Sponsor Committees:
AHB45: Traffic Flow Theory
AHB40: Highway Capacity and Quality of Service
AHB20: Freeway Operations
AHB25: Traffic Signal Systems

TRB Joint Traffic Simulation Subcommittee

SimSub

AHB45(1)

Newsletter

Please visit our web site at:
http://www.tft.pdx.edu/simsub.htm

January 2007:
Contents

Chairman's Message

This is the third issue of our newsletter. We have had another productive year. We did not get the opportunity for a mid-year meeting this year mainly because the sponsor committee mid- year meetings were fragmented around the world.

For those of you attending the TRB meeting next week, please note the items of interest to the traffic simulation community presented in boxes throughout this issue of the newsletter. Please look over the task group reports in preparation for our Monday night subcommittee meeting. A good part of the meeting agenda will be devoted to a discussion of their products.

We also want to provide some time on the agenda this year for discussion of the technical articles in this issue. Technical articles have become an important feature of each issue. We have gone from one article in the first issue to six in this issue. To encourage continued submission of articles, we want to give some time at the meeting for discussion with their authors.

As we enter our third year of operation, we need to review our membership rules and configuration. We have not placed any limit on the number of members but we originally decided that appointments would last for one year and be subject to renewal by those who have maintained an active role in the subcommittee's activities. We now have an idea of who has maintained an active role and who has not. We need to shake up the roster with that in mind. We will take up this question at the Monday meeting.

Thanks to all who have contributed to our productivity and to this newsletter.

TRB 2007 SimSub Meeting Agenda

Monday 7:30-9:30 PM: Marriott Lincoln 2 Room

Introductions

Sponsor Committee Chair Remarks

Discussion of task group reports presented in the newsletter

- Annual Workshop (Brief synopsis and discussion of future topics)
- Newsletter (Critique and suggestions)
- Research Needs and Resources (Discussion of research prioritization
- Simulation Application Summaries (Discussion of draft survey)
- Liaison and Outreach
- Awards

NGSIM Update

FHWA Update

Review of the subcommittee purpose, scope and membership

Old Business

- Member directory

New business

- New initiatives
- Mid-year meeting for 2007?

Discussion of technical articles submitted to the newsletter

Adjourn

Task Group Reports

Here are the reports submitted by each of the task groups:

Annual Workshop Task Group

Submitted by John Halkias, FHWA

This task group is responsible for the organization and presentation of an annual workshop on traffic simulation, historically held on the Sunday afternoon of the TRB annual meeting.

The Workshop on Simulation will be held on Sunday, January 21 from 1:30 to 5:00 PM in the Shoreham Empire Room, as Session 161 of the 2007 TRB Meeting. The theme will be "*Simulation Practices, Needs, and Challenges for Corridor Management*." The workshop agenda is as follows:

2007 TRB Simulation Workshop Agenda
Simulation Practices, Needs, and Challenges for Corridor Management
Session 162, January 21, 2007, 1:30 to 5:00PM

As agencies realize the importance of operating their facilities to make the most of their existing capacity, there has been an increasing interest in the concept of managing multiple transportation facilities as an integrated corridor. Simulation modeling plays a key component in the planning and design of corridor management strategies and plans.

There are many challenges in using simulation for a multi-modal, multi-roadway corridor that implements various ITS devices and strategies. This workshop highlights and discusses the current practice, case studies, international experiences, research needs, and various challenges of simulating corridor management applications.

1. Welcome, Introduction, and Purpose (5 min.) **John Halkias/James Colyar**

2. Overview of Corridor Management Concepts, Strategies, and Benefits (15 min.) **Dale Thompson, FHWA**: *Background on what is corridor management; basic definitions and concepts; the range of possible strategies and applications and the potential benefits of corridor management.*

3. Role of Simulation in Corridor Management (20 min.) **Vassili Alexiadis, Cambridge Systematics, Inc:** *How can simulation be used to support corridor management planning, design, and operations; How different types of simulation (macro, meso, micro) play a role in corridor management.*

Current Practices

4. Case study 1 (20 min.) Real-world case study using simulation to support corridor management.
Jay Jayakrishnan, University of California Irvine

5. Case study 2 (20 min.) Real-world case study using simulation to support corridor management. **Shaun Quayle, University of Tennessee**

6. International experiences (20 min.), **Jaume Barcelo, TSS**: *An international case study and more general discussion of how corridor management simulation is approached internationally.*

Break - (15 min.)

Needs and Challenges

7. Modeling gaps and data needs (30 min, including 10-min. discussion) **Karl Wunderlich, Mitretek Systems:** *Gaps/research needs in current modeling practices, Data needs for simulation modeling of corridor management..*

8. Modeling driver response to traveler information (20 min.),**Ramachandran Balakrishna, Caliper, and Haris Koutsopoulos, Northeastern University:** *Current research and understanding of driver response; current practices in modeling driver response; research and data needs.*

9. Transit issues and challenges (20 min.) **Yi-Chang Chiu and Mark Hickman, University of Arizona:** *Transit is an important, but often neglected, part of corridor management. Incorporating transit strategies in simulation modeling has many issues and challenges, which this presentation will discuss.*

10. Real-time simulation modeling for corridor management (20 min.)**: Brian Park, University of Virginia:** *This presentation discusses how real-time simulation can be used to support corridor management.*

11. Summary (5 min.)

Research Needs and Resources Task Group

Submitted by Mohammed Hadi, Florida International University

As mentioned in the previous news letter, the task group identified 43 simulation research challenges. These challenges and their descriptions were summarized in a matrix format and sent to the SimSub and the four sponsoring committee members and friends for their inputs and for providing a ranking score for each challenge. A total of 40 responses were received. A statistical summary of the received responses is presented in Exhibit 1 at the end of this newsletter. In this exhibit, the research challenges are sorted in descending order based on their average ranking scores.

In addition to the scores of the research challenges, valuable comments were received from the respondents. The task group considered these comments in combination with the average scores to identify high priority research issues. Research problem statements will be produced for these issues. The identified research issues and the writing of the problem statements will be discussed at the TRB 2007 annual meeting.

The task group also produced a draft white paper entitled "Data Repository to Support Traffic Simulation Research and Development," which will be distributed to SimSub members for comments. Based on this draft white paper, a questionnaire was produced to identify potential sources of traffic simulation research data that should be stored in a data repository that supports traffic simulation research. This survey is included as Exhibit 2 at the end of this newsletter. The task group appreciates the help of the traffic simulation community in providing answers to the questionnaire. Please e-mail your answers to Mohammed Hadi

Simulation Application Summaries Task Group

Submitted by Do Nam, T-Concepts Corp.

