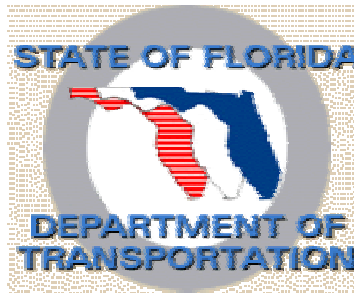


EVALUATION OF TRANSPORTATION MODELS FOR THE STATEWIDE MODEL TASK FORCE

Final Report

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Contract No. BC353, RPWO #41
2003

Acknowledgements

The project team is grateful to the members of the Statewide Model Task Force and the Project Steering Committee for providing technical guidance and advice throughout the course of this research project. The project team thanks the staff of the Systems Planning Office for their help in coordinating this research effort with other ongoing model development projects in the state. Technical and organizational support provided by Fennessy & Associates and Transportation Support Group are gratefully acknowledged. The project team thanks Citilabs, Caliper Corporation, Innovative Transportation Concepts (ITC), and INRO Consultants for participating in the model evaluation process.

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CHAPTER I

REPORT OF THE BLUE RIBBON PANEL

1. INTRODUCTION

Various transportation initiatives such as the Transportation Equity Act for the 21st Century (TEA-21) have brought new challenges to transportation planning. Emphasis on emerging issues such as community impact assessment and planning intermodal and freight transportation facilities have placed greater demands on travel demand forecasting models. Florida's explosive growth has further contributed to the need to maintain technologically and methodologically sophisticated transportation modeling tools.

At this time, all metropolitan areas in the State of Florida run models based on a uniform framework - the Florida Standard Urban Transportation Model Structure (FSUTMS). The Florida Statewide Model Task Force is a forum for state, local and private agency transportation planners to discuss ways to improve the model. At its Fall 2001 meeting, the task force approved a motion to form a blue-ribbon advisory panel of five to seven national experts as a means to evaluate the strengths and weaknesses of the current modeling framework and determine whether additional modeling methods and tools should be added to the FSUTMS toolbox.

After a nationwide search of modeling experts and open call for nominations, the Model Task Force identified a seven-member blue-ribbon panel representing a broad range of knowledge and experience in the development and application of different modeling tools. The panel members were asked to review the current status of transportation modeling in Florida and offer insights into the future directions of transportation modeling that the state should consider.

The blue ribbon panel was convened for a two-day meeting on April 2-3, 2002 at Metroplan Orlando. The panel was charged with assessing the future travel demand modeling needs in

Florida and making recommendations about the various modeling methods, tools, and options that are becoming available. The specific objectives of the blue ribbon panel were as follows:

- To advise the Model Task Force on emerging and new directions/approaches to transportation modeling
- To assess the current modeling process/procedures/methods used in Florida with respect to their strengths and limitations in meeting future transportation modeling needs and incorporating emerging and new directions/approaches
- To inform the Model Task Force about other available and emerging modeling tools and platforms with respect to their capabilities and suitability to meet Florida's future transportation modeling needs

This report summarizes the discussions and results of the blue ribbon panel meeting. As a next step, it is envisioned that a series of small group and full model task force discussions of the recommendations of the blue ribbon panel and the pros and cons of the available options will take place at the April 18, 2002 Florida Model Task Force meeting. Vendors of several major travel demand software packages are scheduled to make presentations and demonstrations of their modeling systems to familiarize Model Task Force members with various technology options and software development plans for meeting emerging challenges in modeling. An evaluation committee will be formed to assess the strengths and weaknesses of major transportation modeling software packages based on evaluation criteria recommended by the blue ribbon panel. The recommendations from the blue ribbon panel and the evaluation committee will help the Florida Model Task Force formulate strategies for improving Florida's future modeling process and responding to emerging paradigms in transportation modeling.

2. TRANSPORTATION MODELING IN FLORIDA

Transportation models in Florida have been characterized by their uniformity in structure and framework. FSUTMS represents a uniform modeling structure that is applied in all metropolitan areas of the state. A few key aspects in which uniformity in FSUTMS may be seen include:

- **Software Engine:** FSUTMS currently uses a TRANPLAN software engine.
- **Database Names:** Input and output databases have common naming schemes.
- **Database Formats:** Input and output databases have common formats and structures.
- **Networks:** Model networks are coded and represented in a uniform manner.

