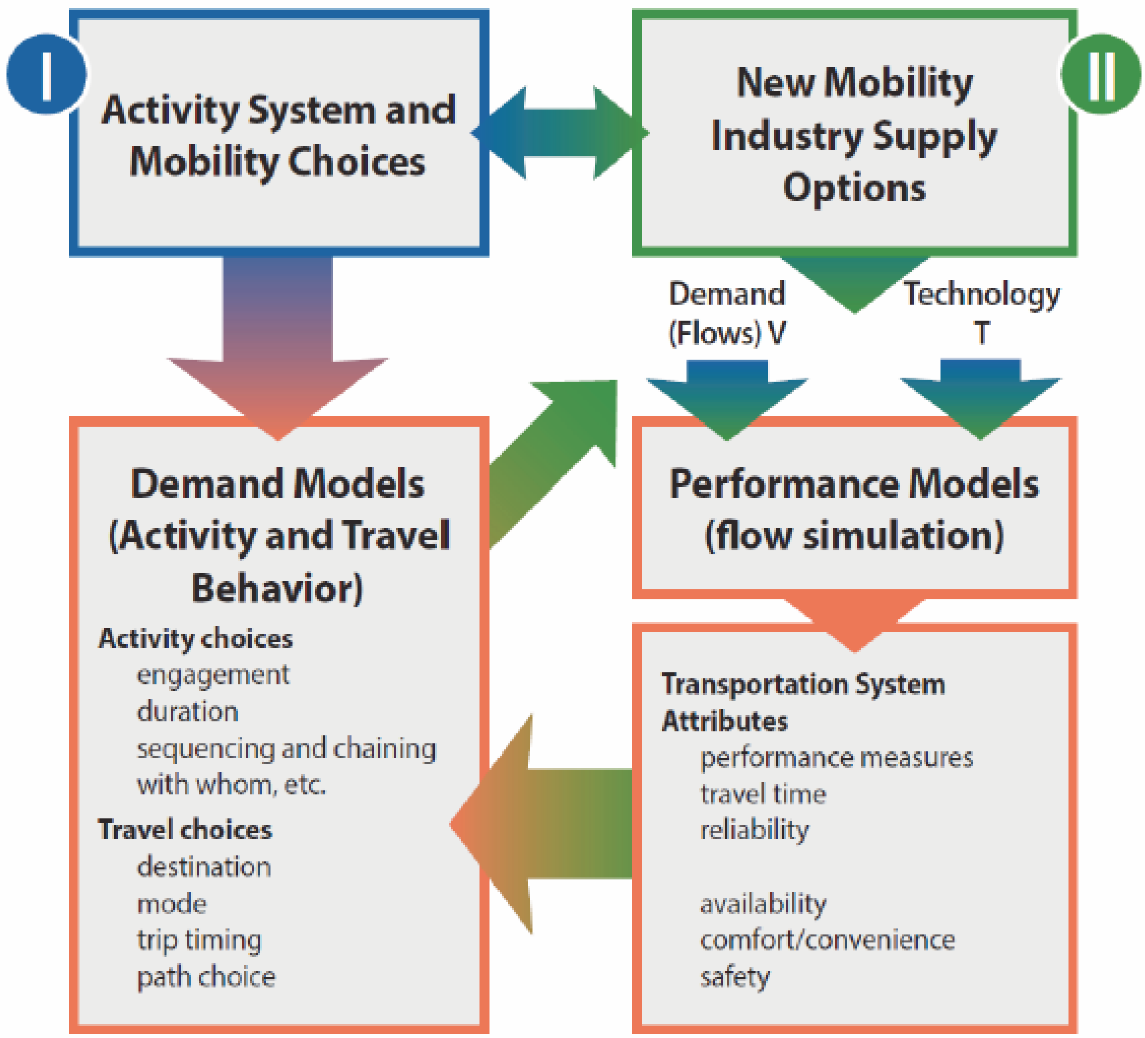

Figure 1. Methodological framework for network- and system-level assessment of CAV impacts. (Source: FHWA).[1]

U.S. Department of Transportation
Federal Highway Administration

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FHWA-HRT-18-026
HRDO-20/12-17(200)E

SimSub Best Paper Award

The Transportation Research Board (TRB) Joint Simulation Subcommittee (SimSub—AHB45(1)) presented its **Best Simulation Application Paper Award** at the TRB 2017 annual meeting.

"**Diverging Diamond Interchange Signal Phasing Scheme Evaluation using Microsimulation**" (presented at the 96th TRB Annual Meeting)

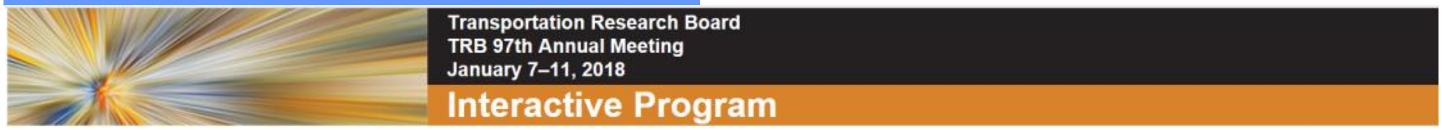
Authors:
Shannon Warchol (NC State University)
R. Thomas Chase (NC State University)
Christopher Cunningham (NC State University)

Awards committee:
Tomer Toledo, **Kaan Ozbay**, and **Jorge Laval**

Pictured from left to right:
Thomas Chase (NCSU)
Shannon Warchol (NCSU)
Tomer Toledo (Technion)
Chris Cunningham (NCSU)

Abstract:

While research surrounding diverging diamond interchanges has existed for more than a decade, the effort to standardize signal timing of the interchange has only recently developed. This research sought to determine the influence of crossover spacing and increased volume levels on DDI phasing scheme performance. A three-factor fully crossed experiment was conducted. Vistro and DBAT were used to optimize the split, cycle length, and offset of each of the 72 treatments. Data was collected through microsimulation using Vissim. Mean interchange delay and mean stops per vehicle were selected as measures of effectiveness. Pairwise comparisons were used to determine if a preferred scheme existed given 1) a set spacing and increased volume; 2) a set volume regardless of the spacing; and 3) a set spacing regardless of the increased volume. The data revealed that most often a two-or three-critical phasing scheme resulted in the lowest mean interchange delay and number of stops. Overall, the results provide an initial signal timing scheme for practitioners given a crossover spacing, an increased volume, or both. Future work includes exploration of low volumes and balanced interchange volumes and their impact on the four-critical movement phasing scheme as well as the impact of closely spaced adjacent intersections.



Workshop
Data Driven Simulation to Support Decision Making in the 21st Century: Barriers and Potential Benefits

Sunday 9:00 AM- 12:00 PM
Convention Center, 101
Workshop 130

Sponsoring Committee:
AHB45 – Traffic Flow Theory and Characteristics Committee

Workshop Description
Simulation modeling has become an important component to support the decision making process of transportation agencies. Recent advancements in data analytics, performance measurement and management, and vehicle connectivity and automation have created opportunities and challenges to transportation system researchers and users that require transformative changes in simulation modeling algorithms, calibration and validation methods, and applications. The simulation algorithms will need to be updated to reflect a traffic stream with mixed levels of emerging technologies such as connectivity and automation that impacts microscopic and thus macroscopic traffic characteristics. The traditional methods to calibrate simulation models based on limited amount of data need to be replaced with methods that take full advantage of detailed and fine grained data that are becoming available from multiple sources. The use of the models to assess the impacts of emerging technologies such as those associated with connectivity and automation is another challenge facing modelers and researchers, considering the limited amount of real-time applications of these technologies. This workshop will present a review of the issues facing simulation modeling in the first half of the 21st century and solutions that are being identified to start addressing these issues.

Moderator: James Sturrock, Federal Highway Administration

Presentations:

Karl Wunderlich - "**Data Driven Analysis Techniques in Reliability Space**"

George List –"**Helping to Converge the Practice of Transportation System Simulation**"

Michalis Xyntarakis, Vassili Alexiadis, Vincenzo Punzo, Erin Flanigan. – **"A Framework for Validating Traffic Simulation Models at the Vehicle Trajectory Level."**

Kier Opie – **"Data Plan for the NYC Connected Vehicle Pilot Deployment Evaluation".**

Samer Hamdar – "**Guidelines for Designing Active Transportation and Demand Management (ATDM) Strategies Through Understanding Travelers' Motivations in Decision-making: Data Collection, Analysis and Modeling**"

Steven E. Shladover -**"Challenges to Simulating the Traffic and Energy Impacts of Connected and Automated Vehicle Systems".**

Alexander Skabardonis _ "**Data Inputs and Impacts to Connected and Automated Vehicle Modeling – Takeaways from ISTTT 22**"

2018 TRB Simulation Activities

Freeway Simulation Subcommittee, AHB20(2)
Sunday, January 7, 2018, 1:30-3:30 PM
Ballroom Salon 1 (M2), Marriott Marquis

Panos D. Prevedouros, University of Hawaii, Manoa, presiding

Sponsored By: Freeway Operations (AHB20)

A G E N D A

1. INTRODUCTIONS

2. PRESENTATIONS AND UPDATES*

- Fanis Papadimitriou and Dimitris Serbis, DIC, Attikes Diadromes SA, Attica Tollway Operator, **Freeway Off-Ramp Bottleneck Simulation**
- John Ash and Yinhai Wang, U of Washington, **CAV Simulation Research on Adaptive Roadway Lighting Control**
- Alkis Papadoulis, Loughborough University, **Estimating Safety Impacts of CAV though Simulation in Mixed Traffic**
- Clark Letter, Mahmoud Pourmehrab and Lily Elefteriadou, University of Florida, **Simulation of Intersection Operation under Traffic of CAV and Conventional Vehicles**
- Linda Wu and Guohui Zhang, **CAV Trajectory Formulation for Optimal Intersection Management and Simulation**
- Brian Park, University of Virginia, **Development and Application of Integrated Safety Assessment Tool for CAV**
- David Stanek, Fehr and Peers, **Measuring CAV Impacts on Congested Networks Using Simulation**
- Alastair Evanson, PTV GROUP, **Vissim Capabilities for CAV Simulation**
- Jordi Casas, TSS, **Aimsun in CAV projects** and **Updated Car-Following in Highway Models**

(*) Presenters will need to adhere to the 8 minute max. requirement for each presentation.

