

**Transportation Research Board  
Committee on Traffic Flow Theory and Characteristics (AHB45)**

**TRIENNIAL STRATEGIC PLAN  
March 2008—March 2011**

**A. General Information**

2. **Committee Name.** Traffic Flow Theory and Characteristics (AHB45)
3. **Technical Activities Division.** Operations Section (AHB00)
4. **Leadership.** Chair: Nathan H. Gartner, University of Massachusetts Lowell  
Secretary: Robert L. Bertini, Portland State University  
TRB Staff: Richard A. Cunard
5. **Subcommittees:**

<b>No.</b>	<b>Name</b>	<b>Chair</b>
AHB45(1)	Joint Subcommittee on Traffic Simulation Models	Kenneth Courage
(2)	Research Problem Statements	Mohammed Hadi
(3)	Paper Review	Nathan Gartner
(4)	'Greenshields' Symposium – Fundamental Diagram	Reinhart Kuhne
(5)	Mid-Year Meeting 2008, Woods Hole, MA	Nathan Gartner
(6)	Special Report on Traffic Flow Theory	Hani Mahmassani
(7)	Committee Website	Robert Bertini

6. **Committee Scope.** This committee is concerned with the development, validation, and dissemination of theoretical, experimental, and applied scientific research on traffic flow theory and traffic flow characteristics, and the relationship of traffic flow theory and characteristics to the planning, design, and operation of transportation systems. The scope includes vehicular highway traffic, pedestrians and crowds, as well as systems with interactions among several modes sharing the right of way.
7. **Goals.** The primary goals of the Committee on Traffic Flow Theory and Characteristics are to serve as the focal point for (a) promoting the development of the theoretical foundations of traffic flow phenomena; (b) the validation, dissemination and application of traffic flow theories in the planning, design and operation of transportation systems, and (c) the study of traffic flow characteristics and the application of this knowledge in the planning, design and operation of transportation systems. The committee's goals, as exemplified through its activities over the years, specifically include:

- Promotion of research activities in development and improvement of traffic flow theories.
- Development of empirical data supporting and expanding the knowledge basis of traffic flow behavior and characteristics.
- Education and training activities on new and existing traffic flow models and their practical application.
- Exposition, critique and validation of traffic flow models incorporated in widely used transportation analysis and planning packages, such as: microscopic, mesoscopic and macroscopic traffic simulation, traffic assignment, traffic management and control, transportation planning, etc.
- Acquisition and analysis of experimental data in support of existing and new traffic flow models.
- Development of sound calibration, validation, interpretation and application procedures for traffic models and related tools.

The above goals are achieved by:

- Information sharing and dissemination through TRB papers and reports, TRB conference sessions, committee meetings, subcommittee activities, the committee website, and TRB-sponsored workshops and symposia.
- Collaboration with other TRB committees on joint activities.
- Development and dissemination of research problem statements from committee and subcommittee members.
- Cooperation with government, industry, university, scientific and professional organizations in conferences, symposia and workshops devoted to traffic flow theory and characteristics and their application.
- Encouraging collaboration among government, industry, university, scientific and professional organizations toward advancing the state-of-the-art in traffic flow theory.
- Development, publication and updating of the Special Report on Traffic Flow Theory (<http://www.tfhrc.gov/its/tft/tft.htm>) which has become recognized as an authoritative source of information on traffic flow models worldwide.

## B. Review of Committee Activities Over Previous Triennium

1. **Critical Issues.** The TFIC committee is addressing cross-cutting issues and methodologies in which committee members have unique demonstrated capabilities. Much of our cross-cutting work related to critical issues is manifested by the collaborative work we do with other TRB committees. The Transportation Research Board released a list of nine critical issues in January 2006:

1. **Congestion:** increasingly congested facilities across all modes;
2. **Emergencies:** vulnerability to terrorist strikes and natural disasters;
3. **Energy And Environment:** extraordinary challenges;
4. **Equity:** burdens on the disadvantaged;
5. **Finance:** inadequate revenues;
6. **Human And Intellectual Capital:** inadequate investment in innovation;
7. **Infrastructure:** enormous, aging capital stock to maintain;

8. **Institutions:** 20th century institutions mismatched to 21st century missions; and
9. **Safety:** lost leadership in road safety.