The uniformity in transportation modeling in the state has served several important purposes. These include, but are not necessarily limited to:

- ***Training and Support:*** As the entire state utilizes a common modeling system, the state has been able to provide very strong technical support and training on a statewide basis. The high level of training and support has proven crucial to the development and application of transportation models in the state.
- ***Technology Transfer:*** The uniformity in transportation modeling has facilitated a high level of technology transfer among and within agencies and among and within the consulting industry. Agencies and consulting firms are able to discuss and exchange information on modeling and help each other enhance the model system.
- ***Data Sharing:*** Because of the common modeling structure and database formats, FSUTMS has allowed the exchange of data and model parameters among agencies. This has helped smaller urban areas that may not have the resources to collect data on their own.
- ***Credibility:*** The adoption of a uniform modeling structure by the entire state has provided strong credibility to the modeling process and has served the state and various agencies well in litigation.
- ***Universal Applicability:*** The strong support and technical training program coupled with a strong technology transfer capability has made it possible for small MPO's and consulting firms to run the model and use it for various planning studies and applications. Even the smallest MPO in the state with a planning staff of just one or two individuals is able to run and maintain the model.
- ***Best Practice:*** Transportation model development and application in the state of Florida is based on best available practice and the ability to provide support and train users in the use of best practice methods. In general, model developments in the state have not been geared towards experimenting with new theoretical approaches that are just beginning to emerge on the horizon and have not yet matured and been tested widely.

The modeling community in the state considers the TRANPLAN-based FSUTMS to have served the state very well for over a decade. As the state moves forward in tackling emerging

planning issues, answering new policy questions, and testing new transportation solutions, the model task force believes that the time has come to assess the modeling needs of the state and identify the best set of software packages that should be included in the FSUTMS toolbox. In addition to emerging transportation planning issues and policy questions, other considerations that motivate the examination of alternative transportation modeling platforms include:

- ***Methodological and Technological Developments:*** In the recent past, there have been several methodological and statistical advances in travel demand modeling. What techniques and statistical methods should the state incorporate into FSUTMS? Looking five, ten, or fifteen years into the future, what is the set of methodological and technological/software capabilities that the state should have in its suite of tools?

In this context, it should be noted that the extent to which methodological and technological issues contribute to model system performance vis-à-vis input data accuracy and quality has not yet been determined. The state has not conducted rigorous studies to isolate the effects of input data errors on model performance and overall model forecast errors. Thus, while methodological and technological developments may certainly enhance model performance in the state, the quality of the input data and its forecasts should not be overlooked. Methodological and technological developments may also help in improving the quality of the input data that feeds transportation models in the state.

- ***Maintain and Further Enhance Credibility:*** As models are called upon to answer new policy questions and tackle emerging planning issues, there is a need to ensure that models used in the state are credible and would stand up to question in a court of law. The assessment of transportation modeling tools in Florida would help maintain and further enhance the credibility of transportation modeling in the state.
- ***Evolution in Industry:*** There has been a natural evolution in the transportation modeling software industry. New software packages have been developed, other software packages have matured and been enhanced over the past decade, and others are potentially in the process of being phased out. There is considerable uncertainty regarding the continuation of a high level of support and enhancement of TRANPLAN.
- ***Levels of Accuracy and Spatial Aggregation:*** Models are increasingly being used to perform analysis at smaller and smaller levels of geography including subareas,

corridors, and intersections. The assessment will help determine whether microsimulation approaches or other emerging methods and tools need to be added to the FSUTMS toolbox.

In this context, it is important to realize that modeling in Florida has been characterized by strong technical support and user training in methods and tools that constitute good practice. In the spirit of continuous improvement, the statewide model task force is now taking a broader look at the complete modeling suite available to modelers in the state. Some of the questions that the model task force desires to have answered prior to making a decision about new modeling platforms to be incorporated into FSUTMS include:

- What transportation modeling software or platform should serve as the main engine of FSUTMS?
- What additional tools or modeling software should be included and interfaced with the FSUTMS engine (e.g., GIS-TM, ULAM, IDAS, STEAM, transit accessibility and ridership forecasting models, etc.)?

Answers to these and other questions about model development and application in the state of Florida will provide the information necessary to set future directions for modeling in the state.