3. UPDATES TO SUBCOMMITTEE PURPOSE AND OBJECTIVES

Please see attached file. Feel free to send me suggestions ahead of the meeting.

2018 TRB Simulation Activities

Simulation-Based Optimization for Time-of-Day Coordinated Ramp Metering of a Large-Scale Urban Expressway Network

Yun (Charles) Ye, University of Hong Kong
Xiqun (Michael) Chen, Zhejiang University

This article adopts a computationally efficient simulation-based optimization (SBO) approach to solve the time-of-day ramp metering optimization problem for a large-scale urban expressway network. In contrast to conventional ramp metering, the SBO approach aims to capture and optimize multiple performance measures while considering the correlated effects among on-ramps. Different from the conventional ramp metering methods, which often focus on isolated ramp metering or a small group of on-ramps, the SBO approach optimizes coordinated ramp metering for a large-scale urban expressway network. To demonstrate the SBO framework for solving the time-of-day coordinated ramp metering problem, this paper uses a mesoscopic simulator, i.e., DTAlite, and adopts a calibrated DTA model to evaluate the performance of the transportation system. In a case study of a real-world large-scale road network in Hangzhou, China, a mixed surrogate model is employed to solve the optimization model, and the candidate approach (CAND) is utilized to infill the initially sampled points. The optimization results show there is 1.36% (0.186 min) reduction in average trip travel time for the overall network. The total travel time savings for all 309,671 travelers are around 961 hours during the extended 4-hour morning peak (6-10 AM). Given the value of time CNY 40 (US $5.9) per hour, the total reduction in the time cost is around CNY 38,440 (US $5676.5) for the study period. The improvements in total throughput and expressway throughput are 0.54% (1,396 vehicles) and 1.24% (1,374 vehicles) during the extended morning peak, respectively. The proposed SBO framework for ramp metering can be incorporated along with other traffic control strategies to solve urban expressway optimization problems.

A Comparison Between Logic-Based and Optimization-Based Adaptive Signal Control Systems, Using Microsimulation

Mahmoud Raoufi, NJ Institute of Technology
Sonal Ahuja, PTV Group
Robert Hildebrandt, PTV Group
Florian Weichenmeier, PTV Group
Domingo Lunardon, PTV Group

Adaptive signal control systems are widely used in big cities around the world. Most of the current systems decide based on a set of logics to extend or cut the current signal stage (phase) in order to maximize the road network use. With the advancements of computers and optimization methods, new systems have been designed. These systems optimize the timings by applying a heuristic optimization method to a target function that contains different traffic measures for each mode of transport. In this paper, a comparison is made in VISSIM traffic micro-simulator between the widely used system SCATS (Version 6.5) as a logic-based adaptive signal control and new developed BALANCE/EPICS as an optimization-based one. A part of the CBD of Tehran with three signalized intersections was modeled in VISSIM from 06:00 to 10:00 AM with around 44,000 veh-trips. Additionally 322 BRT vehicles cross the West intersection. The area was already equipped with the SCATS. To make the comparison, the signal timings of the SCATS in VISSIM were replaced with BALANCE/EPICS Signal Controllers. The results show significant improvement of the performance after applying the optimization-based system. The difference is more considerable during the peak time. Delay, queue length and fuel consumption are decreased by 37%, 45% and 24% respectively. The delay of the BRT vehicles is decreased by 48%. It should be clarified that there are some critiques to the methodology that are described in the paper.

2018 TRB Simulation Activities

Transportation Research Board
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Interactive Program

Multithread Optimization for the Calibration of Microscopic Traffic Simulation Model

Zenghao Hou, Parsons
Joyoung Lee, New Jersey Institute of Technology

This paper proposes an innovative multi-thread stochastic optimization approach for the calibration of microscopic traffic simulation model. Combining Quasi-Monte Carlo (QMC) sampling and Particle Swarm Optimization (PSO) algorithm, the proposed approach, namely the QPS calibration method, is designed to boost searching process without prejudice to the calibration accuracy. Given the search space constructed by the combinations of simulation parameters, the QMC sampling technique filters the searching space, followed by the multi-thread optimization through the PSO algorithm. A systematic framework for the implementation of the QPS method is developed and applied for a case study dealing with a large scale simulation model covering a 6-mile stretch of interstate highway 66 (I-66) in Fairfax, Virginia. The case study results prove that the proposed QPS method outperforms other methods utilizing Genetic Algorithm, Latin Hypercube Sampling (LHS) in achieving faster convergence to obtain optimal calibration parameter set.

Parameter Estimation of a Stochastic Microscopic Car-Following Model

Tu Xu, Georgia Institute of Technology (Georgia Tech)
Jorge Laval, Georgia Institute of Technology (Georgia Tech)

This paper presents the formulation and parameter estimation of a family of microscopic car following models based on stochastic desired acceleration processes. This formulation generalizes previous separate efforts based on Brownian and geometric Brownian acceleration processes, each reproducing a different feature of traffic instabilities. The single extra parameter needed regulates the type of driver error in a scale from Brownian to geometric Brownian acceleration processes. The model parameters are estimated using maximum-likelihood estimation on a six-vehicle car-following experiment. We find evidence that the error process is closer to the geometric Brownian motion and that it is the same for all six drivers.

2018 TRB Simulation Activities

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Evaluation of Multiple Hardware and Software in the Loop Signal Controllers in Simulation Environment

Nikola Mitrovic, Florida Atlantic University
Aleksandar Stevanovic, Florida Atlantic University
Sharmin-E-Shams Chowdhury, Florida Atlantic University

This study evaluates two groups of methods to model traffic signal operations in microscopic simulation: Hardware-In-the-Loop Simulation (HILS) and Software-In-the-Loop Simulation (SILS). These methods have become standards for accurate modeling of traffic signal operations but in spite of large number of available options there were not studies that have conducted relevant comparative evaluations. This study bridges this gap by investigating signal timing and operational differences of these two methods in basic actuated operations of a single signalized intersection. The emphasis is given to broad examination of various platforms as opposed to more complex experiments be done with individual platforms. A representative number of 65-minute simulation runs were executed for each experimental scenario. The results showed that differences between various HILS and SILS platforms are large enough that one cannot confidently switch between the platforms without impacting the final outcomes. The study confirmed previous findings about impact that the initialization process has on the final outcome of the signal and traffic performance. These findings put a significant restriction on how various HILS and SILS platforms, either alone or in conjunction with other higher forms of traffic control strategies, can be used in joint fashion. Future research should address higher-complexity experiments with SILS and should attempt to control initialization process to reduce its impact on the stochasticity of the results.

Assessment of Traffic Signal System Performance Using Vehicle Trajectories

Marija Ostojic, Northwestern University
Archak Mittal, Northwestern University
Hani Mahmassani, Northwestern University
David Hale, Leidos, Inc.

Since the 2000's, researchers have been designing and examining the potential of visualizing high-resolution signal and vehicle trajectory data for the purpose of gaining better insight into traffic control system performance, corridor progression along with the other system measures of effectiveness. Along with technological advancements, obtaining finer granularity data became achievable. Visualizing relevant signal performance data in an easy-to-understand format is crucial when identifying problem areas and/or causes of problems. Furthermore, visualizing of now-obtainable information needs to be accompanied by a tangible and robust performance metric. Traditional measures of effectiveness may not suffice this need. Therefore, to analyse the additional information provided by the high-resolution data alternative performance measures are required. The proposed rate of utilization of available green time and space incorporates multiple aspects of signal performance assessment: total delay, progression speed, quality of progression, as well as the impact of oversaturation. It can be applied at an individual vehicle level, measuring how well the vehicle is utilizing time and space under specific signal control operational conditions, or any other more aggregate level. The concept utilizes vehicle-trajectory and signal phase status and duration data to ascertain the responsiveness of trajectory-based measures when different control strategies are applied. To develop and demonstrate the concept, the study uses simulation data in a format that corresponds to high resolution data - signal status and vehicle positions at a one-second frequency.

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Simulation of Emergency Vehicle Operations

Cristian Cortes, Universidad de Chile
Bruno Stefoni, Universidad de Chile

Emergency services are provided by entities that have a relevant role in the normal operation of a city. The Santiago Fire Department is interested in performing a more precise travel time estimation used by the algorithms implemented for dispatching their trucks if the moving traffic were properly modeled under the presence of an emergency vehicle (EV), which are clearly subject to disturbances. This apparent detail could imply a different routing scheme if the infrastructure were not flexible enough for the other vehicles to move in order to give free pass to the EV. In such and other cases, the best routing decision could be different if the behavior around EVs were added to their routing-dispatching tool. It is clear that the operation of EVs considerably affect traffic conditions due to the perturbations caused on the circulation conditions around the EV's routes when they are moving towards an emergency site. Normally, they do not respect traffic rules as a normal vehicle should do. In order to simulate this phenomenon, we use the Microscopic Traffic Simulator PARAMICS with an API developed to replicate the anomalous behavior found in the literature as well as that observed in video footage provided by the Santiago Fire Department, i.e., crossing intersections without right-of-way, using bus only lanes, forcing nearby vehicles to change lane or to cross at a red light. We present results in terms of variation of response times for a synthetic network under different traffic congestion levels and percentage of drivers cooperating.

