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Final Invoice or Copy of Final Invoice	Y	_____
Final Report of Inventions and/or Subcontracts	N	_____
Government Property Inventory & Related Certificate	N	_____
Classified Material Certificate	N	_____
Release and Assignment	N	_____
Other _____	N	_____
Comments _____		

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January 30, 1995

Ms. Ilene Payne
Director, Universities and Grants Programs
Turner-Fairbank Highway Research Center
6300 Georgetown Pike
McLean, VA 22101-2296

RE: Eisenhower Faculty Fellowship

Dear Ms. Payne:

Please find enclosed one copy of a report titled "Level II Workshop Summary - Where do we go from here?" submitted in satisfaction of the Eisenhower Faculty Fellowship. This document summarizes my efforts at the Workshop on Models in Support of IVHS.

My attendance at the Workshop was beneficial to Georgia Tech, my students, FHWA and myself. Towards improving the content and relevance of a course titled "Advanced Technologies in Transportation" being taught this quarter at Georgia Tech, this document will be included in the course materials and discussed by the students. As a benefit to FHWA, a copy of my report has been forwarded to Al Santiago of FHWA for inclusion in the workshop proceedings. Finally, my participation in this workshop has increased my understanding of the issues relevant to FHWA efforts in the development of computer models in support of ITS technologies, and allowed me to interact with numerous professionals involved in these developments.

I would like to thank you and the Fellowship Program for providing me the opportunity to participate at this workshop.

Sincerely,

John D. Leonard II
Assistant Professor

Enclosures

Level II Workshop Summary
“Where do we go from here?”

John Leonard
1/30/1995

1. Overview

1.1. Background

In early December 1994, a workshop titled “Traffic Models in Support of IVHS” was organized and cosponsored by Federal Highway Administration and the University of Florida. The primary goal of this workshop was to influence the development of practical, integrated traffic modeling support systems for traffic control centers. The specific goals of the workshop were to:

- Create better interfaces for the integration of the research and development and operating functions, and
- Provide input to FHWA regarding the needs and directions in traffic system modeling and the required approaches to ensure the successful transfer of these technologies to the practicing community.

The workshop used a variety of methods to focus the thoughts of the participants towards the problems associated with the development of modeling support systems.

The first two days were filled with presentations selected to highlight current problems in traffic modeling. Three major topics were addressed: Approaches to Assignment Modeling; Signal and Assignment Optimizations; and Training, Education, and Technology Transfer.

The next two days were intended to allow the participants to explore various aspects of several complex issues being faced by FHWA with regards to traffic modeling. The two major thrusts of discussion were: 1) the state of modeling, and 2) where do we go from here. Participants were divided into several small groups and each group was given a series of questions to be addressed. After addressing the first thrust area, the entire group was reconvened, and results presented. New groups were formed, and the second thrust area was then discussed.

The last day of the workshop consisted of two sessions: presentations of the results of the second series of breakouts, and development of a series of recommendations to be submitted to FHWA.

1.2. Purpose of this document

This document intends to address the second goal of the workshop: to provide input to FHWA. As such, it summarizes the results of the Level II workshop breakout sessions addressing the State of Modeling. Specifically, this document summarizes the ideas of Group 3, whose participants included Mike Smith, Larry Head, Michel Van Aerde, Mike Waugh, Eil Kwon, Liang Hsia, John Leonard, Susan Walker, and Shaw-Pin Miaou. The group secretary was Susan Walker and the group leader and author of this document was John Leonard.

2. Focus of this Group

The general thrust area to be addressed by all Level II workshop breakout groups was “Where do we go from here?” This was taken in reference to the overall approach

toward development of traffic models and traffic modeling support software. To guide discussions, the following table was provided to each group:

Stages of Modeling	Funding Who/How?	Support Who/How?	Maintenance Who/How?	Feedback
Development				
Implementation and Marketing				
Education and Training				
Application				

Each breakout group was asked to discuss a row in the table. For example, Group 3 (this group) was asked to discuss and provide recommendations for the “Development” aspects of modeling.

Group 3 determined that “development” issues could not be discussed in a vacuum. Given this, the group chose to discuss, at least in a cursory fashion, issues associated with the all aspects of modeling as presented in the above table.

The group also concluded that the goal of the overall modeling process is to develop tools that assist transportation professionals to solve transportation problems.

Some examples of transportation problems discussed by the group include: system design (e.g., the location of control elements to provide enhanced system safety and performance), effects of control elements on system performance (e.g. “what happens to system performance when a new traveler information technology is introduced”), and enhanced infrastructure modification to better improve the performance of control devices

(e.g., “what happens to the performance of this traffic signal when a right-turn only lane is added”)

Finally, the group determined that the best way to describe directions for the future was to develop and then discuss a framework that 1) clearly identifies the stages in the model life cycle, 2) explicitly identifies interested parties (or stakeholders) that participate in the model life cycle, and 3) distributes responsibility for implementation of each of the life cycle stages among the interested parties. In the context of this discussion, “responsibility” is divided into two components: financial and participatory. A stakeholder with financial responsibility provides funding support for each life cycle stage. A stakeholder with participatory responsibility takes the lead role in implementation of each life cycle stage.

