

# Triennial Strategic Plan Transportation Research Board Committee on Traffic Flow Theory and Characteristics Spring 2004

## I. IDENTIFICATION INFORMATION

### A. Committee Name

1. Traffic Flow Theory and Characteristics (AHB45)

### B. Technical Activities Division

1. Operations Section (AHB00)

### C. Committee Leadership

1. TRB Staff: Rich Cunard
2. Chair: Nathan H. Gartner
3. Secretary: Robert L. Bertini

### D. Scope and Goals of the 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.

**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 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 and TRB-sponsored workshops.
- Cooperation with government, university, scientific and professional organizations in conferences, symposia and workshops devoted to traffic flow theory and characteristics and their application, and
- 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.

**E. Closely Related Committees** - The TRB Committee on Traffic Flow Theory and Characteristics (TFTC) has close interaction and subject matter interests with several other TRB committees. These are committees with which the TFTC Committee has coordinated meeting, workshop or session activities during the last three years:

1. *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 joint sponsorship of the annual workshop on traffic simulation models, the establishment of a joint sub-committee on traffic simulation models, participation in TRB and FHWA advisory panels and activities.

2. *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 FOC task force on traffic simulation models which closely interacts with TFTC, joint participation in TRB and FHWA advisory panels and activities.

3. *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.

4. *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 TFTC committee are the largest drawers of TRB paper submissions, often from the same pool of participants. Papers that emphasize overall transport network and supply issues are directed to ADB30, while papers that emphasize the microscopic nature of traffic, i.e., 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.

5. *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.

## II. REVIEW OF PREVIOUS ACTIONS AND ACCOMPLISHMENTS

### A. Accomplishments During Past Three Years:

1. Critical Issues – The committee plans to prepare a Critical Issues paper during 2004.
2. Paper Review and Presentation – The following provides a perspective on the committee’s paper review and presentation activities over the last three years.
  - a. 2004 – 80 papers reviewed, 52 accepted for presentation.
  - b. 2003 – 39 papers reviewed, 22 accepted for presentation
  - c. 2002 – 35 papers reviewed, 20 accepted for presentation

The 2003-04 paper submission and review cycle experienced a 100% increase in the number of papers previously handled by the committee. In preparation for the 2004 annual TRB meeting the TFTC committee issued a Call for Papers on Traffic Simulation Model Calibration and Validation that generated 40 additional submissions over the average 40 submissions. About 25 of these papers were scheduled for presentation in two podium sessions and in several poster sessions devoted to calibration and validation of traffic simulation models., An additional 25 papers were presented in sessions devoted to traffic flow theory and characteristics. Fifteen of the calibration and validation papers will be published in the 2004 TRB records. They provide a comprehensive review of the state-of-the-art in this very practical and important facet of traffic flow simulation and

analysis. Eleven additional papers on other aspects of traffic flow theory and characteristics will also be published in this cycle.

3. Annual workshop on traffic simulation models – During the past three years the TFTC committee, in cooperation with other TRB committees organized and conducted an 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 2005.
4. Joint sub-committee on traffic simulation models – In 2003 the TFTC and the HCQS committees established a joint sub-committee on traffic simulation models AHB45(1) that had its inaugural meeting in January 2004. The sub-committee generated extensive interest with about 80 persons attending the inaugural meeting. We are now in the process of developing a mission statement and a plan of action for the coming year.
5. Research problem statements – The committee has 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 need to focus more intensely.
6. Establishment of a committee website. In 2002 the committee established a website: <http://web.pdx.edu/~bertini/tft.htm>. This provides committee members and friends a central 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 sub-committee on traffic simulation models, we plan to expand the website to serve as a useful, central clearinghouse for appropriate documentation and web resources. 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.

#### **B. Additional information**

1. The 2000 Triennial Evaluation of the Committee found two areas of committee activity that could be improved. Action is being taken in both these areas.
  - a. Enhance the position of the committee within the TRB structure by demonstrating its contribution to the activities of the other TRB committees as well as the sponsoring agencies.
  - b. Develop research problem statements in cooperation with other committees.