Improving Simulation Assessment of Express Lanes Through Managed Lane Evaluation Output in Vissim

Kelvin Machumu, University of North Florida
Thobias Sando, University of North Florida
Soheil Sajjadi, Arcadis U.S.
Enock Mtoi, AECOM

Dynamically priced toll lanes, also referred to as managed lanes (ML), are increasingly being considered as a strategy to improve travel time reliability on congested corridors. In the United States, Vissim is a recognized simulation software used for analyzing the performance of ML facility. It has a built-in functionality for the dynamic pricing and a module for reporting the managed lane evaluation (MLE) outputs, which include speed, travel time, and density. In computing the performance measures, the existing Vissim managed lane evaluation (EVMLE) tool is designed to use the section starting at the point when vehicles are assigned to use ML facility, also known as the managed lane routing decision (MLRD) point, which is located upstream the ingress. The longer the MLRD distance from the ingress, the more the EVMLE tool uses the traffic conditions of the ML facilities traffic before entering the facility in its computations. This study evaluates the impact of the MLRD distance on the EVMLE outputs and presents a proposed algorithm that addresses the EVMLE shortcomings. For demonstration purposes, only the speed was used to represent other performance measures. The analysis of variance (ANOVA) test was performed to determine whether there was a significant difference in the speed results by changing the MLRD distance. According to the ANOVA results, the EVMLE tool produced ML facility speeds that are MLRD dependent, yielding lower speeds with an increased MLRD distance. On the other hand, the ML facility speed results from the proposed algorithm were relatively constant, regardless of the MLRD distance.

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Model and Simulation of the Traffic of the Urban Signalized Intersection with Island Work Zone

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Work zones exist widely in cities of many countries and have a significant negative impact on city traffic; however, the majority of existing studies focused on freeway work zones, work zones on urban arterials have not been investigated carefully. For the first time, this paper focuses on a specific type of work zone that is located within the area of a signalized intersection, namely, island work zone, and a novel traffic flow model for the island work zone traffic flow is proposed by improving the existing social force model in the paper. Compared to the existing traffic flow models, such as the car-following and lane-changing models, the proposed model can capture the special traffic flow characteristics of the island work zone, including the heterogeneity, no lane division, and irregular boundary. Field data collected in Chengdu, China is used to calibrate and validate the proposed model. Simulations are also conducted to investigate the variations of the vehicle number and average speed for different work zone features and traffic flow characteristics. The results display that the model can replicate the heterogeneous traffic flow of the intersection with island work zone with high performance. When an island work zone is located close to the intersection exit, the entered vehicles are blocked before the exit, so the yellow time should be extended to ensure all the entered vehicles can pass the intersection. When a work zone occupies over one meter of the median divider, its impact on the traffic flow will become much significant.

Safety Impact of Weaving Distance on Freeway Facilities with Managed Lanes Using Both Microscopic Traffic and Driving Simulations

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With the increased traffic congestion challenges, the managed lanes' (MLs) concept has been gaining popularity recently since it could effectively improve traffic mobility. Usually, the MLs are designed to be left-lane concurrent with an at-grade access/exit. Such design forms weaving segments since it requires vehicles to change multiple general purpose lanes (GPLs) to enter or exit the MLs. The weaving segment will have a negative traffic safety impact on the GPLs. This study provides a comprehensive investigation of safety impact of different lengths for each lane change maneuver () on GPL weaving segments close to the ingress and egress of MLs through two simulation approaches: VISSIM micro-simulation and driving simulator. The two simulation studies are developed based on the traffic data collected from I-95 in Miami, Florida. The results from the two simulation studies support each other. Based on the two simulation studies, it is recommend that 1,000 feet be used as the optimal length for per lane change at the GPLs weaving segments with MLs. The safety impact of traffic volume, Variable Speed Limit (VSL) control strategies, and drivers' gender and age characteristics are also explored. This study can provide a valuable insight in evaluating the traffic performance of freeway weaving segment with the presence of concurrent GPLs and MLs in a highway safety context. It also provides guidelines for future conversion of freeways to include MLs.

Microsimulation of Truck Platooning with Cooperative Adaptive Cruise Control: Model Development and a Case Study

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Cooperative adaptive cruise control (CACC) systems have the potential to improve traffic flow and fuel efficiency, but these effects are challenging to estimate. This paper reports the development of a micro-simulation model to represent these impacts for heavy trucks using CACC when they share a freeway with manually driven passenger cars. The simulation incorporates automated truck following models which have been derived from experimental data recorded on heavy trucks driven under CACC, adaptive cruise control (ACC), and conventional cruise control (CC). The simulation includes other behavioral models for lane changing, lane change cooperation and lane use restrictions for trucks to better capture real-world traffic dynamics. The paper explains the calibration of the simulation method for a 15-mile urban freeway corridor with heavy truck traffic and significant congestion. Simulation results show that truck CACC improved traffic operations for trucks in terms of VMT, average speed and flow rate. In addition, truck CACC did not adversely affect passenger cars operations and in some locations it even produced considerable improvements in the general traffic conditions.

Development and Evaluation of a Trajectory-Driven Optimization for Automated Driving (TOAD) on a Signalized Corridor with Imperfect Market Penetrations

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This research presents a signal control strategy for a corridor with automated vehicles utilizing vehicular trajectory-driven optimization method (TOAD). TOAD provides an optimal trajectory for automated vehicles while maintaining safe and uninterrupted movement of general traffic, consisting of regular unequipped vehicles. Signal status parameters such as cycle length and splits are continuously captured. At the same time vehicles share their position information with the control agent. Both inputs are then used by the control algorithm to provide optimal trajectories for automated vehicles resulting in the reduction of vehicle delay along the signalized corridor with fixed-time signal control. To determine the most efficient trajectory for automated vehicles an evolutionary-based optimization is utilized. The concept was evaluated using microsimulation in PTV VISSIM. The results for selected signalized corridor in Princeton, New Jersey indicate up to 18 % reduction in overall corridor travel time depending on different market penetration and lane configuration scenario.

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Impact of Cooperative Adaptive Cruise Control (CACC) on Multilane Freeway Merge Capacity

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Cooperative Adaptive Cruise Control (CACC) allows vehicles to exchange real-time operational information wirelessly, enabling vehicles to travel in strings with shorter than normal time gaps between adjacent vehicles and ultimately increases the freeway capacity. This study is intended to investigate the impact of CACC vehicle string operation on the capacity of multilane freeway merge bottlenecks, commonly found at on-ramp merging areas on urban freeways. Simulation experiments were conducted using CACC car-following models derived from field test data, together with models of lane-changing of CACC vehicles and manually driven vehicles, as well as a maximum CACC string length constraint. Simulation results reveal that the freeway capacity increases quadratically as the CACC market penetration increases, with a maximum value of 3080 veh/hr/lane at 100% market penetration. The disturbance from the on-ramp traffic causes the merge bottleneck and can reduce the freeway capacity by up to 13% but the bottleneck capacity still increases in a quadratic pattern as CACC market penetration becomes larger.

Quantifying Influences of Cooperative Adaptive Cruise Control (CACC) Vehicle String Operation Strategies on Mixed Traffic Flow

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CACC operation strategies are important for the successful deployment of CACC by improving the probability for CACC vehicles to join CACC strings, and help maintain the string operation throughout a highway corridor. To quantify the traffic impacts of CACC when various CACC operation strategies are implemented, we have developed a micro simulation platform that represents the behaviors of CACC vehicles and their interactions with human drivers. With the simulation platform, we have explored the effects of a CACC managed lane (ML) strategy, a vehicle awareness device (VAD) strategy and discretionary lane change (DLC) restrictions on the traffic flow dynamics of a simple four-lane freeway section and a 20-kilometer freeway corridor. Our analysis results indicate that the ML and VAD strategy can substantially increase the pipeline capacity of the freeway when the CACC market penetration is 60% or less. On the other hand, the DLC restriction strategy is most helpful when the penetration is 80% or higher. The ML and VAD strategy can lead to significant improvement of the traffic operation at freeway on-ramp bottlenecks under various CACC market penetration cases. Those strategies are also capable of enhancing the overall operation of the freeway corridor, even for CACC market penetrations as low as 20%.

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Real-Time Adaptive Traffic Metering in a Connected Urban Street Network

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This study presents an adaptive methodology for real-time traffic metering in urban street networks with various degrees of connectivity. The methodology is a model predictive control approach. It gathers connected vehicle and loop detector data, estimate density across network links, find near-optimal metering rates at network gates over a prediction period constituting several time steps, and implement them in the network for the next time step. Finding optimized metering rates involves solving a mixed-integer linear program (MILP) that is very complex. As a result, distributed optimization decomposes the network to various subnetworks, and rather than solving a network level MILP, solves several subnetwork level MILPs in parallel. As a result of this technique, real-time solutions are attainable. Creating effective distributed coordination among various subnetworks pushes the solutions towards optimality and ensures finding near-optimal solutions. The developed methodology is applied to a number of case studies in a real-world urban street network in VISSIM with different connected vehicle penetration rates. The results show that traffic metering increases network throughput by 69.2% to 70.3% and at the same time reduces total system delay by 16.8% to 22.7% compared to a no-metering strategy. Increasing the penetration rate of connected vehicles up to 30% results in significant improvements in the performance of the case study network; however, increasing the penetration rate beyond this value does not result in further significant improvements.

Effects of Connected and Autonomous Vehicles on Contraflow Operations for Emergency Evacuation: A Microsimulation Study

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Efficient and effective emergency evacuation depends primarily on the transportation infrastructure. Time sensitive evacuation operations can place significant demand on the evacuation routes, and authorities deploy the best possible emergency evacuation plans to evacuate maximum amount of traffic in an efficient manner. One such evacuation technique employed by different state agencies is contraflow evacuation. Connected and Autonomous Vehicle (CAV) technologies, equipped with vehicle-to-vehicle (V2V) or vehicle-to-infrastructure (V2I) communications, can be very effective to improve overall traffic operations in a unique evacuation operation such as contraflow. This study presents a comprehensive assessment of the contraflow evacuation operation in CAV environment for I-10, which is one of the major evacuation routes in the State of Florida. The microsimulation software VISSIM was used to model the roadway network. Evacuation traffic data was collected from previous FDOT studies. A customized external driver model was developed for the CAV with automated longitudinal control to be used in VISSIM. System performance was evaluated for different market penetration rates (MPRs) of CAVs. This study found significant improvements in system performance for contraflow operations with the presence of CAVs in evacuation traffic. The results showed significant reduction in total delays and travel times for the overall evacuation route and significant increase in evacuation speeds when CAVs were at least 30% of the total traffic. It concludes that higher percentages of CAVs contribute to efficient operational performance and fast evacuation during a contraflow operation.