This Task Group is responsible for compiling and publishing a comprehensive summary of significant applications of microscopic traffic simulation models. We have finalized a survey form and posted on the SimSub subcommittee website.

The survey may be accessed from the SimSub Website: http://www.tft.pdx.edu/simsub.htm Acrobat 7.0 is required to complete the survey and submit it by email.

Only a few survey results have been returned so far. Please get the word out to reach as many people as possible. We need to discuss how the response to this survey can be improved

Liaison and Outreach Task Group

No report was received from this task group.

Newsletter Task Group

Submitted by Ken Courage, University of Florida

This task group will post a newsletter to its web site in advance of each meeting to inform members and others of items of interest to the simulation community. This issue of the newsletter constitutes the task group report.

The size of the newsletter, especially the number of technical articles submitted, has grown with each issue. We are still in need of a proper task group to take this publication to the next level.

We welcome your comments on this issue, either at the meeting or by email.

Awards Task Group

Note: This is a new Task group.

After discussion with several SimSub members, we have appointed a new task group to identify and recognize individuals who have distinguished themselves and projects that have advanced the state of the practice. Tom Rioux has agreed to chair this task group. Tom will configure the task group membership and will present a report on the proposed task group scope and activities at the SimSub Meeting.

Simulation-Related Activities of the Sponsor Committees

Highway Capacity & Quality of Service Committee AHB40

- The Committee will meet in the Marriott Lincoln 2 Room Monday, 8:00-Noon.

- The Committee is holding a workshop on Guidance for the Use of Alternative Traffic Analysis Tools in Highway Capacity Analyses on Saturday, 10:30 to Noon in the Shoreham Congressional Room This workshop will discuss the progress and future direction of NCHRP Project 3-85.

- The Committee is sponsoring Conference Session 674 "Role of Highway Capacity Manual in the Age of Microsimulation." Marriott Salon 2 Wednesday, 10:15 AM–Noon

- The Simulation Applications Subcommittee will meet in Marriott Park Tower Suite 8216 Sunday, 10:30 AM–Noon

Freeway Operations Committee AHB20

- The Committee will meet in the Marriott Lincoln 2 Room Tuesday, 8:00 AM-Noon and 7:30-930 PM .

- The Freeway Operations Simulation Subcommittee AHB20(2) will meet on Sunday, January 21, between 6 and 7 PM in Marriott Park Tower Suite 8206. The focus of this year's meeting is on *simulation modeling of High Occupancy Toll (HOT) lanes*. Several presenters will provide brief presentations of traffic simulator capabilities relating to HOT lanes; they include:

  - Jaume Barcelo – **Aimsun NG**, TSS, Spain
  - Michael Mahut **– Dynameq**, INRO, Canada
  - Yi-Chang Chiu – **DYNASMART-P**, University of Arizona
  - Hesham Rakha – **Integration**, Virginia Tech
  - Haris N. Koutsopoulos, Northeastern University and Valibhav Rathi, MIT – **MITSim**
  - Pete Sykes – **PARAMICS**, SIAS, UK
  - Daniel Morgan – **TransModeler**, Caliper Corp.
  - Jim Dale – **VISSIM**, PTV America

Traffic Signal Systems Committee AHB25

- The Committee will meet in the Marriott Lincoln 2 Room Tuesday, 8:00 AM-Noon and 7:30-930 PM .

- The Simulation Subcommittee will meet on Monday, 11:00 AM to 12:00 Noon in the Marriott Park Tower Suite 8228

Traffic Flow Theory Committee AHB45

- The committee will meet on Tuesday 1:30 to 5:00 PM in the Marriott Lincoln 2 Room
- The Committee is sponsoring Session 417 "Macroscopic, Hybrid, and Microscopic Traffic Models" in the Marriott Cotillion South Room, Tuesday, 8:00 AM–9:45 AM
- The Committee is sponsoring Session 659 "Vehicular Traffic Flow: Developments in Simulation Modeling and Data Analysis" in the Hilton International Center, Wednesday, 9:30 AM–12:00 Noon

Research News and Results

NCHRP 3-87: Proactive Ramp Management Under the Threat of Freeway Flow Breakdown

Submitted by Lily Elefteriadou, University of Florida

This project started in October 2006; the primary contractor is the University of Florida (PI: Lily Elefteriadou), supported by PB Farradyne, the University of Bochum, and Drs. Fred Hall and Bhaghwant Persaud. The objective of this project is to develop procedures for selecting ramp-management strategies for a freeway section under the threat of flow breakdown. These procedures will be evaluated using simulation in conjunction with field data. The project will identify the functional and operational requirements of a real-time model to predict freeway-flow breakdown, build the model, and provide the necessary information for the implementation of appropriate ramp-management strategies. A data collection and analysis plan will be developed and executed to build the real-time breakdown prediction model. The plan will specify the types of sites to be considered, data to be collected, as well as data collection and analysis methods. The model will be developed, assessed, and calibrated for various sites. The research team will develop procedures for using the outputs of the breakdown prediction model to select ramp-management strategies to prevent or delay breakdown, and will evaluate these procedures using microscopic simulation modeling. The project is expected to be completed in April 2009.

Simulation Application Guidelines in Germany

Submitted by Roland Trapp, Dr. Trapp Traffic Engineers, Aachen, Germany

Subcommittee 3.18.7: Microscopic Traffic Flow Simulation Models of the German FGSV has developed “Guidelines for the Application of Microscopic Traffic Flow Simulation Models” (Publication no. 388 of the FGSV, original: “Hinweise zur mikroskopischen Verkehrsflusssimulation - Grundlagen und Anwendung”). The purpose of the paper is to help clients and consultants to better understand modelling in general and to give a detailed insight into typical questions that are crucial to the quality and trustworthiness of simulation results in traffic engineering.

The paper covers general modelling and traffic modelling fundamentals such as operational, tactical and strategic traffic behaviour. A large portion of the paper is devoted to the detailed description of a standardized simulation study. Within this standard, two categories of calibration/validation quality are defined. Satisfactory quantitative results may be obtained from a simulation study only with a validation of the higher category. No general limits for validation errors are given. However, examples for possible measures of validation errors are provided along with a suggestion of maximum error for certain modelling applications. Furthermore emphasis is put on a comprehensible documentation of the simulation study.