The remaining sections of this document are used to describe the framework for the future, as proposed by Group 3. The group felt that successful implementation of this framework would be very beneficial to the development of traffic models.

3. Life cycle Stages of Modeling

In order to more clearly distinguish the roles and responsibilities of the various stakeholders, the group decided to expand the stages of development (or life cycle stage) as originally presented in Table 1. Ten individual stages resulted from this disaggregation. The following table presents these stages along with a brief definition of each.

Stage of Modeling	Description
Problem Identification	Identify problems and other needs. To be effective, inputs from a variety of stakeholders are required
Equations	A methodology for problem solution is proposed.
Prototype Development	This step includes development of any worksheets, templates, and/or software in support of the methodology proposed in the “equations” step. Development of a “finished” product (defined by polished interfaces or computationally efficient algorithms) is not the focus of this step.
Evaluation	The solution of the proposed methodology is evaluated for effectiveness. Any necessary improvements are documented (but not necessarily implemented by the contractor at this time)
Model Extensions	This step assumes that the proposed solution actually constitutes a step forward (as documented in the evaluation) and further development is warranted. This step involves the incorporation of necessary improvements and creation of a more widely distributed product
User Interfaces	This step describes the implementation of polished “user friendly” interfaces to increase widespread acceptance of the solution methodology.
Add-Ons	This step describes further enhancements, including data transfer/conversion with other methodologies (e.g., T7F -> NETSIM conversion).
Evaluation	This step describes the continual evaluation of the family of products resulting from the original prototype with respect to the ability of the products to solve the original transportation problem.
Training / Education	This step describes the continual process of education and training of transportation professionals with regards to the problem identified, and potential solutions to the problem. It can also include training in the use of techniques that specifically address the problem solution.
Marketing	This step describes the marketing of vendor-specific packages which implement the original prototype
Promotion	This step describes the process of promoting this framework in an effort to sustain interest and support for the process. Continual support will ensure participation of all necessary stakeholders.

The order of each stage describes a general sequence of implementation of each stage. The first five stages (e.g., Problem Identification through Model Extensions) should be considered sequential, and are generally used to describe a software development process. The last six stages (User Interfaces through Promotion) may occur in any order, but usually after the “Model Extensions” stage.

4. User Community / Stakeholders

Successful development, implementation, and marketing of software tools requires cooperation of many players throughout the entire life cycle of the software tool. The following table presents the key players / stakeholders identified by the group.

User Group	Description
Federal Government	Initially the FHWA but as solutions become increasingly multimodal and comprehensive in nature, may also include other branches of the USDOT. The federal role is one of facilitation, by both bringing together professionals with transportation problems that need to be solved, and providing financial support at earlier life cycle stages.
State Government	Primarily the DOT (surface transportation)
Local Jurisdictions	Counties, MPOs, Cities, Transit Agencies, etc.
Professional Societies	ITE, ASCE, ITS-America
Academia	Universities, National Labs
Private Software Developer	

5. Desired Levels of Stakeholder Participation

The following table summarizes the consensus of the group with respect to the levels of participation of each stakeholder group in the modeling development process.

The contents of each cell summarize this relationship on a scale of 1 to 3, with 3 being the highest level of participation. A dash represents no required participation.

Development	Feds	State	Local	Prf.Soc	Acad	Pr.Dev
Problem ID	3	3	3	1	1	1
Equations	1	-	-	2	3	1
Prototype	-	-	-	-	3	2
Extensions	1	1	1	-	2	3
User Interfaces	1	2	1	1	1	3
Add-Ons	-	2	2	-	1	3
Evaluation	3	3	3	3	3	1
Training/Educ	2	2	1	2	3	3
Marketing	-	-	-	-	-	3
Promotion	3	3	3	3	2	3

Note that in all life cycle stages at least one stakeholder is assigned a participation level of “3”, indicating the this stakeholder should assume the lead responsibility for completion of the task. When more than one stakeholder is assigned a level of “3” responsibility is shared (perhaps with the creation of NCHRP-like panels or task forces.)

In general, the level of Federal participation is relatively high during early stages of traffic model development (Problem ID, etc.) and this role is primarily focused on coordination and coalition building. The group felt that the primary responsibility for problem identification, however, should lie with the state and local agencies: those with the traffic problems that need to be solved.

During the problem identification stage, all stakeholders must play some role in the process. Since the entire modeling process should be transportation needs-driven, participation of the States and Local agencies (and other transportation service operators and providers) is critical. It was felt that professional societies, academia, and private

developers, while important to the process, played a relatively minor role with respect to identifying modeling needs.

Development of the actual methodologies (e.g. Equations) and initial prototype development is the primary responsibility of the academics with the participation of the professional societies, Feds, and private developers.

As the technology becomes mature, refined and well-accepted, the responsibility for development of model extensions, user interfaces, and add-ons (including data transfer with programs) falls on the private developer.