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Estimating Passenger Car Equivalents on Level Freeway Segments Experiencing High Truck Percentages and Differential Average Speeds

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In the Highway Capacity Manual (HCM), the passenger car equivalent (PCE) of a truck, which represents the number of passenger cars that would have an equivalent effect on the traffic flow, is used to account for the impacts of trucks on a traffic flow. The values were provided from a FRESIM simulation, and it was determined that the truck PCE for level freeway segments was 1.5 for all conditions. The HCM PCE values are not appropriate for the western U.S., which consistently experiences truck percentages higher than 25 percent. Furthermore, the HCM PCE procedure assumes that truck and passenger cars travel at the same average speed on level terrain. However, many heavy trucks in the western U.S. have speed limiters installed, to travel at speeds considerably less than the speed limit, to improve fuel efficiency. The interaction of the high truck percentages and large speed differences may result in platoon formation when trucks pass other trucks at low speed differentials. This may lead to increased delay for the following passenger car vehicles who, all else being equal, wish to travel faster. This paper examines these effects using data from I-80 in western Nebraska. The paper develops new PCE values based on the HCM equal-density approach using calibrated CORSIM and VISSIM simulation models. It was found that the PCE values in the HCM 2010 underestimate the effect of heavy trucks on level terrain freeways that experience high truck percentage and where different vehicle types have large differences in average speeds.

Calibration of Microscopic Traffic Flow Models Enabling Simultaneous Selection of Specific Links and Parameters

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This study proposes a methodology for the calibration of microscopic traffic simulation models by enabling simultaneous selection of traffic links and associated parameters. That is, any number and combination of links and model parameters can be selected for calibration. Most calibration methods consider the entire network without 1) enabling a specific selection of location and associated parameters or 2) using a sequential and ad hoc approach. In practice, only a subset of links and parameters are used for calibration based on several factors, such as expert knowledge of the system or constraints imposed by local governance. In this study, the calibration problem for simultaneous selection of links and parameters was formulated using a mathematical programming approach. The proposed methodology is capable of calibrating model parameters, taking into consideration multiple time periods and performance measures simultaneously. Traffic volume and speed were the performance measures used in this study. The methodology was developed without considering the characteristics of a specific traffic flow model. A genetic algorithm was implemented to find a solution to the proposed mathematical program to calibrate microscopic traffic flow models. In the experiments, two traffic models were calibrated. The first set of experiments included selection of links only, while all associated parameters were considered for calibration. The second set of experiments considered simultaneous selection of links and parameters. Results showed that the models were calibrated successfully subject to selection of a minimum number of links.

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Uncertainty and Stochasticity in Traffic Simulation: A Theoretical Framework

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This paper attempts to clarify how uncertainty affects stochastic traffic simulation. The nature of uncertainty in both real systems and models is described and compared, distinguishing between heterogeneity and stochasticity. Taxonomy, useful to describe the uncertainty flow throughout a model is introduced, defining uncertainty sources and causes, i.e. mechanisms triggering uncertainty. The proposed conceptual framework is applied to shed light on crucial issues such as error compensation and model overfitting. Eventually, a general framework to manage the uncertainty in a traffic modelling process is introduced and its basic implications on current traffic simulation practice are outlined.

Analysis of Wiedemann Car-Following Thresholds Using Driving Simulator Observations

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The Wiedemann model is a widely-used regime change type of car following model. The perception thresholds used in differentiating between regimes depend on differences in speed states of the subject and lead vehicles. Many of these thresholds are difficult to measure in the field and are typically calibrated using aggregate field measures. However, driving simulators can be used to study car following behavior in a controlled environment. In this study, driving scenarios have been designed in a driving simulator to study these car following thresholds at different speeds. Trajectory data from subjects using a driving simulator are used to calibrate Wiedemann thresholds at different speed ranges. The methodology can calibrate these thresholds for other populations and for specific driver types.

A Driver–Vehicle Integrated Model Using Car-Following and Engine Dynamics

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A traffic system consists of a driver, vehicle and the travel environment. A natural way to mimic this real world system is to model the driver-vehicle-environment as a closed loop problem. However, the current microscopic traffic models attempt to solve this dynamic closed-loop problem as an amalgamation of open-loop. This leads to artifacts such as representing the vehicle and its dynamics as a part of the larger driver-vehicle unit and treating it as a single floating kinetic particle. The movements of these particles are largely governed by driver behavioral models such as car-following, gap-acceptance and lane-changing and a few user-specified vehicle characteristics such as desired and maximum/minimum speeds and acceleration. Such inexplicit treatment of vehicle and its dynamics will not allow for an accurate representation of the traffic system. An attempt to overcome this issue by modelling drivers and vehicles separately but with interaction between them is made in this paper. The proposed driver-vehicle integrated model takes into account the driver behavioral characteristics in the form of desire to brake and desire to throttle, the vehicle characteristics such as mass and the tractive force produced by the engine, and the surrounding environment in terms of aerodynamic, rolling, and grade resistances. The proposed model when tested with the field data performed satisfactorily.

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A Multiregime Car-Following Model for Representing Vehicle-Type–Dependent Driving Behavior in Mixed Traffic

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One of the key components of a traffic simulator is the car-following model, which is meant to emulate drivers' longitudinal movement behavior. Car-following models may be classified as stimulus-response, collision-avoidance and psycho-physical models. Among these, the most widely used is the well-known stimulus-response based General Motors' (GM) car-following model. The assumptions such as the ability of drivers to detect even a small stimulus, identical magnitude of driver's response in both the acceleration and deceleration regimes, same distribution of reaction times for all drivers, and similar driving behavior with respect to different vehicle types make the applicability of the GM car-following model questionable when adopted for representing the driving behaviors in mixed traffic conditions which is characterized by the presence of multiple vehicle types. This paper addresses these shortcomings by proposing a vehicle-type dependent multi-regime GM car-following model. The stimulus response thresholds for demarcating the acceleration and deceleration regimes were determined based on signal detection theory. The model parameters were estimated for different leader-follower pairs in different regimes using the trajectory data collected in mixed traffic conditions. Genetic Algorithm was used for the estimation purpose. The results indicate that the driving behavior is significantly different in acceleration and deceleration regimes and, for different vehicles being driven and/or followed.

Lateral Interactions Between Vehicles Help Explain Capacity Drop

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In this paper, we pose the hypothesis that lateral interactions between vehicles help explain the relaxation phenomenon as well as lateral friction. In particular, we propose that distance keeping by drivers in order to avoid collisions plays a role in the genesis of both phenomena. To test the theory, we propose a parsimonious, two-dimensional microscopic car-following model. We use it in simulation experiments in order to qualitatively reproduce said phenomena. They are reproduced as an indirect consequence of the model's formulation (in contrast to the inclusion in an existing model of ad-hoc rules, conceived to directly achieve the effect), thus shedding light over their real causes. Both phenomena are reproduced with the help of the proposed model, suggesting a link between two-dimensional distance keeping and the genesis of those. Understanding the lateral position of human traffic is key to make autonomous driving algorithms that are both efficient and human-friendly at the same time.

Safety Impacts of Automated Vehicles in Mixed Traffic

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Automated Vehicles can enhance the current state of transportation by reducing human errors and improving safety and mobility. This paper presents a study that predicts the impact of automated vehicles on the safety performance at intersections. As a motivation for the study, real-life AV-involved crashes in California are analyzed. Thirty-one crashes were reported among which 22 automated vehicles were operating in the autonomous mode at the time of the collision. The crashes were predominantly rear-ends at intersections. To anticipate future safety impacts of mixed traffic at intersections, a simulation framework is defined that considers travelers who are not driving AVs and those who have some level of automation, relieving them of car-following and steering tasks. Different market penetration scenarios are simulated using SUMO (Simulation of Urban Mobility) software. The Wiedemann car-following model is suitable for the study as it allows simulating both traffic flow and traffic crashes. However, the default Wiedemann model in SUMO does not reflect the real-world relationship between vehicles accelerations and speed. Therefore, the Wiedemann model was modified and tuned using real-world Basic Safety Message (BSM) data. It was then used to characterize the behavior of human-driven vehicles and AVs. The case study that simulates the mixed environment of human-driven, level 3, and level 5 AVs indicates that with decrease in human-driven vehicles, the crash rate will decline. However, when it comes to the mixed environment of human-driven and level 5 vehicles, the safety benefits will be substantial at about 40% market penetration levels.

Comparisons of Mandatory and Discretionary Lane-Changing Behavior on Freeways

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This research performs comparative analyses on driver's behavior during mandatory and discretionary lane changes. We do this by examining the statistical properties of four lane changing decision variables that describe the gaps between the subject vehicle and the surrounding vehicles. Mandatory and discretionary lane changes in the NGSIM's I-80 Freeway and U.S. Highway 101 data collection sites were identified. First, for each variable at the same site, descriptive statistics were compared and hypothesis tests on the difference between two means conducted for the two types of lane change. Then, for each decision variable at the same site, the observed cumulative distributions between the mandatory and discretionary lane changes were compared by means of the Kolmogorov-Smirnov test. This test was repeated for the fitted cumulative distributions of the same decision variable at the same site between the mandatory lane change and discretionary lane change. The results show that the statistical parameters or distributions between the mandatory and discretionary lane changing decision variables are not significantly different, for the three decision variables associated with gaps in the target lane. The only variable found to be significantly different is the gap between the subject vehicle and the preceding vehicles in the original lane. This may be because this variable is not an important input in mandatory lane change decisions. This finding provides justification for researchers to develop models with different inputs for mandatory and discretionary lane changes in driver assist systems, in autonomous vehicles, and in microscopic traffic simulation tools.