The guidelines are not mandatory; however it is likely that they will be referenced in future procurement actions. Further activities for the subcommittee are currently under discussion:

- Definition of calibration/validation error limits
- Tolerable degree of extrapolation from the validated model
- Further research on the behaviour and simulation of pedestrians and bicycles.
- Modelling of driver behaviour under influence of ITS
- Modelling on single carriage ways
- Further investigations on the integration of operational, tactical and strategic behaviour
- Comparability of (German) HCM and simulation results

Simulation Application Guidelines in Japan

The Traffic Simulation Committee of the Japan Society of Traffic Engineers (JSTE) has developed a document that describes the standard verification process used to verify reproducibility of traffic conditions in the development of a traffic flow simulation model. The model verification process is roughly divided into two stages. In one stage, the reproducibility of assumed traffic phenomena is evaluated by comparing the result of model applications with theoretical values with a virtual data set for frequent appearance of phenomena. In the other stage, an evaluation is made to see if the model can comprehensively reproduce actual traffic conditions, including various traffic phenomena

The document is divided into four sections:

- Simulation Model Development Process
- Traffic Phenomena To Be Modeled Through Simulation
- Simulation Model Standard Verification Process
- Car-Following Type Model Verification Procedure

This document will be one of the items presented at Session 623, Highlights of the Fifth International Symposium on Highway Capacity on Wednesday, 8:00 AM - 9:45 AM, in the Marriott Salon 2.

TEXAS Model Enhancements Funded by FHWA

Rioux Engineering, as part of a Federal Highway Administration Small Business Innovative Research Project, has modified the TEXAS Model for Intersection Traffic to detect major collisions both on a lane and within the intersection, optionally stop the vehicles involved in the major collision using "collision deceleration", and cause other vehicles to respond to the major collision. Vehicle response to a major collision include (1) the vehicle trying to stop so as to not have a collision with the vehicles involved in the major collision, (2) the vehicle trying to stop at the stop line for an inbound lane before entering the intersection so as to not block the intersection, (3) the vehicle slowing down if it has to travel close to the major collision using a user-specified percentage of normal desired speed, (4) a vehicle not making an optional lane change into a lane containing a vehicle involved in or blocked by a major collision in front of the vehicle, (5) a vehicle making an optional lane change out of a lane containing a vehicle involved in or blocked by a major collision in front of the vehicle, and (6) when the vehicle is blocked by a major collision for a normally-distributed random time generated using a user-specified mean and standard deviation, the vehicle changing its destination (its route) and/or the vehicle changing lanes under drastically reduced criteria.

Industry News

The PTV Vision Scientific Award

In 2007, PTV AG will confer for the first time the PTV Vision Scientific Award. The award is presented to researchers for outstanding published papers about research work using VISUM or VISSIM. The submitted papers will be judged by an international jury of transportation scientists. Three prizes will be awarded: The winner will receive 2500 € and will be invited to present his or her paper at the international PTV Vision user group meeting in Germany. The runner-up will receive 1000 € and will be invited to attend the user group meeting, and the third prize winner will be invited to attend the user group meeting. Papers are eligible that have been presented or accepted at scientific conferences during the last year. Final theses (bachelor's, master's, doctoral) are eligible as well, but the author will have to submit a summary of not more than 10 pages. The submission of papers worked on by several authors will also be accepted. Deadline for this year's submissions is April 15.

For more information, see PTV's website (http//www.ptv.de) or contact Peter Vortisch (peter.vortisch@ptv.de).

Technical Articles

Anyone can submit a technical article for the newsletter. The only requirement is that the content be non commercial and of interest to the traffic simulation community. There is a limit of three pages (in this format) per article. It has been our practice to focus the mid-year issue on a single topic and to keep the January issue open for all topics

Using Simulation to support Evacuation Planning in Boston

Submitted by Russ Bond, Manager, Technical Systems Operations, MassHighway

Recent natural disasters such as Hurricane Katrina and the need for Homeland Security preparedness has mandated that evacuation plans be developed that are coordinated across jurisdictions and modes of travel. In response to this need, the Massachusetts' Executive Office of Transportation (EOT) initiated a study that would review existing local and state exodus plans, review the existing decision-making criteria, procedures and protocols for evacuation management, evaluate gaps in resources, and propose a unified evacuation plan for the Boston metropolitan area. An important element of this work was the application of travel demand and simulation models that could estimate the performance of the transportation system under varying evacuation conditions.

Planning for a catastrophic event and the use of simulation tools to support planning efforts, presents numerous challenges. First among these challenges is modeling a transportation system that rapidly becomes oversaturated and is compounded by the expected loss of vital transportation links. For example, a terrorist event will likely necessitate the shutdown of some or all of the bridges and tunnels in the area. During the September 11th attack on Manhattan most commuters chose or were forced to walk out of the disaster area. Therefore, simulation modeling needs to be robust enough to test various levels of emergency evacuation, loss of critical infrastructure, unusual travel patterns and behavior, and different response plans and strategies. Another important consideration is the ability to model shifts in transportation mode, including pedestrian movement. In Boston over 75% of employment destinations are located within a 10-minute walk to a subway or bus stop. Also, Boston has the third highest percentage of transit use in the country with over 31 percent of workers using public transportation to commute to work. Additional complications come from the high percentage of schools and hospitals in the downtown area, including Logan Airport, located only two miles from downtown and connected by three highway tunnels and a subway tunnel. If that is not enough, *Bicycling* magazine recently named Boston as one of the worst cities in the U.S. for cycling.

The justifications, assumptions, and data requirements underlying the application of the modeling work were based on lessons learned during the 2004 Democratic National Convention (DNC) held in Boston. The DNC created unprecedented challenges to transportation agencies in the

Boston area and significantly impacted the freeway system, the MBTA rail and bus system, Boston Harbor ferry transport, and the air system. Restrictions were implemented on portions of the freeway and roadway system during the convention, including the designation of emergency lanes in some areas. Restrictions were also implemented on Boston Harbor and the transit and commuter rail system, including closing the MBTA North commuter rail station.

Given these issues and the corresponding criteria for modeling, the transportation model selected was the *DynaMIT* mesoscopic simulation tool developed by MIT. Due to time and budget constraints the initial evacuation model was built upon existing data available from the State's regional transportation model and previous simulation work completed by MIT for the Central Artery project. While the total metropolitan area contains over 4 million people, the initial modeling work was limited to the evacuation of only the daytime commuter employee population, (approximately 200,000 people) including students in downtown Boston and the surrounding communities. In the event of an actual emergency a portion of the residential population of Boston (approximately 650,000) would likely evacuate the city as well, creating induced demand on the roadway network. Similarly, some number of commuters may shift modes in an emergency situation through spontaneous carpooling and transit. *DynaMIT* does not simulate transit or pedestrian movements, yet these elements were considered critical to any evacuation strategy. Thus the Project Team proposed to treat transit services and pedestrian destinations on the periphery of the CBD as demand 'sinks' with an assumed outflow rate of evacuees/hour to represent transit pedestrian exodus from the CBD.