The TFFC committee's activities relate in many ways to the majority of these issues. In particular, issues 1, 2, 3, 6, 7 and 9 are the most closely linked to the committee's expertise and activities. The presentations and publications sponsored by our committee address these issues in terms of the analysis, quantification and alternatives evaluation. Our Millennium Paper and the Traffic Flow Theory Monograph contain elements that describe needs and accomplishments in these areas. Some specific ways that our work relates to these select critical issues are:

1. **Congestion:** the ability to measure, describe, model and manage congestion is based on understanding the fundamental principles of traffic flow. Any effort to develop alternative planning, demand management, control or pricing strategies is founded on models of traffic flow. Nothing is more directly related to the mission of our committee. Our work disseminated at the Annual Meeting, the annual simulation workshop, and through the joint simulation subcommittee provides a critical platform for addressing congestion on our nation's transportation system.
2. **Emergencies:** increasing attention is being paid to planning for emergencies. Simulation tools are being used to model evacuation strategies and much more research is needed in this area. Any network model developed for simulating evacuation or emergency response will be based on fundamental traffic flow theory principles, drawing from the research topics that we advocate and facilitate.
3. **Energy and Environment:** a heightened focus on sustainability, energy consumption and fuel prices in recent years has led to many new needs for rigorous evaluations of energy and environmental impacts due to transportation improvements. Many models of noise, energy, fuel consumption, etc., require the use of sound and up to date traffic models. Therefore, developments in traffic flow theory are required in order to ensure that energy and environmental impacts are correctly modeled.
6. **Human and Intellectual Capital:** This committee provides an important opportunity for graduate students and young professionals to interact with more senior academics and professionals. Our meetings, sessions and workshops attract numerous students, and our Traffic Flow Theory Special Report (available on the committee website) is often required reading for students in traffic engineering around the world. The committee recognizes its role helping to develop human and intellectual capital so that future implementations of transportation solutions will be based on sound theory and rigorous analysis.
7. **Infrastructure:** the management of our infrastructure requires an ability to measure, evaluate and forecast the demand and user attributes for components of the transportation system. An effort to perform this kind of work requires a firm basis in theoretical traffic principles. The work done by this committee contributes to the infrastructure management and modeling processes in many ways.
9. **Safety:** modeling of traffic behavior (such as car following and lane changing) and the impact of control devices (e.g., traffic signals, stop signs, etc.) are essential tools in the analysis of hazards and the prediction of risk.

## 2. Committee Activities Since Last Triennial Strategic Plan.

**a. Paper Review and Presentation.** One of the committee's points of pride is the quality of papers submitted, presented and published under its auspices. The committee members view this as our most important activity. We are recognized as one of the most selective committees of TRB, with high standards of scientific excellence for membership, presentations and publications. The following provides a perspective on the committee's paper review and presentation activities over the last four years.

- 2008 – 83 papers reviewed, 53 accepted for presentation
- 2007 – 88 papers reviewed, 59 accepted for presentation.
- 2006 – 70 papers reviewed, 52 accepted for presentation
- 2005 – 69 papers reviewed, 45 accepted for presentation

The 2007-08 paper submission and review cycle experienced a 137% increase in the number of papers handled by the committee since 2002. This explosive growth is a manifestation of the important role that traffic flow theories and characteristics have in all aspects of transportation modeling. We continue to develop our substantial record of publications sponsored by the committee addressing both theoretical and practical issues. We are also proud of our continuing track record with large attendance at the Annual Meeting activities, including the paper and poster sessions, the committee business meeting, the joint simulation subcommittee meeting and the simulation workshop.