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A Platform to Evaluate Connected Vehicle Applications Using Hardware-in-the-Loop Simulation

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The Texas A&M Transportation Institute (TTI) has developed an augmented reality environment where real entities (vehicles and traffic signal operation) are combined with simulated traffic in a platform to test connected vehicle (CV) applications and technologies. The first-of-its-kind approach — called CONVAS (CONnected Vehicle Assessment Simulation) — marries the cost effectiveness of computer simulation with actual roadway operations to produce an efficient, yet dependable evaluation mechanism in a controlled environment for FHWA. The project team developed an enhanced hardware-in-the-loop (HITL) simulation in this project by incorporating an actual CV on a roadway network into a simulation model and displaying simulated CVs inside the real vehicle at the same time. This platform also provides SPaT (signal phasing and timing) message signal status and the MAP information to the CV through a tablet display. This enables development and testing of advanced CV applications or strategies by allowing assessments of how connected vehicles respond to each other and other entities like pedestrians, emergency vehicles, and transit vehicles in a controlled environment. The CONVAS system integrates a traffic signal controller and a real CV with an On Board Unit (OBU) with the VISSIM simulation model to form the HITL platform. In addition, the HITL platform consists of a road side unit (RSU) and an integrated infrastructure to vehicle prototype (IVP) system to facilitate communication between RSU, OBU, external signal controller and VISSIM. This paper describes how to use the platform to evaluate a CV application.

Collision Mitigation at Signalized Intersection Using Connected Vehicles Data and Technologies

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Connected vehicle technology has shown great potential to improve traffic operations and safety. Intersections are among locations in urban areas with a high number of crashes between vehicles and pedestrians. This study utilizes the vehicle to vehicle (V2V), vehicle to infrastructure (V2I), and vehicle to pedestrian (V2P) communications to develop algorithms to predict unsafe conditions at signalized intersections, determine an appropriate crash remedial decision, and communicate it with appropriate vehicles. The proposed algorithms are examined in a simulation testbed developed in VISSIM under various demand patterns, connected vehicle penetration rates, and driver compliance with the crash remedial decisions. Case study results show that increasing the traffic demand and reducing driver compliance rate are associated with higher number of conflicts and potential crashes. Furthermore, increasing the market penetration rates is shown to be associated with less number of conflicts. Moreover, adding V2I communication to V2V and V2P communications helped decrease the number of conflicts significantly.

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Trip-Length Estimation for the Macroscopic Traffic Simulation: Scaling Microscopic into Macroscopic Networks

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After the seminal works of Daganzo (1) and Geroliminis and Daganzo (2), traffic simulation based on the Macroscopic Fundamental Diagram (MFD) has been gaining more interest from the scientific community, especially in applications for control purposes. One fundamental question is the proper definition of the macroscopic trip lengths. Some approaches have been discussed in the literature (Daganzo, Yildirimoglu and Geroliminis, Ramezani et al., 1, 3, 4). However, no study focused on definition of macroscopic trip lengths based on the microscopic network. In this paper, we discuss three methods to calculate macroscopic trip lengths based on aggregation of microscopic trips, within each reservoir considering: (i) no further information; (ii) the next reservoir to be traveled; and (iii) the related macro-path (i.e., the list of reservoirs crossed from the Origin to the Destination). Based on a static analysis, we show that these methods: yield different average trip lengths at the reservoir level; and give similar average trip lengths at the macroscopic-path level, where the aggregation effect is on the standard deviation. We analyze the dependence of the trip lengths on the O-D matrix. We discuss a procedure to estimate macroscopic trip lengths based on a new O-D matrix. We show that the estimated trip lengths show a good agreement with the ones calculated based on a new calculation of the microscopic trips, for the new O-D matrix. We analyze the impact of macroscopic trip lengths on the traffic states, that are simulated using an accumulation-based simulator. We show that trip lengths have a strong impact on the traffic states. And, trip lengths are congestion-dependent when calculated at the reservoir level.

Traffic Flow Characteristics with Cooperative Adaptive Cruise Control: An Intensive Study Using Enhanced AIMSUN

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Traffic flow effects of cooperative adaptive cruise control (CACC) have not been well understood, though such understanding is essential for a majority of forthcoming research and applications concerning connected and autonomous vehicles (CAV) as well as the CAV implication in future traffic management and control. This paper aims to explore the impacts of CACC on traffic flow efficiency based on in-depth microscopic simulation studies using an enhanced version of AIMSUN. First, the Gipps car-following and lane-changing models used by default in AIMSUN were replaced or enhanced by us with some more advanced car following and lane changing models to strengthen the capability of the simulation system in realistically reproducing capacity drop phenomena and capturing traffic merging processes. Second, this enhanced AIMSUN was successfully calibrated and validated with respect to a 10-km Dutch freeway stretch that includes multiple bottlenecks involving recurrent congestion. Third, we explored on this simulation platform the impacts of CACC on traffic flow mixed with regular (manually driven) vehicles and CACC equipped vehicles, in consideration of a variety of market penetration rate of CACC vehicles. The study results turn out that the impacts of CACC are quite positive.

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Measuring Autonomous Vehicle Impacts on Congested Networks Using Simulation

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Elliot Huang, Fehr & Peers
Yayun (Allen) Wang, Fehr & Peers

Autonomous vehicles (automated vehicles, driverless cars, self-driving cars) offer a wide variety of potential benefits. One commonly discussed benefit is improved traffic operations (that is, decreased congestion, decreased delay, and improved efficiency) due to the way that autonomous vehicles are expected to behave in a traffic stream. In this research, we evaluate the effect of varying the percentage of autonomous vehicles in the overall vehicle fleet mix on transportation network performance.
To perform this analysis, we began with calibrated microsimulation models created in the Vissim microsimulation traffic analysis software. An appropriate set of driver behavior parameters for autonomous vehicles was then determined from a review of previous research including recommendations from the software developer. Efficiencies in traffic flow from connected vehicles was not considered in this analysis. Finally, different levels of autonomous vehicle penetration were tested and compared to the calibrated baseline scenario. The findings are intended to guide decision makers when considering future vehicle fleet mixes that include autonomous vehicles.

A Microsimulation Approach to Quantify the Safety Benefits of Connected Vehicles: A Road Hazard Warnings Application

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The deployment of connected vehicles is highly anticipated, and likely to become a reality in the near future. There is an enormous potential for connected technologies to improve safety, which can only be realized if communication capabilities are paired with smart strategies to manage traffic, complementing vehicle sensors and navigation technologies. Microsimulation can provide invaluable insights into the design and implementation of such strategies. This paper proposes an approach to model and quantify the safety benefits of connectivity enabled through Long Term Evolution (LTE) technology. The methodology extends an existing microsimulation tool and implements it to the analysis of a freeway accident. The enhanced simulation model allows for vehicle collisions, and captures the reaction of drivers to road hazard warnings. Safety is measured using a robust surrogate safety metric, the Time Integrated Time to Collision, and the number of secondary crashes. Numerical experiments are used to test the impact of various communication and traffic-related parameters. We also consider a novel strategy to improve safety by slowing down vehicles in lanes adjacent to the hazard lane, which facilitates merging. Experimental results suggest that the proposed strategy has a positive impact on safety. However, the performance of strategies was observed to vary across scenarios, suggesting that adaptive strategies coordinated by a centralized warning system may provide significant benefits. The framework proposed in this work may be extended to the analysis of such systems, and to the study of other scenarios where communications may have significant impacts on safety.

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A Platooning Strategy for Automated Vehicles in the Presence of Speed Limit Fluctuations

Sina Arefizadeh, Texas A&M University
Alireza Talebpour, Texas A&M University

Platooning is expected to enhance the efficiency of operating automated vehicles. The positive impacts of platooning on travel time reliability, congestion, emissions, and energy consumption has been shown for homogenous roadway segments. However, the transportation system consists of inhomogeneous segments. Understanding the full impacts of platooning requires an investigation of impacts in a realistic setup. One of the main reasons for inhomogeneity is speed limit fluctuations. Speed limit changes frequently throughout the transportation network, due to either safety related considerations (e.g., change in geometry and work-zone operations) or congestion management schemes (e.g., speed harmonization systems). In current systems with human driven vehicles, these speed drops can potentially result in shockwave formation, which can cause travel time unreliability. Automated vehicles, however, have the potential to prevent shockwave formation and propagation and therefore, enhance travel time reliability. Accordingly, this study presents a constant time headway strategy for automated vehicle platooning to ensure accurate tracking of any velocity profile in the presence of speed limit fluctuations. The performance of the presented platooning strategy is compared with Gipps car-following model and Intelligent Driver Model (IDM), as representatives for regular non-automated vehicles. Simulation results show that implementing a fully autonomous system prevents shockwave formation and propagation, and enhances travel time reliability by accurately tracking the desired velocity profile. Moreover, the performance of platoons of regular and automated vehicles is investigated in the presence of a speed drop. Results show that as market penetrations of automated vehicles increase, the platoon can track the velocity profile more accurately.

Development of Left-Turn Phasing Decisions Combining Simulated Traffic Conflicts and Historical Crashes

Kiriakos Amiridis, National Technical University of Athens (NTUA)
Nikiforos Stamatiadis, Kentucky Transportation Cabinet
Adam Kirk, Kentucky Transportation Center

A fundamental objective of traffic signal operations is the development of phasing plans that reduce delays while maintaining a high level of safety. One issue of concern is the treatment of left-turn phasing, which can operate as a protected movement, a permitted movement yielding to conflicting traffic, or a combination protected-permitted movement. Protected-only movements can improve safety of the turning movement, but they can also increase delays and congestion at intersections. Most states use criteria for left-turn phasing selection based on a threshold crash values and do not account for traffic volumes or intersection features that may influence crash frequency. This research leverages conflict points as an indicator of potential safety estimation to assist in the selection of the left-turn phasing and relates them to historical crash records. Prediction models of potential conflicts were developed through microsimulation for 200 existing intersections; hourly volume data resulted in approximately 2,300 hours of observations. The number of left-turn-related conflicts was obtained through SSAM and related to the number of crashes at each intersection. The proposed models offer a simple but realistic approach for determining the boundary conditions that influence safety when left-turn decisions are required. The models can be used to develop nomographs, which practicing traffic engineers can use for left-turn phasing decisions.