The actual results of the study are still under review, however, it is expected that the resulting model performance metrics (such as time to evacuate, corridor congestion levels, and intersection levels of service) will provide useful talking points as decision makers validate their assumptions regarding the duration and severity of a potential evacuation. For example, if the time to evacuate takes over 14 hours instead of 5 hours then the availability of police needed to manually control critical intersections during the evacuation would be severely underestimated.

While the modeling work was conceived as a valuable tool for decision makers to evaluate response strategies such as coordinated ramp closures for inbound or outbound traffic, contra-flow lane implementation on certain main corridors, phased release from major parking facilities, pedestrian only corridors, and various transit options being considered by the MBTA and Amtrak, the long term objective of this work has been to develop a real time decision support system (that includes a dynamic traffic simulation and predictive model) as part of the MassHighway's central control software. The MassHighway Traffic Operation Center operates 24/7 and continuously receives real time information updates. The capability to forecast traffic impacts 15 to 30 minutes ahead would allow decision makers the opportunity to prioritize alternative response strategies and relocate resources where they would provide the greatest benefit.

MassHighway is optimistic that additional funds will be dedicated to fund simulation modeling as a tool to support evacuation planning and incident management. There is considerable work that remains to be done. In support of these activities MassHighway has invested in real time situational awareness tools such as the Massachusetts Interagency Video Information System (MIVIS). MIVIS collects real time CCTV video from transportation agencies, including the State Police helicopter, and redistributes them to authorized users over the Internet. A unique feature of this system is the capability to spatially encode video to GIS base maps in real time. This system allows matching and overlaying dynamic video images over roadway maps to allow real-time tracking and mapping of ground objects. A screen shot is provided below. The ability to use this system for model calibration and validation is currently being evaluated.

Need for Comprehensive Simulation Model and Highway Capacity Guidelines for Heterogeneous Traffic

Submitted by Bhuvanesh Singh, Ecometrica, Inc and Athonu Chatterjee, Corning Inc.

The flow of heterogeneous traffic in a road network is a highly complex phenomenon for which very limited research has been attempted. In heterogeneous traffic, vehicles have wide variation in dimensions, operating speed, acceleration-deceleration capabilities, power mass ratio etc. These dynamic and static disparities lead to very complex flow logic and require extensive interaction and behavior modeling. In other words, heterogeneous traffic can be defined as a composition of vehicles having disparity in physical and dynamic characteristics.

The importance of traffic simulation is recognized globally in deciding investment strategies for infrastructure development, transportation planning, incident management and traffic mitigation, work area traffic control, etc. For several decades' individuals, groups, and organizations conducted extensive research to improve the state-of-the-art in this field. Their works have been published in various proceedings, journals, reports, dissertations, etc., which are an extensive database for the real life application tool development. The outcome of these researches resulted in a number of real life traffic simulation models, e.g., SYNCHRO, CORSIM, PASSER, PARAMICS, VISSIM, VTI etc. These models have been mostly developed for simulating homogeneous traffic networks, which are most predominant in the developed nations. They are considered to be very important tools for investments, decision-making, traffic control, infrastructure improvements, and, also, providing optimal solution to the real life challenging traffic problems. The importance of simulation models is growing day by day, which is recognized by the researchers, organizations, and other governmental and non-governmental organizations all over the world.

In the past some of the models meant for simulating homogeneous traffic were used to simulate the bicycle traffic with motorized vehicles. This was an attempt to include heterogeneity in the available homogeneous traffic simulation models. However, successes were limited. The available models with reference to simulation of heterogeneous traffic have limitations with reference to lane discipline, overtaking/yielding behavior (meandering of narrow motorized and non-motorized vehicles), calibration and validation of models based on the observed flow processes, etc. To date there are only limited number of models that come to attention for the simulation of heterogeneous or mixed traffic conditions. Out of these none have the ability to simulate road networks having heterogeneous traffic and none are considered to be comprehensively calibrated and validated for rigorous use. Most of the models were created to simulate certain type of configuration, like, intersection, road stretch, small corridor, and these models cannot be claimed to be generalized to give global solutions to heterogeneous traffic. Considering the limitations of existing simulation models, therefore, there is an imperative need for developing new tools to justify the alternative urban traffic operational policies and measures.

It is very important to note that heterogeneous or mixed traffic is predominant amongst more than two-third of the world population. The two most populous nations of the world like China and India have road networks on which, heterogeneous traffic flow is predominant. Based on various studies conducted by the World Bank, UNDP, and other researchers, it is accepted that heterogeneous traffic will exist for several decades due to a plethora of reasons like: socio-economic conditions, existing road network and infrastructure, environmental and health issues, availability of technology, political and affordability issues, etc. In some of the cities of world heterogeneous traffic related accidents are unacceptably high. Therefore, there is an urgent need of generalized simulation tool, which can simulate the real life heterogeneous traffic and road network all over the world. This may lead to Highway Capacity guidelines for heterogeneous traffic, which may be universally accepted.

The highway capacity manual was first introduced in 1950 to set guidelines for the homogeneous traffic and was found to be a very effective tool for traffic and infrastructure management, and development. The latest HCM manual in use is an outcome of several decades of research and application conducted by hundreds and thousands of researchers all over the globe. The effort can be considered as a very well coordinated teamwork with a common objective. Now, the question arises why we were not able to develop a comprehensive simulation model, which may lead to similar type of capacity guidelines for heterogeneous traffic? It is true that for heterogeneous traffic permutations and combinations will be quite high in comparison to homogeneous traffic but it is imperative that there should be initiation of some preliminary guidelines, which may lead to full HCM at a later stage. In this article this issue is addressed and we are trying to discuss the bottlenecks and hurdles in the growth of this field, and suggested approach for the rapid growth.

Need of Comprehensive Model For Heterogeneous Traffic

The flow of heterogeneous traffic especially on urban roads is highly complex and the existing models cannot be used to predict the flow behavior on urban road network. In the past, attempts have been made to develop models for localized traffic problems or small part of the network such as intersections, small road stretch, or small corridors. These attempts, unfortunately, fall far short of acceptable outcome. In our opinion the important performance measures which need to be estimated with a traffic simulation model are: flow level of heterogeneous traffic handled at different levels of service; time and safety advantage gained by major/minor improvements of the road system; effect of different operating environments; segregating motorized and non-motorized vehicles; and providing separate lanes for public transport modes like buses.