3. FRAMEWORK OF PANEL DISCUSSION

The blue ribbon panel set out by establishing a framework that would help organize and guide the panel deliberations. Within the context of a two day discussion, the panel felt that it would not be able to identify or recommend one or more specific software platforms for incorporation into FSUTMS. In the absence of a comprehensive study of the current specifications and capabilities of FSUTMS and the latest developments in the transportation modeling software industry, the panel considered it impossible to perform a rigorous evaluation of all software packages with respect to various criteria and identify one or more packages for adoption. In addition, the panel did not have sufficient information to identify the specific criteria that the state considered important in its software selection process. The panel felt that it would be able to provide guidance with respect to the methods, criteria, and issues to be considered in evaluating alternative options; armed with such guidance, the model task force may then

undertake a full-scale comprehensive evaluation of alternative platforms before deciding the future of transportation modeling in the state.

The panel felt that a comprehensive evaluation of alternative modeling platforms should be aimed at answering the following four questions:

1. What are the current and future specifications (methods, parameters, software functionality, etc.) of the different modeling options?
2. What are the criteria to be used in evaluating alternative options?
3. Which of the criteria are important for the state and help distinguish among the options?
4. How do the alternative options rate on the various criteria identified under Question 3?

The panel felt that answers to these four questions would help the model task force identify one or more software platforms that best meet the needs of the state.

In this context, the discussion of the blue ribbon panel was centered around four broad themes as follows:

1. ***Current and Emerging Issues:*** This category is geared towards setting the stage for determining future directions for transportation modeling in Florida. Current and emerging issues in transportation planning and modeling play a critical role in defining the methodologies and capabilities that need to be incorporated into transportation models. Therefore, the panel felt that it would be useful to first identify the current and emerging issues in transportation planning. Within this broad category, the panel also included the identification of transportation policies, strategies, and solutions as a subtask. Transportation models need to be able to respond to and model the impacts of alternative transportation strategies, policies, and solutions as planners address current and emerging issues in transportation planning and modeling.
2. ***Modeling Directions:*** This category deals with an array of items that include modeling paradigms, modeling methodologies, spatial and temporal aggregation, and model specification and definition. In recent years, there have been considerable developments in the travel demand modeling arena with respect to modeling structures, paradigms, and specifications. The blue ribbon panel utilized this category to help identify the variety of developments occurring in the modeling arena and to provide

guidance on the strengths and weaknesses of alternative methods and criteria that should be applied in choosing among them.

3. ***Modeling Software Capabilities and Functionality.*** In addition to methodological considerations, there are many software-related capabilities and functionality that are crucial to the selection of modeling platforms for FSUTMS. Under this category, the blue ribbon panel identified the myriad model features, characteristics, and software capabilities that need to be considered in choosing a transportation modeling platform. The blue ribbon panel also utilized this opportunity to identify and define examples of options or platform alternatives that may be considered by the model task force.
4. ***Administrative and Management Aspects:*** Finally, the blue ribbon panel addressed the administrative and management issues related to adopting a platform to support transportation modeling needs in the state. Various administrative and management aspects such as training and technical support, vendor viability, and cost fall under this category. The blue ribbon panel recognized that administrative and management issues often play a very important role in determining the appropriate modeling software platform.

The remainder of this report summarizes the deliberations and recommendations of the blue ribbon panel within each of the four topic areas.

4. CURRENT AND EMERGING ISSUES IN TRANSPORTATION PLANNING

The blue ribbon panel recognized that there are numerous planning issues that drive the development and enhancement of transportation models. As such, the panel did not work on developing a comprehensive and exhaustive list of issues that transportation planners are confronting in the current context and might confront in the future. Instead, the panel worked on developing a list of issues that represent the diversity of application contexts in which models are likely to be applied today and in the future.

The key planning issues and contexts identified by the blue ribbon panel may be summarized as follows:

1. ***Capacity Deficiencies and Congestion:*** Addressing capacity deficiencies in the transportation system and solving congestion and bottlenecks in transportation networks

continue to be major issues addressed by transportation planners. Models should be able to identify capacity deficiencies and congestion points in the system and model the potential effects of alternative policy actions and solution strategies that might be considered.