Evaluation of the progress and success of the framework at all life cycle stages is the responsibility of all players involved.

Promotion of the underlying approach and problem-solving methodology is the responsibility of ALL stakeholders.

6. Desired Levels of Stakeholder Funding

The following table summarizes the thoughts of the group with respect to the levels of funding to be provided by each stakeholder in support the modeling development process. The contents of each cell summarize this relationship on a scale of 1 to 3, with 3 being the highest level of funding support and 1 being the lowest. A dash represents no participation.

Each row has at least one stakeholder with a 3 designation. This stakeholder is understood to be the lead player. In cases where more than one stakeholder has been assigned a “3”, these players share responsibility equally.

Development	Feds	State	Local	Prf.Soc	Acad	Pr Dev
Problem ID	2	3	3	2	1	1
Equations	3	2	1	-	2	-
Prototype	3	2	1	-	1	1
Extensions	2	2	1	-	1	3
User Interfaces	-	2	1	-	1	3
Add-Ons	-	1	1	-	-	3
Evaluation	3	3	3	1	1	1
Training/Education	1	2	1	1	2	3
Marketing	-	-	-	-	-	3
Promotion	2	2	1	1	2	3

The consensus of the group was that earlier (e.g. riskier) stages of the life cycle should be funded by the public sector, while the later, market-driven enhancements (e.g., User Interfaces, Add-on and Marketing) should be financed by the private developer.

Financing of the problem identification is the primary responsibility of the stakeholders with the problems (e.g., the State and Local agencies.)

Financing of the methodological development (e.g., Equations) stage, initial prototype stage, and the evaluation stage is the primary responsibility of the Feds. Later stages, including extensions, user interfaces, add-ons, training and education, and marketing is the primary responsibility of the developer of the individual products.

7. Important Considerations

The group also identified the following considerations in support of the proposed framework.

7.1. ITE / TRB/FHWA sponsored workshops

An important part of the problem identification stage, better communication between the practitioners and the researchers is critical to the overall success of the

framework. These workshops can be focused at a specific transportation issue (e.g., traffic control) or at broader needs (e.g., improved frameworks for the evaluation of policy decisions.)

The purpose of these workshops is to assess the current state of the practice, enumerate current limitations, and then prioritize the “real problems” as identified by the actual practitioners. These workshops form the basis of the “problem identification” stage

7.2. *Better interaction between users and developers*

This consideration highlights the importance of interaction between the model developer and the user. The consensus of the group was that a substantial gap exists between “perceived problems” and “real problems.”

The group felt that better communication between the researcher and the stakeholders at the equations stage would assist the researcher in maintaining focus on the actual needs of the user and prevent the researcher from becoming lost in the more theoretical satisfying aspects of the problem.

The group also felt that better communication between the software developer and the stakeholder will result in tools that are both useful and easy to use, reducing frustration and increasing desirability of modeling approaches in general. One approach to address this problem would be to specify in development RFP that tightly-coupled development teams (consisting of stakeholders and developers) are preferable.

7.3. Strong Validation / Evaluation Component

The group felt that in general, transportation professionals are skeptical of results generated from a “black box.” Better documentation will result in the increased transparency of traffic models, leading to a greater acceptance of their results. Well documented field evaluations, demonstrating the applicability of these approaches to “real” problems (rather than hypothetical case studies) will also increase confidence in model results and their applicability.

The group felt that greater emphasis should be placed on documenting the proper application of models towards solving “real” problems.

7.4. Better Education and Training

Better education and training of the practicing professional in the proper application of traffic models is critical to the widespread acceptance of these models. For educational aspects related to the approach of incorporating traffic models into decision making the group felt that the primary responsibility was assigned to the public sector. For training in the user of specific tools, the primary responsibility was assigned to the developer.

Financing of the education and training should be incorporated into the costs of the software.

7.5. Shortcomings

The group identified one major need: metrics on the learning and application of models. This metric represents the time required (in hours) to learn the use and

application of a traffic model. Metrics of this type may be used by managers to assess the labor resource requirements for application of a model, including the upfront “learning curve” time. The group felt that these measures would be invaluable to stakeholders that may be unfamiliar with the time requirements associated with model application.

8. Recommendations

The proposed framework represents a model that may be used to guide future discussions of the roles and responsibilities of the many stakeholders involved with traffic model development. This framework proved very useful in illuminating various issues during this group’s discussions.

In closing, the group developed several recommendations that may break the current implementation cycle and impact the environment in which traffic models are developed and applied:

- A process of continual reassessment should be initiated. This process should include representatives of all stakeholder groups and is used to identify “real problems” and modeling needs.
- A process of identifying and promoting “success stories” should be initiated. This task is critical to the life cycle stage of “promotion” and will help increase the confidence of practitioners in the modeling process.
- The group agreed that traffic development projects should be undertaken jointly between stakeholders (e.g., those with the problem) and developers (e.g., those with the solution.) This funding model would promote closer interaction between the groups and ensure that the final product actually solves the original problem.