Bottlenecks and Hurdles

A number of questions arise with regard to the slow development of the field of heterogeneous traffic simulation and modeling. Genuine among are: is it too complex to model and simulate? are we not competent enough to model and simulate the real life heterogeneous traffic situation? are we lacking in resources? are we lacking in motivation? are there fewer incentives to work in this field? Some plausible answers follow:

Complexity – To completely model heterogeneous traffic one has to consider many factors like inter and intra vehicular interactions, behavioral patterns of users and efficient traffic flow logic, all of which are quite complicated and cumbersome. Further, integrating various sub models of a simulation system into a complete comprehensive model with proper calibration and validation is tough and time consuming.

Resources **-** Some of the countries dealing with heterogeneous traffic have limited financial resources with more pressing priorities. Therefore, less attention is provided to this cause. Most of the countries have limited number of professionals involved in traffic and transportation engineering research and development mostly due to lack of funding in this area.

Social and Political Awareness – Due to high illiteracy rate and other pressing issues in the developing and underdeveloped countries, the general public do not pay much attention to this problem and hence general awareness is sorely lacking.

Suggested Approach

It goes without saying that the problem of heterogeneous traffic modeling is critical, and more so, in developing and booming economies like China and India. Even in developed countries cities are becoming overpopulated, and less and less amenable to simplistic homogeneous models. New York city, Boston are but a few examples. Therefore, this is in essence a global issue and should be treated like one with nations blessed with resources taking the lead. Another important reason for this is that smooth transportation facilities in developing nations will facilitate higher returns on the investments made by rich nations in them.

An attempt should be made at international levels to create a forum or committee of qualified professionals with common mission and goal to achieve the desired results. Also, effort should be made at the global level to generate enough funds, which may help to promote research in this field and will create monetary incentives and infrastructure for researchers to work in this field.

Government agencies should be persuaded to improve public awareness about this issue through state-controlled media and print. Unless this problem is portrayed as a critical problem nothing significant can be expected.

BABSIM – Microscopic Simulation Tool for Freeways

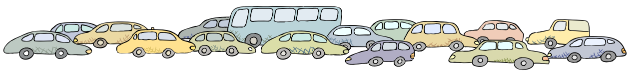
Submitted by Werner Brilon and Jochen Harding, Institute for Transportation and Traffic Engineering, Ruhr-University Bochum, Germany

BABSIM is a new tool for freeway traffic flow simulation that was developed at the Ruhr-University Bochum (Germany), Institute for Transportation and Traffic Engineering and Institute for Computational Engineering on behalf of the BASt (German Federal Highway Research Institute). The software is applicable for the evaluation of design alternatives and traffic management measures. It provides a comfortable graphical editor that ensures straight forward network coding and editing based on aerial photographs or design plans. Other features include 2D and 3D visualisation of the vehicle movements and various output files containing measures-of-effectiveness such as traffic flow volumes, mean speed, travel-times and time-space-diagrams.

The first prototype of BABSIM was completed in 2004. At this time, the use of the software was limited to freeway sections with single lane on- and off-ramps. The field testing furthermore showed some inaccuracies at high-volume on-ramps. To overcome these disadvantages, a second phase of the development project was initiated. As part of this project, a new and self-contained behavioral model was developed. This model can be described as an intention based approach and is subdivided into small modules that operate independently from each other. Each module deals with one distinct problem or intention of the current driving task and provides a situation based recommendation for the longitudinal and the lateral movement of the vehicle. Each module is evaluated separately and returns its results over an interface to the managing driving behavior. The task of the higher-ranked driving behavior is to collect the desired values of each intention and to decide which action to take. The decision-making process is modeled in a way that it also incorporates the chronological sequence of each recommendation and thus emulates actual driver behavior. The simple and concise structure of the model simplifies its maintenance and ensures the expendability of the concept.

The new behavioral model was implemented in BABSIM. During the calibration process it was examined whether the model is capable of reliably reproducing the traffic pattern on freeways. For that purpose empiric data for a number of applications, ranging from rather simple freeway stretches over a lane reduction up to complex multilane on- and off-ramps, was available. Summarizing the results it can be stated that the model proved to be valid for each application. The high level of compliance between the simulation and the empiric data confirms that the new model and its implementation are appropriate. Based on the experience gathered during the calibration process and applications in further research projects a set of default values for the model parameters was established.

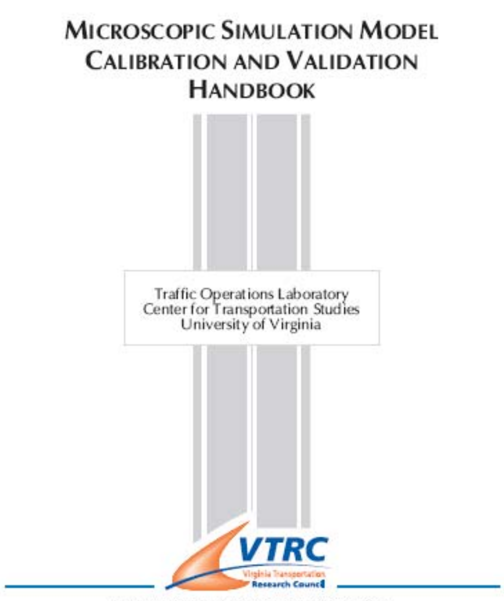
Thanks to the new behavioral model, BABSIM can be applied to a much wider range of simulation studies. Compared to the former version, it also provides more accurate results especially at traffic volumes close to capacity. Furthermore, the usability of the software was improved. Modifications to the program architecture also led to a reduction of computing time. Thus, the latest version of BABSIM presents a powerful tool for the analysis of freeway traffic flow under the aspect of freeway design and operation. It is now on the BASt to decide on a second field test or to set a date for the official market launch.



Handbook on Microscopic Simulation Model Calibration and Validation

Submitted by Brian Park, University of Virginia
Note: This article contains several hyperlinks to referenced documents that will be useful to readers of the online version of this newsletter.

The Traffic Operations Laboratory (TOL) at the Center for Transportation Studies at the University of Virginia and the Virginia Transportation Research Council, the research arm of the Virginia Department of Transportation, conducted research in the development of a systematic procedure on microscopic simulation model calibration and validation. The following summarizes handbook on microscopic simulation model calibration and validation, workshop slides and prototype program.



Microscopic Simulation Model Calibration and Validation Handbook:

In the first part of the handbook, each step in the calibration and validation procedure is explained with examples, and each technique used is presented with definitions and directions for its use. At the end of each step, examples are included. The second part of the handbook consists of four case studies using a proposed calibration and validation procedure with two simulation models: VISSIM and CORSIM. These four case studies include (1) an actuated isolated signalized intersection, (2) an actuated signalized corridor, (3) a highway basic segment with a work zone, and (4) a highway merging segment. With these case studies, detailed techniques that can be used for the calibration and validation procedure are provided.