**b. Collaboration With Closely Related Committees** - Our committee works closely with several other TRB committees on cross-cutting topics. These are committees with which the Traffic Flow Theory and Characteristics Committee has co-sponsored meeting, workshop or session activities during the last three years. A number of TFTC members are serving, or have served, on each of these committees and thus are familiar with issues and activities that are of mutual interest. Following is a list of the principal committees with which TFTC interacts:

- i. *Highway Capacity and Quality of Service* (AHB40). The HCQS Committee addresses issues that increasingly rely on traffic flow models and characteristics and their implementation through measurement, analysis and simulation. Facilities under purview by this committee include: freeway sections, arterials, rural roads, signalized and non-signalized intersections, etc. Interaction takes place through sponsorship of the Joint Subcommittee on Simulation (AHB45(1)), and continuing sponsorship of the highly successful annual workshop on traffic simulation models, as well as participation in TRB and FHWA advisory panels and activities.
- ii. *Freeway Operations* (AHB20). The Freeway Operations Committee addresses issues that increasingly rely on traffic flow models and characteristics and their implementation through measurement, analysis and simulation. Interaction takes place through joint sponsorship of the annual workshop on traffic simulation models, the establishment of a task force on traffic simulation models which closely interacts with TFTC, joint participation in TRB and FHWA advisory panels and activities.
- iii. *Traffic Signal Systems* (AHB25). The TRB Signal Systems Committee addresses issues of traffic management and control that rely on traffic flow modeling and

characteristics, especially through the application of simulation tools for strategy development and evaluation, data collection and data analysis. Interaction takes place through joint sponsorship of the annual workshop on traffic simulation models, cross participation in committee activities and participation in TRB and FHWA advisory panels and activities.

- iv. *Transportation Network Modeling* (ADB30). This committee is a constituent member of the TRB planning and environment group. It focuses on issues of quantity and quality of supply (as opposed to demand) of transportation facilities. Highway and transportation network models, by necessity, have an intimate relationship with traffic flow models. This committee and the TFIC committee are the largest drawers of TRB paper submissions, often from the same pool of participants. Papers that address transport network and supply issues are directed to ADB30, while papers that address traffic flow models and characteristics, are directed to AHB45. This is another manifestation of the pervasive nature of traffic flow modeling that spans group divisions and interests. Interaction takes place through joint sponsorship of sessions, cross participation in committee activities and participation in TRB and FHWA advisory panels and activities.
  - v. *Intelligent Transportation Systems* (AHB15). This committee is concerned with ITS systems level issues. Such systems include technologies that integrate the provision of information to travelers about road and transit conditions with monitoring, guiding, and/or controlling the operation of vehicles. AHB15 activities focus on the broad technological, institutional, economic and planning aspects of the development and implementation of ITS systems. The committee also serves as a focal point for coordination of ITS related activities of other standing committees. ITS systems rely on the development of improved traffic flow models and interaction occurs through cross participation in TRB and FHWA advisory panels and activities.
- c. **Joint Subcommittee on Simulation.** Traffic simulation models are playing an increasing role as a problem solving tool for transportation system analysis. The interest in simulation cuts across the boundaries of several TRB committees. The TFIC committee has taken a leading role in serving as a focal point for simulation modeling and application activities at TRB. Along with our successful Annual Workshop on Traffic Simulation Models (see below), and in collaboration with the Highway Capacity and Quality of Service (HCQS) Committee, we established in 2003 the Joint Subcommittee on Traffic Simulation Models designated as AHB45(1). Soon thereafter, two other committees joined forces so that AHB45(1) is now a jointly sponsored subcommittee of four parent committees:
- AHB45: Traffic Flow Theory
  - AHB40: Highway Capacity and Quality of Service
  - AHB20: Freeway Operations
  - AHB25: Traffic Signal Systems

This structure of the subcommittee ensures that it functions better than a stand-alone committee since its membership is fed by four very active committees. The subcommittee has an email listserve with over 100 members. Newsletters are published

on its website (<http://www.tft.pdx.edu/simsub.htm>) and, furthermore, the subcommittee has helped to generate numerous research problem statements through a survey of its membership. The subcommittee's goal is to coordinate the efforts of its parent committees to avoid duplication and conflict by:

1. Providing a forum for presentation, discussion and dissemination of information on traffic simulation models.
2. Recommending parent committee actions on:
  - Capabilities of existing models
  - "Best practices" and guidelines of model application
  - Development of improved models
  - Calibration and validation issues
3. Maintaining liaison with other TRB committees and FHWA, especially with the NGSIM project.
4. Promoting basic research on simulation models
5. Identifying data needs (demand, etc.)

The subcommittee is comprised of four task groups: Annual Workshop, Newsletter, Liaison and Outreach, and Research Needs and Resources. Each task group has specific responsibilities that contribute to the subcommittee's mission.