### **III. STRENGTHS AND WEAKNESSES**

#### **A. Strengths**

1. Coordination and cooperation with numerous other TRB committees.
2. Addressing cross-cutting issues and methodologies in which committee members have unique demonstrated capabilities.
3. Recognition as one of the most selective committees of TRB, with high standards of scientific excellence for membership, presentations and publications.
4. Authorship and publication of the authoritative and highly regarded Special Report on Traffic Flow Theory (<http://www.tfhrc.gov/its/tft/tft.htm>).
5. Serving as a focal point for simulation modeling and application activities at TRB.
6. A substantial record of publications sponsored by the committee addressing both theoretical and practical issues.
7. Large attendance at the Annual Meeting activities.
8. Significant benefits from international cooperation: strong international participation in committee activities, as well as in paper submission and review; and recognition as the principal annual international forum for presentation of new developments in traffic science and traffic modeling.

#### **B. Weaknesses**

1. Critical Issues – the committee is currently developing a Critical Issues paper.
2. Millennium Paper – The substantial effort devoted by committee members in developing, revising and continual updating of the Special Report on Traffic Flow Theory has in large measure supplanted the development of a millennium paper. As the latest version of the Special Report is now being published by TRB, the committee will turn its attention and efforts to developing a separate millennium paper.
3. Committee activities and accomplishments are not sufficiently recognized by the practitioner community both inside and outside of TRB.

### **IV. ACTION**

#### **A. Justification for the retention, revision, or elimination of the committee:**

1. The committee addresses essential issues underlying the operation, analysis and design of transportation systems. These issues cut across most TRB committees on the operations side, as well as several committees on the planning side. Committee activities 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. It draws a substantial international participation which is also represented in the committee membership. This contributes significantly to the knowledge base and information on best practices on a worldwide basis.
2. For more than a half-century the TRB TFTC Committee serves as a global focus 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: No. 79 in 1964 and No. 165 in 1975. The third generation of the monograph has been in preparation under committee sponsorship and a draft is available on the web since 1996. A revised and updated version of the Report will be published by TRB within the next year. 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 and TRISTAN.

**B. Recommendation for any revisions to the scope, organization, or membership of the committee:**

1. Scope: none recommended.
2. Organization: further develop focused sub-committee activities.
3. Membership: seek new members with focus on simulation modeling expertise as well as new members with traffic flow characteristics expertise; expand participation from the physics community where significant developments in TFTC are taking place.

**C. Committee goals and objectives for the next triennium:**

1. Continue close cooperation and established liaison with other TRB committees.
2. Develop clear definition and distinction of TFTC activities within the operations group.
3. Continue to develop activities in the simulation modeling and applications area.
4. Expand activities in the traffic flow characteristics area.
5. Improve, expand and publicize the committee web site.
6. Develop permanent sub-committees activities.

**D. List of critical and cross-cutting issues that the committee hopes to address:**

1. Traffic flow theory and characteristics research needs.
2. Improved simulation modeling techniques and applications.

**E. Planned committee activities:**

1. Plan a 2005 mid-year meeting in conjunction with the ISTTT 16 conference in College Park, Maryland.
2. Coordinate annual and mid-year activities with other TRB committees.
3. Review and presentation of research and applications papers.
4. Adopt stronger 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 and situations.

5. Spearhead the formation of a subcommittee to lead the effort in collection and archiving of observational data in cooperation with other interested committees.
  6. Establish a subcommittee to develop the Critical Issues paper and the Millennium Paper.
  7. Continue focus on simulation model development and applications.
- F. Verification that the committee's set of research problem statements is complete and up-to-date, and where these can be found:**
1. The committee will develop research problem statements on an annual or biannual basis.
  2. The committee will develop a location 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.
  3. The committee will work with other organizations to identify and develop high-priority problem statements.
- G. An update of the committee's millennium paper (every six years):**
1. The Special Report on Traffic Flow Theory, which supplanted the millennium paper, is currently available on the web and will also be published by TRB (<http://www.tfhrc.gov/its/tft/tft.htm>). The committee plans to develop a new version of its millennium paper.