Hands-on Short Course Slides:

Microsoft Powerpoint slides were developed for use as short-course material during the hands-on short course as well as for future reference for the calibration and validation procedure. Short course material consists of two major parts: (1) tutorials on the calibration and validation method with examples, and (2) a case study using the calibration and validation prototype program developed in the previous task. Before conducting the formal short course, the project team held an informal mini-short course with several key simulation modeling experts. Based on the comments and suggestions from these participants, the short course material and handbook were updated. The first microscopic simulation model calibration and validation short course was held on June 27, 2006, at the Knowledge Management Division in Charlottesville, Virginia.

A Prototype Program:
This program can conduct calibration and validation of VISSIM and CORSIM simulation models. The program allows the users to:

- Conduct multiple runs for a specific simulation model.
- Display simulation outputs in histogram format.
- Generate an experimental design for the calibration parameter combinations using Latin Hypercube Design (LHD).
- Conduct multiple runs for the combinations of parameter sets from the experimental design.
- Generate an X-Y plot of performance measure versus each calibration parameter that can be used for the feasibility test.
- Optimize selected calibration parameters using a genetic algorithm (GA).
- Watch animations of simulation models for visualization purpose.

If you have any questions regarding the microscopic simulation model calibration and validation or are interested in attending a hands-on short course, please contact Dr. Byungkyu “Brian” Park at bpark@virginia.edu or 434-924-6347.

The TRANSIMS Open Source Community: A New FHWA Initiative

Submitted by Meenakshy Vasudevan, Mitretek Systems, Inc.

The Transportation Analysis and Simulation System (TRANSIMS) program has striven to advance the state of modeling and simulation analysis for state Departments of Transportation (DOTs) and Metropolitan Planning Organizations (MPOs) for more than a decade. The goal of the program is to encourage the modeling community to move towards a more robust and realistic approach that captures both the complex nature of individual traveler activity and the collective interaction of these activities within the transportation system. Such a detailed approach has been considered both beyond the capability of the traditional four-step process and too complex to conduct at the regional scale using simulation-based methods.

The TRANSIMS program has produced an analytical process in the form of integrated methods that differs from previous travel demand forecasting techniques. These differences include: a consistent and dynamic representation of time; detailed representation of individuals; time-dependent routing; and a person-based micro-simulation. These are implemented in TRANSIMS in four core modules or methods:

- *Population synthesizer*, for synthesizing households from census data
- *Activity generator*, for assigning activities to individuals in each household
- *Router (or route planner)*, for estimating time-dependent routes
- *Traffic microsimulator*, for simulating individuals second-by-second

The Need for Change

Researchers at the Los Alamos National Laboratory developed the original TRANSIMS software. Other researchers (funded by FHWA and non-FHWA sources) continue to enhance the core modules.

In order for these researchers to effectively collaborate, and to encourage additional collective development and application of TRANSIMS core assets, FHWA identified three critical, unfulfilled needs in the existing TRANSIMS program:

- Resource to engage broader transportation modeling community
- Centralized, unbiased venue for current information
- Coordination nexus for key technical issues and version control

Community Development

With the goal of establishing TRANSIMS as an ongoing public resource, FHWA has released TRANSIMS under the NASA Open Source Agreement Version 1.3. FHWA realizes that simply releasing software as open source cannot guarantee the development of a robust, interactive community. FHWA has initiated a new effort led by Mitretek Systems for the development and maintenance of an independent and eventually self-supporting open source community of TRANSIMS users, researchers and developers. The objectives of this open source community development effort are:

- To build a community-supported infrastructure based on best-practice methods for providing on-going public access to and support for TRANSIMS software, utilities, and documentation.
- To establish a self-governing organization to maintain and improve the TRANSIMS software in support of community requirements
- To engage and support the community at large in learning, applying and advancing the TRANSIMS software

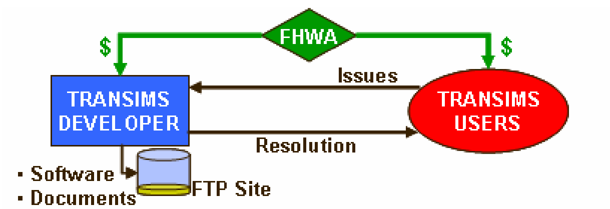


Figure 1. Pre-Open Source Community

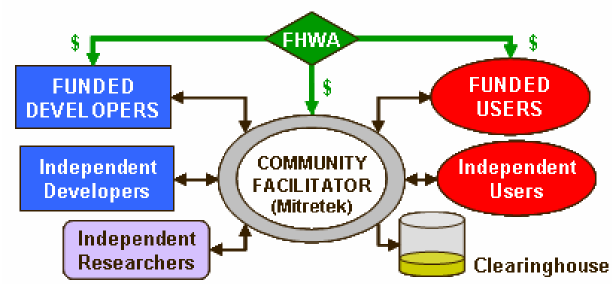


Figure 2. Early Open Source Community

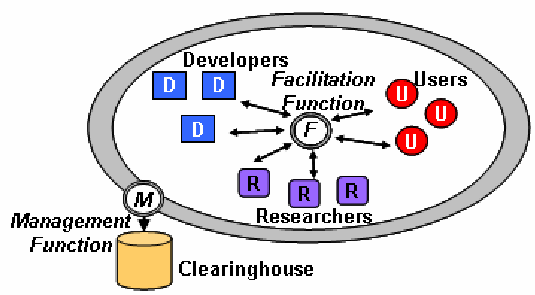


Figure 3. Open Source Community End-State

Community Evolution

Open source communities, although common in mainstream information technology (IT) development, are relatively new to the transportation modeling community. Traditional FHWA roles in the direction and management of the TRANSIMS program (Figure 1) will migrate into the community itself.

Early community development will include a FHWA-funded facilitator (Figure 2).

The end-state vision for the community (Figure 3) is a radical re-configuration of the current top-down, FHWA-driven TRANSIMS program. This model is more organic, always evolving, utilizing different community members at different times to solve key technical issues.

The TRANSIMS community will be comprised of individuals, not organizations. There is no cost to join, and there is no remuneration for participation. Community governance is a meritocracy, based on the adage: "those that contribute, lead."

Getting Involved

To find out more, please visit the community portal on the Travel Model Improvement Program (TMIP) web site: http://tmip.fhwa.dot.gov/transims
or contact Brian Gardner at Brian.Gardner@dot.gov.