- d. **Committee Membership and International Connections.** The committee has 30 members at present. During the past triennium the committee has undergone membership rotation as a result of which approx. one-third new members have been appointed, including the addition of two Young Members. Currently, 25 of the members come from academic institutions, while 8 members are international. We leverage significant benefits from our vibrant international cooperation. There is strong international participation in committee activities, as well as in paper submission and review. There is increasing recognition of our role as a leading international forum for presentation of new developments in traffic science and traffic modeling. The broad representation and high caliber of our membership is one of the committee's principal strengths. In addition, the committee is supported by a large network of friends—our friends' listserve consists of more than 300 members. A total of 217 individuals provided reviews during the 2007 paper review cycle. These numbers reflect the strong interest in our committee's activities.
- e. **Annual Workshop on Traffic Simulation Models.** The TFTC committee continues to serve as a focal point for simulation modeling and application activities at TRB. For the past seven years the TFTC committee, in cooperation with other TRB committees, organized and conducted the annual workshop on traffic simulation models during the Sunday workshop period preceding the annual TRB meetings in January. These workshops have focused on the most recent developments in simulation modeling activities, including research, applications and validations. The workshop has been highly successful in that it attracts the leading actors in the traffic simulation modeling field, and consistently draws large audiences in excess of 200 participants. We plan to continue this important workshop in 2009 and beyond.

- f. **Midyear Meetings.** A significant proportion of the TFTC membership is regularly participating at the venerated biennial ISTTT (International Symposium on Transportation and Traffic Flow Theory). Thus, informal midyear meetings of the Committee were held during the 16th ISTTT in College Park, Maryland in 2005 and during the 17th ISTTT in London, U.K. in 2007. Reports were given on ongoing activities of committee members and plans were forged for the Greenshields Symposium on the Fundamental Diagram to be held in conjunction with the 2008 mid-year meeting in Woods Hole, Massachusetts (see below).
  
- g. **Summer Meeting and Symposium on the Fundamental Diagram: 75 years (“Greenshields Symposium”).** The committee is planning a summer meeting and symposium, to be held July 8-10, 2008 at the J. Erik Jonsson Conference Center of the National Academy of Sciences in Woods Hole, MA. The theme of the Greenshields Symposium is “Celebrating 75 years of the Fundamental Diagram.” Bruce D. Greenshields is recognized as the originator of the Fundamental Diagram in traffic flow theory and was an original member of the (then) Highway Research Board Committee on Traffic Flow Theory. Main topics to be addressed will be: historical appreciation of traffic flow theory founders, recent developments and influence on current practice, impact of technological developments, e.g., real-time measurements, remote sensing, etc. The Thursday Workshop will focus on assessing the current status of traffic flow theory, identifying gaps in knowledge and developing research topics to address areas that need improvement or where we have insufficient experience.
  
- h. **Millennium Paper and Other Publications.** The committee has developed a Millennium Paper that is available on our website. As an extension of this effort, the committee maintains authorship and publication of the authoritative and highly regarded Special Report on Traffic Flow Theory (<http://www.tfrc.gov/its/tft/tft.htm>). The Special Report is posted on our committee website, and we also provide links to the previous two special reports published in 1975 and 1964. An ad hoc subcommittee of three members has been formed to examine options for the next generation of the traffic flow theory special report.

There is also interest in the committee and our community to provide more of a clearinghouse of seminal/historic publications related to traffic flow theory. Our Millennium Paper includes references to many of these, and we plan to investigate ways to increase our strength in this area in the future. An ad hoc subcommittee of five members has been formed to examine and recommend options for enhancing the committee’s web presence.

- i. **Committee Website and Communications.** In 2002 the committee established a website: <http://www.tft.pdx.edu>. This valuable resource provides committee members, friends, and aspiring transportation professionals around the world a central, accessible location for learning about committee and related activities (typically centering around the annual meeting). In addition, using a listserv for committee friends (all correspondence is permanently archived on a website: [http://www.lists.pdx.edu/tft\\_friends/current/](http://www.lists.pdx.edu/tft_friends/current/)), individuals with interests related to committee activities can interact and communicate across the globe. With the establishment of the joint subcommittee on traffic simulation models, the website has

been expanded to serve as a useful, central clearinghouse for appropriate documentation and web resources. For example, all subcommittee materials and newsletters are archived on the website. The committee also uses the website to archive committee meeting agendas and minutes (password protected for committee members only). We also provide links to related committees, record our TRB Annual Meeting activities, and provide links to the ISTTT website.