Transportation Research Board
TRB 97th Annual Meeting
January 7–11, 2018
Interactive Program

Cross-Comparison and Calibration of Two Microscopic Traffic Simulation Models for Complex Freeway Corridors with Dedicated Lanes

Xingan (David) Kan, UC Berkeley
Lin Xiao, Delft University of Technology
Hao Liu, University of California, Berkeley
Meng Wang, Delft University of Technology
Wouter Schakel, Delft University of Technology
Xiao-Yun Lu, California Partners for Advanced Transportation Technology
Bart van Arem, Delft University of Technology
Steven Shladover, California Partners for Advanced Transportation Technology
Robert Ferlis, FHWA

Realistic microscopic traffic simulation is essential for prospective evaluation of the potential impacts of new traffic control strategies. Freeway corridors with interacting bottlenecks and dedicated lanes generate complex traffic flow phenomena and congestion patterns, which are difficult to reproduce with existing microscopic simulation models. This paper discusses two alternative driving behavior models that are capable of modeling freeways with multiple bottlenecks and dedicated lanes over an extended period with varying demand levels. The models have been calibrated using archived data from a complicated 13-mile long section of the northbound SR99 freeway near Sacramento, California for an 8-hour time period in which the traffic fluctuated from free-flow to congested conditions. The corridor includes multiple bottlenecks, multiple entry and exit ramps, and an HOV lane. Calibration results show extremely good agreement between field data and model predictions. The models have been cross-validated and produced similar macroscopic traffic performance. The main behavior that should be captured for successful modeling of such a complex corridor includes the anticipative and cooperative driver behavior near merges, lane preference in presence of dedicated lanes and variations in desired headway along the corridor.

AutonoVi-Sim: Modular Autonomous Vehicle Simulation Platform Supporting Diverse Vehicle Models, Sensor Configuration, and Traffic Conditions

Andrew Best, University of North Carolina, Chapel Hill
Sahil Narang, University of North Carolina, Chapel Hill
Lucas Pasqualin, University of Central Florida
Daniel Barber, University of Central Florida
Dinesh Manocha, University of North Carolina, Chapel Hill

This paper introduces AutonoVi-Sim, a novel high-fidelity simulation platform for testing autonomous driving algorithms. AutonoVi-Sim is a collection of high-level extensible modules which allows for the rapid development and testing of vehicle configurations, and facilitates construction of complex road networks. Autonovi-Sim supports multiple vehicles with unique steering or acceleration limits, as well as unique tire parameters and overall vehicle dynamics profiles. Engineers can specify the specific vehicle sensor systems and vary time of day and weather conditions to gain insight into how conditions affect the performance of a particular algorithm. In addition, AutonoVi-Sim supports navigation for non-vehicle traffic participants such as cyclists and pedestrians, allowing engineers to specify routes for these actors, or to create scripted scenarios which place the vehicle in dangerous reactive situations. AutonoVi-Sim also facilitates data analysis, allowing for capturing video from the vehicle's perspective, exporting sensor data such as relative positions of other traffic participants, camera data for a specific sensor, and detection and classification results. Thus, AutonoVi-Sim allows for the rapid prototyping, development and testing of autonomous driving algorithms under varying vehicle, road, traffic, and weather conditions.

An Estimated Distribution Algorithm for Calibrating Microscopic Traffic Models

Mehdi Rafati Fard, Iran University of Science and Technology
Afshin Shariat-Mohaymany, Iran University of Science and Technology

The importance of calibration of microscopic traffic models as the main core of traffic simulation software is due to presenting more realistic traffic behaviors. The latent essence of several parameters in such models and consequently, the impossibility of extracting the values of these parameters from field measurements as well as the uncertainties resulting from the noise in the data, make the process of calibration much more complex. Selecting the appropriate solution algorithm has attracted the attention in recent years when dealing with the simulation-based calibration problems. The importance of the issue is yet more when the matter of calibrating the medium or large-scale simulation model is considered. This is mainly due to the expensive cost that running the simulation models impose and therefore, more efficient algorithms are required. In the present study, a type of estimated distribution algorithm has been suggested. In contrast with GA, the proposed algorithm in order to reduce the disrupting effect of GA operators, particularly in case of complex interaction between the parameters, the combination and mutation operators have been replaced by building and sampling from a probabilistic model. Applying an explicit probabilistic model provides a better guide for the search process as well as the possibility of extracting the knowledge regarding to the structure of the calibration problem through analyzing the probabilistic model during the evolution process. Employing the suggested algorithm using hypothetical noise-free and noise-contaminated data prove the efficient and more robust performance of the algorithm to calibrate microscopic traffic models.

Introducing Vehicle Dynamics in Car-Following Logic: The MFC Vehicle Acceleration Model

Michail Makridis and Georgios Fontaras, European Commission - Joint Research Centre
Biagio Ciuffo, EC-JRC
Kostantinos Mattas, EC-JRC
Christian Thiel, EC-JRC

Most car-following models in microsimulation software use a set of equations, which are basically independent from the vehicle dynamics. The vehicle, the driver and the road conditions are modeled in such deterministic way that for a given pair of start-desired speed all vehicles/drivers demonstrate the same behavior, which is fundamentally different from what happens in reality. Since car-following models are used to simulate traffic evolution rather than vehicle motion, the low computational and implementation cost of the underlying models is more important than a reliable representation of the microscopic vehicle dynamics. However, in studies where energy consumption estimation is important and more in general when vehicle dynamics can play a role in the simulation study, current car-following logic can lead to significant error in the accuracy of the prediction and to misleading conclusions.
In order to contribute to close this gap, the present paper proposes a novel vehicle acceleration model (MFC) composed by three interconnected layers: i) the driver style which is simulated via a proposed ‘willingness to accelerate curve’; the driver/vehicle gear shifting strategy; and the vehicle’s acceleration curve. The model input takes two offline-calibratable parameters, gear shifting style and driver style, it is not computationally expensive and provides very accurate predictions in terms of both acceleration profile and energy consumption. Comparative results along with well-known Gipps model and Rakha and Lucic Vehicle Dynamics Model acceleration model which is part of RPA model are presented and prove the robustness of the proposed MFC approach.

2018 TRB Simulation Activities

Transportation Research Board
TRB 97th Annual Meeting
January 7–11, 2018
Interactive Program

Microscopic Simulation and Calibration of a Large-Scale Metropolitan Network: Issues and Proposed Solutions

Jianhe Du, Virginia Polytechnic Institute and State University
Hesham Rakha, Virginia Polytechnic Institute and State University
Ahmed Elbery, Virginia Polytechnic Institute and State University
Matthew Klenk, Palo Alto Research Center

Microscopic traffic simulation has been used extensively to study network-wide congestion, traffic operations, traffic incidents, vehicle emissions, the performance of newly built transportation facilities and the effectiveness of traffic improvement projects. Because of the nature of microscopic simulation, it is typically used to study relatively small networks in which the level of demand is not too high and the road network is not large. In this study, INTEGRATION, a microscopic traffic assignment and simulation tool, is used to model the Greater Los Angeles Area, a metropolitan area with a population of more than three million. To overcome the computational challenges associated with typical large-scale microscopic traffic simulation, the network was divided into five sub-networks with each network run on a different core, and the input demand file was also partitioned to account for connectivity between sub-networks. The results show that it is feasible to microscopically simulate large-scale networks. The findings are significant because they expand the applicability of microscopic simulation tools to large networks, which could only be modeled macroscopically or mesoscopically before. The agent-based microscopic results obtained can provide significantly more detailed vehicle-by-vehicle movement data that are expected to dramatically enhance the simulation results of large-scale networks.

HIL Testing of Connected and Automated Vehicle Applications: A Use Case for Queue-Aware Signalized Intersection Approach and Departure

Jiaqi Ma, University of Cincinnati
Fang Zhou, Leidos, Inc.
Zhitong Huang, Leidos, Inc.
Christopher Melson, Louisiana State University
Xiaoxiao Zhang, University of Virginia

Most CAV application studies apply simulation to evaluate system effectiveness. Model accuracy, limited data for calibration, and simulation assumptions limit the validity of results. One approach is to use emerging hardware-in-the-loop (HIL) testing methods that allow physical test vehicles to interact with virtual vehicles from traffic simulation models, providing an evaluation environment that can replicate deployment conditions at early stages of CAV implementation (without incurring excessive costs related to large field tests). In this study, a HIL testing system for CAV applications is proposed. The software and hardware includes CAVs controlled in real-time, traffic signal controllers, communication devices, and a traffic simulator (VISSIM). Such HIL systems increase validity by considering the physical vehicle's trajectories (constrained by real-world factors such as GPS accuracy, communication delay, and vehicle kinematics) in a simulated environment. The developed HIL system is then applied to test a representative early deployment CAV application: queue-aware signalized intersection approach and departure (Q-SIAD). The algorithm generates speed profiles based on vehicle status, signal phase and timing, exiting queue length, and system constraints (e.g., maximum acceleration and deceleration). The algorithm also considers the status of other vehicles in designing speed profiles. The experiment successfully demonstrated this functionality with one test CAV driving through one intersection controlled by a fixed-timing traffic signal under various simulated conditions. Q-SIAD equipped vehicles can save up to 55 percent of fuel consumption.