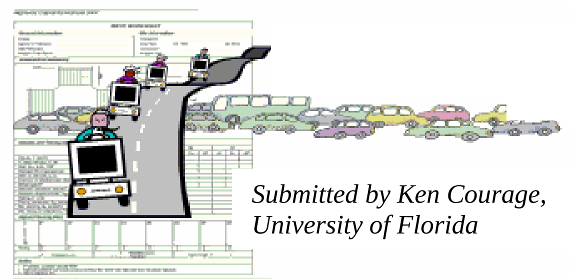
Community development is now underway and will continue throughout 2007. Source code for all four core TRANSIMS modules, documentation, how-to's, test data sets, and support tools are available for download now. Additional community resources (e.g., forums, automated version control) are in development and will be incrementally deployed.

Upcoming TRANSIMS Opportunities

The TRANSIMS program will be funding core module research, training, and deployment through two Broad Agency Announcements (BAA) in 2007. The BAA for deployment of TRANSIMS requires the support of a planning agency. The second BAA specifically targets research and methods development. Interested applicants can find the most updated information on TRANSIMS software through the open source community.

BAA participants should expect to leverage the most current TRANSIMS assets and make contributions in collaboration with other TRANSIMS open source community members.

NCHRP Project 3-85: Guidance for the Use of Alternative Traffic Analysis Tools in Highway Capacity Analyses



Submitted by Ken Courage, University of Florida

Recognizing that many traffic analysts use a combination of Highway Capacity Manual (HCM) and non-HCM based tools for highway capacity analyses, the National Cooperative Highway Research Program (NCHRP) has initiated Project 3-85 to develop practical and useful guidance for the use of other tools, either in combination with, or instead of, the HCM. This project is being carried out by the University of Florida Transportation Research Center and T-Concepts Corp. More details may be found on the project website at http://trc.ce.ufl.edu/research/nchrp385/.

The work is scheduled to be completed in May of 2008. The project tasks include:

1. Literature Review
2. Review of Current Practice
3. Identification of limitations of HCM methodologies that would lead an analyst to consider using alternative traffic analysis tools
4. Identification of currently available traffic analysis tools that are commonly used to replace or augment HCM analysis.
5. Interim Report
6. Identification of relationships among measures of effectiveness commonly reported by alternative traffic analysis tools and those used in the HCM
7. Development of approaches to properly present the results of traffic analysis tools
8. Development of a new Part V for the HCM, including general guidance on selecting and using alternative tools and their cost implications
9. Final Report

This project will be of interest to SimSub members and friends because it will produce guidance in the use of simulation models for evaluating the performance of highway facilities.

Draft versions of several products have been developed for discussion with various stakeholders at the 2007 TRB meeting. A brief review of these products follows:

Survey of Practice

A survey has been posted on the project web site addressing the following topics:

- Policy constraints requiring the use of specific traffic analysis tools
- Purposes for which the HCM procedures are applied, by facility
- Perceived limitations of the HCM procedures
- Purposes for which alternative tools are used
- Which software products are available to the agency
- Which alternative tools have been applied
- Which alternative tools are being considered
- Perceived limitations of alternative tools
- Innovative projects involving application of the HCM and alternative tools
- Specific questions that should be addressed by this project

Draft Working Paper 1: Analysis Framework and Treatment of Identified HCM Limitations

This document focuses on the limitations the HCM procedure and the extent to which these limitations can be mitigated through the use of other traffic analysis tools. Four facility categories are considered:

1. Intersections and arterials,
2. Highways,
3. Freeway segments and facilities and
4. Corridors and area-wide analyses

The overall analysis framework for each facility category is first established. Each procedural chapter of the HCM is then examined in terms of its limitations, the potential for improved treatment by alternative analysis tools, the proposed treatment in Part V and the priority that should be given to each limitation. The list of limitations has been derived from the limitations explicitly stated in each procedural chapter of the HCM, documentation developed by the HCQS Simulation Subcommittee and various other sources in the literature.

Draft Working Paper 2: Summary of HCM Procedure Inputs Processes and Outputs

Part III of the HCM Contains a set of procedures for computing performance measures on specific facilities. Each of the procedures applies a process to a set of required inputs and produces a set of outputs, each of which is affected to some extent by the inputs. Alternative tools follow the same concept but the inputs, process and outputs may differ from tool to tool. To understand the differences in the performance measures reported by various tools, it is necessary to examine the inputs, process and outputs associated with each tool. This working paper examines the HCM procedures from that perspective.

The discussion for each chapter begins with an overview that identifies the service measure (i.e., the measure of effectiveness upon which the LOS estimation is based) followed by a narrative description of the steps involved in computing the service measure. Each chapter includes an Input-Process-Output (IPO) table identifying all of the input variables used in the computations, the process to which these variables are subjected and the result on the service measure. The IPO tables provide a structure for examining alternative tools in a later stage of the project.

Draft Working Paper 3: Traffic Analysis Tool Experiments with Input Data Variation

This document builds on the results of Working Paper 2, which analyses the inputs processes and outputs that apply to each of the HCM procedural chapters. To understand the differences in the performance measures reported by various tools, it is necessary to conduct experiments to examine the relationships between the inputs and outputs associated with each tool. Working Paper 3 describes the experiments that will be conducted.

Base data sets have been developed to support future comparisons between the HCM Procedures and alternative tools. A minimum of one base data set has been developed for each procedural chapter, generally representing the simplest possible conditions and making maximum use of default parameters. Additional data sets have been developed for chapters that require them to compare the effect of input data on the performance measures. All HCM data sets have been prepared using HCS Plus.

Facilities with multiple segments were constructed using the base data sets for each segment. A total of 12 base data sets was created. A series of experiments was prescribed to establish the effect of selected input variables on the resulting performance measures.

Each experiment was described in terms of:

- The objective
- The base data set
- The input variable to be examined
- The procedure by which the experiment was conducted
- The results (usually a graphical plot)

The working paper describes and executes 16 experiments. Several more will be added at a later stage of the project.

Draft Working Paper 4: Proposed Expansion of the HCMAG

One of the tasks in this project will focus on the expansion of the case studies in the Highway Capacity Manual Applications Guidebook (HCMAG). The HCMAG was developed under NCHRP Project 3-64 to illustrate how the HCM and other tools can be used to analyze traffic operations. The HCMAG is available on the Internet at http://www.hcmguide.com as a readily accessible HTML document. It has been well received by traffic analysts and by the HCQS Committee.

The proposed revisions will be incorporated in a separate appendix of the final report. The material in this appendix will follow the same format as the existing HCMAG case studies to facilitate incorporation into the original document. It is not within the scope of this project to make the actual modifications to the HCMAG document.