- 3. Research Problem Statements.** The review of the committee TSP in 2004 highlighted the need to “develop research problem statements.” The committee has previously been indirectly active in this area: by providing input and review to the FHWA sponsored NGSIM project and by contributing to research problem statements prepared by allied committees. This is an area in which we have focused our efforts more intensely. The committee has generated a list of 17 potential research topics that will be entered into the TRB Research Needs Statements (RNS) database. Links to the problem statements will also be posted on the committee website. Efforts will continue to be made to stay abreast of international research efforts, and to the extent possible, find ways to collaborate across international boundaries.

In addition, the Chair of Joint Subcommittee on Simulation Research Needs and Resources Task Group is also an active member of the TFTC Committee. The subcommittee has developed a list of 40 potential research problem statements that are being refined by the subcommittee members. Research problem statements deemed suitable to the TFTC will be fed into the committee by the subcommittee, and submitted to the TRB RNS database.

### C. Planned Activities During Next Triennium

- 1. Justification for Retention.** The committee addresses essential issues underlying the operation, analysis and design of transportation systems. These issues cut across most TRB committees in the Operations Section, as well as several committees in the Planning Section. Committee activities continue to draw large attendances at the Annual Meeting and among the largest submission, presentation and publication of papers that benefit both the research and the practitioner communities. We are also very proud of our substantial international participation which is represented in the committee membership. This contributes significantly to the knowledge base and information on best practices on a worldwide basis and serves as an important resource for the TRB constituencies.

For more than a half-century the TRB TFTC Committee serves as a global focal point for research, presentation and dissemination of information on traffic flow theory and characteristics related topics. Over the years it has spawned a number of other committees as new focus areas were developed. The committee continues to be a focal point for research, presentation and dissemination of information through the TRB Annual Meeting and the publication of its records. A continuing principal contribution has been the sponsorship, development and publication of the Special Report (Monograph) on Traffic Flow Theory: Report No. 79 in 1964 and No. 165 in 1975, as well as the third and most recent generation of the monograph developed under committee sponsorship, are available on the web since 1996. This series of monographs has become a recognized world standard for traffic flow theory research and practice. Notwithstanding the proliferation of conferences, workshops and symposia dealing with traffic flow issues, the TRB TFTC

Committee maintains its unique position as the principal clearinghouse for high-quality, unbiased research, applications and publications in the areas of traffic flow theory and characteristics that contribute to improved planning, design and operation of transportation systems. Committee members have worked with NCHRP and FHWA in developing research problem statements and in reviewing, monitoring and disseminating research results. The Committee regularly co-sponsors workshops, conferences and symposia concerning traffic flow theory and simulation models in co-operation with organizations such as INFORMS, ITSA, ISTTT, ISTS and TRISTAN.

## 2. Revisions to Scope, Organization and Membership.

- a. **Scope.** At this time, we do not recommend any changes to the committee scope.
- b. **Organization.** We recognize the ongoing need to strengthen and focus sub-committee activities. We are delighted by the success of the joint simulation subcommittee, and by the ad hoc subcommittee activities related to the development of research problem statements, the next generation of the documentation of the state of the art in traffic flow theory, the committee website and communication tools, advocacy and action related to the creation of datasets stemming from NGSIM, as well as connections with international research activities. We plan to continue to strengthen these areas of activity and develop new areas as they emerge.
- c. **Membership.** We are pleased with the addition of new members during the recent rotation and the strong representation by international members. Over the next three years we plan to seek new members with focus on simulation modeling expertise as well as new members with traffic flow characteristics expertise and interest in contributing to theory from empirical experience. We will also seek to continue participation from the physics community where significant developments in traffic flow theory are taking place.