TRANSPORTATION RESEARCH BOARD
JOINT TRAFFIC SIMULATION SUBCOMMITTEE

AHB45 (1)

SimSub

Joint Traffic Simulation Subcommittee

Transportation Research Board Annual Meeting
Monday, January 9, 2017, 7:30-9:30PM
Marriott Marquis, Marquis Ballroom Salon 5 (M2)

Introductions – **Mohammed Hadi**
Sponsoring Committee Representative Remarks - attending chairs or liaisons
Task Group Reports
- Research Needs and Resources Task Group
- Calibration, Verification and Validation Task Group – **Ray Benekohal**
- Awards – **Tomer Toledo**
- SimSub Reports – **David Hale**
- Agent-Based Simulation Task Group – **Monty Abbas**
- Joint SimSub and SimCap task group
- Liaison and Outreach
- Annual Workshop Report – **John Halkias** and **Jim Sturrock**

Transportation System Simulation Manual development effort update
FHWA ATDM-DMA Analysis, Modeling, and Simulation (AMS) Testbed project – **James Colyar** and **Balaji Yelchuru**
USDOT Open source microscopic traffic simulation software: ETFOMM – **Li Zhang**
Joint SimSub and SimCap task group presentation – **Sanhita Lahiri** and **David Petrucci**
Other FHWA Programs and Activities – **John Halkias** and **Jim Sturrock**
SimSub website and Google Group Open Discussion – **Aleks Stevanovic**
Presentations
- "Agent-Based Simulation: Modeling the Dynamics of Faculty Productivity Using Agent-Based Methods" – **Monty Abbas**
- Simulation-based Assessment of the Impact of Connected and/or Autonomous Vehicles: New Challenges and Current Trends – **Jordi Casas**

New Business
- Summer meetings
- 2018 Annual Workshop Planning
- Other Business

Closing

Joint Traffic Simulation Subcommittee

Draft Meeting Agenda
Transportation Research Board Annual Meeting
Monday, January 8th, 2018, 7:30-9:30PM
Marriott Marquis Ballroom Salon 10 (M2)

Introductions - Mohammed Hadi
Sponsoring Committee Representative Remarks - attending chairs or liaisons
Task Group Reports
- Research Needs and Resources Task Group
- Calibration, Verification and Validation Task Group - Ray Benekohal
- Awards – Kaan Ozbay
- SimSub Reports – David Hale
- Agent-Based Simulation Task Group – Monty Abbas
- Joint SimSub and SimCap task group - Sanhita Lahiri and David Petrucci
- Safety modeling task group - David Petrucci
- Liaison and Outreach
- Annual Workshop Report –Jim Sturrock

Transportation System Simulation Manual development effort update
FHWA Work Zone/Driver Model Software- James Colyar
Other FHWA Programs and Activities– John Halkias and Jim Sturrock
SimSub website and Google Group Open Discussion – Aleks Stevanovic
Freight Modeling – Mihalis Golias and Kaisar Evangelos
Potential for new sponsoring committees (ITS and Freight)
New Business
- Summer meetings
- 2019 Annual Workshop Planning
- Other Business

Closing

The 21st International IEEE Conference on Intelligent Transportation Systems

Maui, Hawaii, USA, November 4-7, 2018

The 2018 annual flagship conference of the IEEE Intelligent Transportation Systems Society will be held in Maui, Hawaii, United States. This conference welcomes papers and presentations in the field of Intelligent Transportation Systems, dealing with new developments in theory, analysis, simulation and modeling, experimentation, demonstration, case studies, field operational tests and deployments. ITSC 2018 particularly invites and encourages prospective authors to share their work, findings, perspectives and developments as related to implementation and deployment of advanced ITS applications.

Original contributions and workshop proposals are solicited in all areas pertinent to Intelligent Transportation Systems (see key topic areas at https://www.ieee-itss.org/). All presented papers will be published by the IEEE and included in IEEEXplore. Please visit ITS Society webpage for more detailed information (https://www.ieee-itss.org/conferences).

General Chairs

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Workshops and Tutorials Chair

Hilmi Berk Celikoglu

Finance Chair

Petros Ioannou

Outreach Chair

Matthew Barth

Arnaud de La Fortelle

Shunsuke Kamijo

Important Dates

Please check our website for the latest Important Dates: http://www.ieee-itsc2018.org

- Workshop & Tutorials Proposals: February 15, 2018
- Workshop & Tutorials Announcement: March 01, 2018
- Regular & Workshop Papers Submission: April 15, 2018

Please visit the conference website at http://www.ieee-itsc2018.org for news and updated deadlines. You can also follow us at Twitter (@ITSC2018) and Facebook (ITSC2018).

Journal and Magazine Publication of Selected Papers

Selected papers of exceptional quality will be invited for submission to a special issue of the IEEE Transactions on ITS or the IEEE ITS Magazine. Authors will be asked to revise their papers according to the standards of the Transactions or the Magazine.

Topics - The technical areas include but are not limited to the following:

- Transportation Networks
- Advanced Public Transportation Management
- Ports, Waterways, Inland navigation, and Vessel Traffic Management
- Modeling, Simulation, and Detection of Vulnerable Road Users and Animals
- Air, Road, and Rail Traffic Management
- ITS User Services
- Emergency Management
- Artificial Transportation Systems
- Transportation Electrification
- Emissions, Noise, Environment
- Management of Exceptional Events: Incidents and Evacuation
- Security, Privacy and Safety Systems
- Transportation Smartification
- Deep Learning
- Automation and Robotics
- Commercial Vehicle Operations
- Intelligent logistics
- Sensing, Detectors and Actuators
- Connected and Probe Vehicles
- Big Data and Naturalistic Datasets
- Communication in ITS
- Cooperative Techniques and Systems
- Intelligent Vehicles
- Vision, and Environment Perception
- Electric Vehicle Transportation Systems
- Electronic Payment Systems
- Smart Mobility
- Traffic Theory for ITS
- Modeling, Control and Simulation
- Human Factors, Travel Behavior
- ITS Field Tests and Implementation
- Driver and Traveler Support Systems
- Shared Mobility

2018 Upcoming Events

The 9th International Conference on Ambient Systems, Networks and Technologies (ANT-2018)

The 7th International Workshop on Agent-based Mobility, Traffic and Transportation Models, Methodologies and Applications (ABMTRANS'18)

http://cs-conferences.acadiau.ca/ant-18/workshop_approved http://www.abmtrans.eu/

in conjunction with ANT-2018 conference | Porto, Portugal (08-11 May 2018)

ABMTRANS 2018 provides an international forum on the latest technologies and research in the field of traffic and transportation modeling using an agent-based approach.

ABMTRANS 2018 will be held in Porto, Portugal (08-11 May 2018) in conjunction with The 9th International Conference on Ambient Systems, Networks and Technologies (ANT-2018).

Transportation Research Institute (IMOB)
Hasselt University
Wetenschapspark 5 bus 6
B-3590 Diepenbeek, Belgium

2018 Upcoming Events

SCOPE

This workshop provides a multidisciplinary collaborative forum for researchers and practitioners to submit papers presenting new research results and novel ideas related to the theory or the practice of agent-based traffic and transportation modeling.

This workshop also invites researchers to submit their work focusing on the data mining, management and configuration for agent-based traffic and transportation modeling.

Check http://www.abmtrans.eu/ for a detailed overview of the topics of interest!

SUBMISSION AND PROCEEDINGS

All papers accepted for workshops will be included in the ANT-2018 proceedings, which will be published by Elsevier in the open-access Procedia Computer Science series (on-line).

The authors must follow Elsevier guidelines as given in ANT-2018 website (*http://cs-conferences.acadiau.ca/ant-18/*).

The submission processes will be managed by easychair.org.

The selective outstanding papers presented at the workshops, after further revision, will be considered for publication in special issues of these high-quality journals:

Journal of Ambient Intelligence and Humanized Computing (IF: 1.588)

Journal of Personal and Ubiquitous Computing (IF: 2.395)

IEEE Intelligent Transportation Systems Magazine (IF: 3.654)

Please consult the website for latest information about these journals.

IMPORTANT DATES

Submission deadline: 31 December, 2017 (**extended**)

Notification of acceptance: 05 February, 2018

Camera-ready deadline: 05 March, 2018

Workshop: 08 - 11 May, 2018

REGISTRATION

Please visit: *http://cs-conferences.acadiau.ca/ant-18/#registration* for more information.

VENUE, ACCOMMODATION & VISA REQUIREMENTS

Please visit: *http://cs-conferences.acadiau.ca/ant-18/#conferenceVenue* for more information.

WORKSHOP ORGANIZERS

Prof dr. Ansar-Ul-Haque Yasar
Transportation Research Institute (IMOB) | Hasselt University (Belgium)
ansar.yasar@uhasselt.be

dr. ir. Luk Knapen
Transportation Research Institute (IMOB) | Hasselt University (Belgium)
luk.knapen@uhasselt.be

If you have any further questions please contact one of the workshop organizers.

2018 Upcoming Events

ANT-2018 - Modeling and Simulation in Transportation Sciences

The 9th International Conference on Ambient Systems, Networks and Technologies (ANT-2018)

Track on Modeling and Simulation in Transportation Science

http://cs-conferences.acadiau.ca/ant-18/

Porto, Portugal (08-11 May 2018)

ANT-2018 is a leading international conference for researchers and industry practitioners to share their new ideas, original research results and practical development experiences from all Ambient Systems, Networks and Technologies related areas.

ANT-2018 will be held in conjunction with the International Conference on Sustainable Energy Information Technology [SEIT]).

ANT 2018 will be held in Porto, Portugal (08-11 May 2018).

Transportation Research Institute (IMOB)
Hasselt University
Wetenschapspark 5 bus 6
B-3590 Diepenbeek, Belgium

2018 Upcoming Events

SCOPE

The goal of the ANT-2018 conference is to provide an international forum for scientists, engineers, and managers in academia, industry, and government to address recent research results and to present and discuss their ideas, theories, technologies, systems, tools, applications, work in progress and experiences on all theoretical and practical issues arising in the ambient systems paradigm, infrastructures, models, and technologies that have significant contributions to the advancement of ambient systems theory, practices and their applications.

At ANT-2018, there is a dedicated track on *Modeling and Simulation in Transportation Sciences (MSTS)* organized by the Transportation Research Institute (IMOB), *Hasselt University, Belgium*. The aim of this track is to bring together communities interested in the computation, knowledge discovery and technology policy aspects of transportation systems. Researchers in the domains of transportation sciences and engineering, computer science, urban and regional planning, civil engineering, geography, geo-informatics and related disciplines can submit papers for presentation and for publication in the conference proceedings.