The current HCMAG document presents five case studies, each of which contains several problems dealing with the use of the HCM procedures as well as alternative tools. This working paper identifies the case study problems that could be significantly improved by incorporating some of the results of this project. It also proposes a new case study based on corridor (i.e., freeway and surface networks) simulation tools, primarily to illustrate the use of such tools to augment or replace the HCM Part IV procedures.

Draft Working Paper 5: Representation of Traffic Analysis Tool Outputs in a Common Format

Task 7 in this project will focus on how to present the results from all tools in a manner that will avoid the problems of interpreting each of the separate output reports and reconciling the values contained in those reports with the HCM definitions. The key to this task lies in the development of a common representation of the outputs of all of the analysis tools. Lacking a common representation, it is necessary to train personnel on the interpretation of outputs from each tool and to relate those outputs, sometimes subjectively, to the HCM.

An extensible markup language (XML) representation is proposed for this purpose, since XML is already in use for representing the results produced by the HCM. The Traffic Model Markup Language (TMML), which is fully XML compatible, has been developed by the University of Florida Transportation Research Center.

The specific results of this task will be

- A set of XML schema that can be expanded by any user or developer in the future
- A set of conversion utilities that will convert the tabular outputs of selected tools into files conforming to the XML schema
- A set of comparison utilities that will pinpoint differences between results to facilitate interpretation and
- A set of style sheets and office productivity examples that will create a flexible and expandable means of presenting data from traffic analysis tools

This working paper describes a conversion utility that can be used to present the results of a CORSIM and HCM analysis for a signalized intersection in identical formats. The concept of operation is explained, operating instructions are provided and samples of the outputs are demonstrated.

Draft Working Paper 6: Modifications to the Highway Capacity Manual to Incorporate the Project Results

The existing Part V consists of a single chapter that is essentially tutorial in nature. It presents an overview of traffic simulation concepts and modeling categories. Typical simulation model applications are presented along with a set of three examples. A list of simulation references is included at the end. This chapter was inserted into the HCM 2000 as a placeholder for Part V. A future expansion of Part V to include three more chapters was recommended by the HCM 2000 development team.

One of the most important issues for the project 3-85 is the manner in which the results will be incorporated into the HCM. Input from the HCQS Committee and other stakeholders will be important to the development of an enhanced version of the HCM that will serve the needs of a vide variety of users.

Closure

The results of this project will be a set of new chapters in the HCM that give specific guidance on when and how to use alternative traffic analysis tools for highway capacity analyses. This guidance will clarify some issues that are now somewhat cloudy and will benefit both the developers and users of traffic analysis tools.

Exhibit 1: Research Challenges as Ranked by the Traffic Simulation Research Community

Challenge	Avg. Score	Standard Deviation	Low 80%	High 80%
Data needs and attributes for calibration, and use of simulation models	4.30	1.03	2.9	5
Sensitivity of simulation model results to the degree of calibration	4.15	0.96	3	5
Development of procedures and guidelines for calibration and validation of simulation/DTA models	4.10	0.98	3	5
Development of standards of simulation program performance measures	3.88	1.07	2.9	5
Data sets for use as "baseline" for testing	3.87	1.30	2	5
Incorporate automatic calibration in simulation	3.74	2.05	2	5
Develop case studies and modeling handbook	3.70	1.09	2	5
Work zone modeling	3.69	1.20	2	5
Driver behavior under different congestion levels.	3.68	1.12	2	5
Integration of simulation modeling as part of the operation and planning decision making processes	3.63	1.19	2	5
Estimation of existing and future O-D matrices for Dynamic Traffic Assignment	3.62	1.14	2	5
Effect of incidents	3.62	1.09	2	5
Modeling the responses of drivers to traveler information devices	3.59	1.07	2	5
Determining the accuracy of the models to predict future conditions	3.50	1.22	2	5
Incorporating simulation into real-time decision-making	3.38	1.11	2	5
Development of website for information/guidance dissemination	3.38	1.29	2	5
Air quality, noise, and fuel consumption modeling	3.33	1.13	2	5
Effects of pricing (including dynamic) strategies	3.32	1.23	2	5
Effects of HOV and HOT strategies including Dynamic Pricing Schemes	3.32	1.17	2	5
Effect of geometric design and sight restrictions	3.31	1.08	2	5
Modeling of roundabout	3.31	1.08	2	5

Challenge	Avg. Score	Standard Deviation	Low 80%	High 80%
Improved Traffic Flow Models for Mesoscopic Simulation	3.31	1.00	2	5
Modeling the effect of emerging VII technologies.	3.26	1.07	2	4.2
Establishment data standards for real-time data exchange between simulation engines and the outside world	3.26	1.21	2	5
Effect of mixed vehicle types (trucks, trains, buses, etc.)	3.23	0.96	2	4
Identification of the factors involved in route, mode and trip time choice	3.21	1.28	1.8	5
Evaluation of safety based on simulation results	3.18	1.27	1	5
Enhance representation of instrumentation (e.g., data from sensors, DMS, ramp metering, etc.)	3.18	1.14	2	5
Modeling of special use lanes (e.g., truck lanes)	3.16	1.15	1.7	4.3
Collection of trajectory data	3.13	1.26	2	5
Traveler behaviors during emergency events	3.11	1.45	1	5
Development of a process by which new R&D findings/design source will be available to public	3.10	1.25	1	5
Guidelines regarding resolution requirements for planning and operation	3.08	1.16	1.9	5
Driver behavior under different safety levels	3.07	1.28	1	4.4
Development of Application programming interface (API) standards	3.03	1.33	1	5
Effect of weather conditions (Visibility/pavement conditions)	2.97	1.16	2	5
Effect of mixed driver types	2.90	1.02	1	4
Modeling of non-motorized traffic (pedestrians, bicycles, etc.)	2.74	1.14	1	4
Modeling of transit operations(This could be combined with Challenge 1.2)	2.62	1.09	1	4
Guidelines for procurement of simulation models	2.54	1.17	1	4
Modeling the response to emergency vehicles	2.51	1.12	1	4
Use of Person-based OD	2.50	1.11	1	4
Investigation of the optimal use of distributed computer networking	2.38	1.17	1	4

Exhibit 2: Potential Data Sources Questionnaire

Name: ____ Title:_____________________________________

Affiliation: _____________________________________E-mail Address:___________________________________

1. Please identify trajectory data that should to be stored in the SimSub simulation data respiratory (other than the NGSIM dataset), provide a short description of the data, and a contact information/reference/web address for the data source

2. Please identify system state data that should to be stored in the SimSub simulation data respiratory, provide a short description of the data, and a contact information/reference/web address for the data source for the data source.

3. Please identify traveler strategic behavior that should be stored in the SimSub simulation data respiratory, provide a short description, and a contact information/reference/web address for the data source for the data source.