## 3. Goals and Objectives for Next Triennium.

Following our long history and recognizing that the 21st century calls for new innovations in research and practice, our committee plans a vibrant set of integrated goals. We recognize the expanding role that simulation plays in transportation practice and we plan to continue being a leader in this area. New and continuing activities will aim to accomplish the following goals:

- Continue close cooperation and established liaison with other TRB committees.
- Continue to enhance and clarify the definition and distinction of TFTC activities within the TRB Operations Group.
- Continue to develop and strengthen our activities in the simulation modeling and applications area under the auspices of the Joint Simulation Subcommittee.
- Expand activities in the traffic flow characteristics area, further enhancing international collaborations and encouraging the expanded development of high quality data sets that can be used to examine the validity of traffic simulation models, to evaluate congestion remediation actions, safety issues, etc. Coordinate with International Workshop on

Traffic Data Collection and Its Standardization, September 8-9, 2008, Technical University of Catalonia, Spain.

- Improve, expand and publicize the committee's web site. Provide access to archival reports (e.g. Greenshields, Treiterer, etc.), research problem statements, research solicitations by state DOTs, etc.
- Develop permanent sub-committees activities.
- Develop intellectual capital in the traffic flow theory and characteristics field.

4. **Critical and Cross-Cutting Issues.** The committee will address these goals in the context of the TRB critical issues, with an eye toward issues that cross disciplines and looking for ways to collaborate with other committees. Some of the issues include:

- Traffic flow theory and characteristics research needs that support national congestion mitigation goals, emergency response and evacuation, environmental and energy sustainability, development of human and intellectual capital and infrastructure needs.
- Improved simulation modeling techniques and applications that support the planning, design and operation of the transportation system in the context of the critical issues mentioned above.

#### 5. **Planned Activities**

- Hold a 2008 mid-year meeting in conjunction with the Greenshields Symposium at Woods Hole, Massachusetts.
- Coordinate annual and mid-year activities with other TRB committees.
- Plan mid-year meetings in 2009 in Hong Kong in conjunction with the 18th ISTTT and in 2011 in Berkeley in conjunction with the 19th ISTTT.
- Continue review and presentation of research and applications papers. Based on past success with targeted call for papers for the TRB annual meeting, consider developing future calls for papers based on critical issues or topics identified at mid-year meeting.
- Adopt strong advocacy role for collection and archiving of observational data, using existing and emerging technologies, to support the development and testing of existing and new theories and models that apply to a wide range of traffic phenomena.
- Spearhead the formation of a subcommittee to lead the effort in collection and archiving of observational data in cooperation with other interested committees.
- Establish an ad hoc subcommittee to update and improve our committee's approach to the TRB Critical Issues and update the Millennium Paper.
- Continue our focus on simulation model development and applications under the auspices of the joint simulation subcommittee.
- Work with ad hoc subcommittee on the website to create a clearinghouse of seminal publications via our website.

- Find ways to encourage the mentoring of graduate students and young professionals, particularly to convey the history of traffic flow theory research so that future research can successfully build on the past efforts of the best scholars.
- Pursue the publication options for a new version of the Traffic Flow Theory Special Report. Create print on demand capability for current traffic flow theory monograph.
- Review past committee sponsored Transportation Research Records and highlight most significant publications since the committee's founding.

6. **Research Problem Statements.** The committee is finalizing a set of research problem statements that will be posted on our website and in the RNS database.

No.	Title
1	Exploration of Monitoring Techniques of Traffic Characteristics
2	Psychological Factors and Their Effect on Traffic Flow
3	Procedures and Guidelines for Calibration and Validation of Simulation/Dynamic Traffic Assignment Models
4	Use of NGSIM Data to Validate/Calibrate the Various Simulation Models
5	Investigation of Synchronized Traffic Flow and Modeling Traffic Flow Instability on Freeways
6	Emission Modeling as Related to Traffic Characteristics
7	Gap Acceptance Behavior of Different Types of Drivers
8	Effect of Cycle Length on Discharge Headway
9	Effect of Advanced Technologies on Traffic Flow Characteristics

The committee will continue to review and update the problem statements over the next triennium:

- The committee will develop and update research problem statements on an annual or biannual basis.
- The committee will provide a spot on the committee website where research problem statements can be located and accessed by individuals outside the committee using the committee website as a forum for dissemination and archiving. They will also be available and searchable via the TRB RNS database.
- The committee will work with other organizations to identify and develop high-priority problem statements.
- Midyear meetings will include agenda items related to development and updating of research problem statements.