Check-out the website for a detailed overview of the topics of interest!

SUBMISSION AND PROCEEDINGS

All ANT-2018 accepted papers will be printed in the conference proceedings published by Elsevier Science in the open-access Procedia Computer Science.

The submitted paper must be formatted according to the guidelines of Procedia Computer Science, MS Word Template, LaTeX, Elsevier.

Submitted technical papers must be no longer than 8 pages for full papers including all figures, tables and references.

Authors are requested to submit their papers electronically using the online conference management system in PDF format before the deadline (see Important Dates).The submission processes will be managed by easychair.org.

All accepted papers will be scheduled for oral presentations and will be included in the conference proceedings published by Elsevier Science in the open-access Procedia Computer Science series on-line. At least one author of each accepted paper is required to register and attend the conference to present the work.

Authors of selected outstanding papers presented in the MSTS track will be invited to publish an extended version in special issues of these high-quality journals: 'Journal of Ambient Intelligence and Humanized Computing' *(IF: 1.588)*, 'Journal of Personal and Ubiquitous Computing' *(IF: 2.395)* and 'IEEE Intelligent Transportation Systems Magazine' *(IF: 3.654)*. Please consult the website for latest information about these journals .

IMPORTANT DATES

Submission date: 31 December, 2017. **(extended)**
Notification of acceptance: 05 February, 2018.
Camera-ready date: 05 March, 2018.
Conference: 08-11 May, 2018.

REGISTRATION

Please visit: *http://cs-conferences.acadiau.ca/ant-18/#registration* for more information.

VENUE, ACCOMMODATION & VISA REQUIREMENTS

Please visit: *http://cs-conferences.acadiau.ca/ant-18/#conferenceVenue* for more information.

PROGRAM VICE-CHAIRS

dr ir Luk Knapen | IMOB - UHasselt | Belgium | *luk.knapen@uhasselt.be*

You may also visit our website (*http://cs-conferences.acadiau.ca/ant-18/*) for more details.

2018 Upcoming Events

Call for Papers

ELSEVIER

The 9th International Conference on Ambient Systems, Networks and Technologies

http://cs-conferences.acadiau.ca/ant-18/

ANT

May 8-11, 2018, Porto, Portugal

General Chairs
Hossam Hassanein, Canada
Albert Zomaya, Australia
Program Chairs
Haroon Malik, USA
Ansar Yasar, Belgium
Local Chairs
Ana C. R. Paiva, Portugal
João C. P. Faria, Portugal
Workshops Chair
Stéphane Galland, France
International Journals Chair
Javier Sanchez Medina, Spain
Program Vice Chairs
Boulmakoul Azedine, Morocco
Nik Bessis, UK
Kechar Bouabdellah, Algeria
Samia Bouzefrane, France
Lars Braubach, Germany
Martine Collard, France
Amine Dhraief, Tunisia
Roberto Di Pietro, Italy
Khalil Drira, France
Wael El-Medany, Bahrain
Etienne Feukeu, South Africa
Antonio Filieri, UK
Luk Knapen, Belgium
Flavio Lombardi, Italy
Ahmed Nait Sidi Moh, France
Ana C. R. Paiva, Portugal
Francesco Pilla, Ireland
Cristina Seceleanu, Sweden
Khaled Shaaban, Qatar
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Publicity Chairs
Wim Ectors, Belgium
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Sarmad Ullah Khan, Pakistan
Advisory Committee
Reda Alhajj, Canada
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Paul Davidsson, Sweden
Dino Pedreschi, Italy
David Taniar, Australia

The 9th International Conference on Ambient Systems, Networks and Technologies (ANT-2018) is a leading international conference for researchers and industry practitioners to share their new ideas, original research results and practical development experiences related to Ambient Systems, Networks and associated Technologies. The ANT program will include guest speakers, peer reviewed technical program, demos, short papers, posters, industrial presentations, and exhibitions covering wide spectrum of topics, including but not limited to:

P Porto

- Agent Technology and Intelligent Computing
- Big Data Analytics
- Cloud Computing
- Context-awareness and Multimodal Interfaces
- Emerging Networks, Tracking & Sensing Technologies
- Internet of Things (IoT)
- Mobile Networks, Protocols and Applications
- Modeling and Simulation in Transportation Sciences
- Multimedia and Social Computing
- Service Oriented Computing for Systems & Applications
- Smart, Sustainable Cities and Climate Change Management
- Smart Environments and Applications
- Systems Security and Privacy
- Systems Software Engineering
- Vehicular Networks and Applications
- General: Distributed Systems, Networks & Applications

Submission of Papers

Original, unpublished papers are solicited for presentation at the ANT conference. Prospective authors are invited to submit papers (electronically, PDF only) that are no longer than 8 pages for full papers, including all figures and references, and must be formatted according to the conference guidelines found at: http://cs-conferences.acadiau.ca/ant-18/#paperSubmissions

Submitted papers will follow peer-review procedures, and accepted papers will be scheduled for oral presentations. Selected papers will be invited for publication, in the special issues of:

- Journal of Ambient Intelligence and Humanized Computing (IF: 1.588), by Springer
- Journal of Personal and Ubiquitous Computing (IF: 2.395), by Springer
- IEEE Intelligent Transportation Systems Magazine (IF: 3.654), by IEEE

At least one author of each accepted paper is required to register and present the work at the conference.

Venue

The conference will be held in the city of Porto at Hotel Solverde Spa & Wellness Center. It is one of the most attractive hotels of greater Porto. With a privileged location, 2 minutes from the city of Espinho and only 15 minutes from Porto, it stands on modern infrastructures providing a service of excellence and bringing together the ideal conditions for leisure and business tourism in the North of Portugal.

Deadlines

Workshop Proposal:	November 30, 2017
Paper Submission Due:	December 15, 2017
Acceptance Notification:	February 5, 2018
Final Manuscript Due:	March 5, 2018

2018 Upcoming Events

ITE 2018 Annual Meeting and Exhibit - Institute of Transportation Engineers

08/20/2018 - 08/23/2018

Minneapolis, Minnesota

Join your peers the ITE 2018 Annual Meeting and Exhibit. The conference is designed to share knowledge, expertise and ideas on multifaceted approaches to addressing transportation issues and to exploring emerging trends in the industry. The meeting content will include sessions in a mix of presentation and training formats focused on state-of-the practice, advancement of the profession, and emerging issues designed to benefit transportation professionals in the public and private sectors. Transportation engineering students are encouraged to attend. Additionally, networking events provide opportunities to connect with one another outside of the class-

2018 Upcoming Events

FAU LABORATORY FOR ADAPTIVE TRAFFIC OPERATIONS & MANAGEMENT
PRESENTS

5-day TRAINING ON

ADAPTIVE TRAFFIC CONTROL SYSTEMS

BOCA RATON, FLORIDA
MARCH 5-11, 2018

PURPOSE

Adaptive Traffic Control Systems (ATCSs) are slowly, but surely, replacing traditional coordinated actuated signal systems. Yet, only few training opportunities about existing ATCSs are available for the general public. Potential ATCS users struggle to find information about several aspects of ATCS deployments - anywhere from selecting the right corridor/network for a successful ATCS installation, through the process of selecting a right technology, to better understanding of the fundamental principles of the existing systems. This comprehensive 5-day training is intended to cover all of these issues and give attendees an opportunity to gain additional knowledge about ATCSs, from an unbiased perspective.

TARGETED AUDIENCE

- Public agency decision makers, traffic operation center's staff, and traffic signal practitioners interested in deployment, selection, and utilization of ATCSs.
- Private consultants interested in prioritization of the corridors for ATCS deployment, selection of the technologies, and ATCS features and capabilities.
- Researchers and scholars interested in ATCS's frameworks and their fundamental concepts.

ABOUT INSTRUCTOR

Source: http://www.wptv.com/news/region-s-palm-beach-county/boca-raton/smart-traffic-signals-aim-to-give-you-green-light-on-pbc-roads

Aleksandar Stevanovic, PhD, PE
Associate Professor - Civil, Environmental & Geomatics Engineering @ FAU. Director - Laboratory for Adaptive Traffic Operations & Management (LATOM).
http://latom.eng.fau.edu/
astevano@fau.edu
Phone: (801) 671-2868

Dr. Stevanovic's is the author of the NCHRP Synthesis on "Adaptive Traffic Control Systems: Domestic and Foreign State of Practice". He has authored numerous journal papers and reports on ATCS and traffic signal systems. He is the member of TRB AHB25 Committee on Traffic Signal Systems and he has presented on the ATCS topics at a dozen of ITE, TRB, ASCE, and ITS conferences and webinars. He has been involved with multiple field evaluations of ATCSs and has had hands-on experiences with multiple ATCSs.

TRAINING CONTENT

DAY 1
- Definition, history, and overview of various commercially available ATCSs
- Brief description of various ATCS technologies
- Detailed coverage of fundamental principles of 3-4 major ATCS technologies

DAYS 2-3
- Infrastructural and institutional requirements
- Network prioritization for successful deployment of ATCS technologies
- Criteria and process for technology selection
- System Engineering process for ATCS

DAYS 4-5
- Detailed hands-on exercises on simulated corridors (3-4 major ATCS technologies)

Each training day will be closed with a short quiz to test acquired knowledge. Full-description of the training program will follow soon…

REGISTRATION & COSTS

Further details about registration will follow soon. Training capacity is very limited (about 20 trainees) and it will be handled on the first-come-first-served basis. Interested parties are strongly encouraged to reserve their seats by contacting the organizers asap at astevano@fau.edu.

Estimated training fees (per person) vary from \$500 for one day to \$1,500 for the duration of the entire training. Discounts will be available for the staff of the local (FL) public agencies (~25%) and university students (~50%). The fees will cover training material, food & refreshments, parking, and certificates of completion (PDHs included).