2. ***Transportation – Land Use Interaction:*** The interactions between land use and transportation and the feedback loops that characterize the transportation – land development cycle are important components of the urban transportation planning process. Models should be able to reflect the feedback relationships between transportation and land use as they might be used to gauge the effects of various land use and smart growth initiatives.
3. ***Economic Development Impacts of Transportation:*** As transportation investments are increasingly seen as important ingredients driving economic development, planners are being expected to be able to model the economic impacts of alternative transportation plans. It is likely that transportation models will be increasingly asked to address questions of economic impacts in the future.
4. ***Freight Mobility Strategies:*** Recent federal and state initiatives have greatly emphasized the need for enhancing freight and truck mobility through the development of appropriate freight mobility strategies. While freight mobility is often associated with economic development, freight mobility also has far reaching safety and system performance implications. Models will be increasingly expected to help evaluate alternative freight mobility options.
5. ***Air Quality:*** It is conceivable that Florida, with its high growth rates, may have some non-attainment areas in the not-so-distant future. The models should be able to adequately address air quality impacts of alternative transportation plans. The EPA guidelines do call for the use of feedback loops in transportation models and the use of time of day models to help better address air quality impacts of transportation. The transportation model incorporated in FSUTMS should be able to provide the information needed by air quality models such as MOBILE6.
6. ***System Preservation, Maintenance, and Operations:*** Increasing attention is being paid to system preservation and maintenance including operational enhancements. Ramp metering, pavement condition monitoring, and other applications that are aimed

at system preservation and operations may call for enhanced modeling capabilities including greater GIS functionality and microscopic traffic flow analysis.

7. **Safety:** Even though safety has traditionally been the domain of traffic engineers, it is increasingly being considered in transportation planning processes. A new NCHRP project on the incorporation of safety into the long range transportation planning process is about to be initiated. Models may be expected to be able to estimate the expected number of accidents and incidents by functional classification and geographical location. Models may also be expected to analyze the impacts of alternative transportation plans on safety.
8. **Security and Emergency Evacuations:** With the recent emphasis on transportation security, the question arises as to whether models are equipped to deal with and respond to transportation emergency situations. Such situations may include attacks that compromise the transportation system, hurricanes, earthquakes, floods, and other catastrophic events that often call for mass evacuations or shut downs. Planners are likely to be asked to model the impacts of alternative strategies in response to such emergency situations.
9. **Equity:** While environmental justice is a term that is being used widely in the transportation planning profession, it continues to be a term that is not very well-defined. Moreover, there is no law that requires it. The panel felt that various issues related to environmental justice, community impacts, and social considerations may be broadly classified under the term of equity. Planners need to be concerned with who is affected by a transportation action, how many of each demographic or social group are affected, and what might be done to mitigate any adverse impacts. Models may be called upon to answer such questions.
10. **Resource Allocation and Project Selection:** In a world of multimodal transportation systems, balanced transportation system development, and project trade-offs, it is imperative that models provide the information needed to make key resource allocation and project selection decisions. How is money allocated to address the various issues identified in this section? Models should be able to adequately evaluate alternative solutions and strategies and help decision makers allocate resources in the best way possible. This is probably one of the most important bottomline-type issues that needs to be considered in model development and application. How can the model

be developed and applied such that the information it provides translates into effective resource allocation decisions.

In this section, the panel attempted to identify a diverse set of transportation planning issues that planners are confronting and will likely face in the future. There are many different strategies and solutions that can be used to address these issues. Capacity enhancements, transportation policy actions, transportation demand management strategies, operational improvements, and transportation control measures constitute a wide range of solutions that planners can deploy. The panel felt that it is important to identify the many strategies and policy actions whose impacts models will be expected to measure and quantify.

5. TRANSPORTATION POLICIES AND SOLUTIONS/STRATEGIES

The panel recognized that there are different ways in which one can approach the task of developing modeling recommendations. In one approach, one can identify all of the transportation policies, strategies, and solutions that the model should be able to evaluate and then develop recommendations for modeling directions with a view towards making sure that the modeling methodology and tools can do so. Another approach is one where it is simply stated that models are intended to simulate travel behavior as well as possible and in doing so should be able to respond to the large variety of policy actions and solution strategies that planners might be interested in analyzing. While the latter approach is conceptually appealing, it does not necessarily ensure a desired outcome because one has to make sure that variables representing the effects or characteristics of the solution strategy are included in the models. The panel attempted to utilize both approaches in its deliberations by both considering the many policies and solution strategies that planners might be interested in analyzing and the ability of the model system to simulate behavioral patterns. As it is difficult to predict the future, the panel felt that it should offer a list of ways by which issues identified in the previous section may be addressed. The panel believed that the model task force desired a model set that is sensitive to the issues and the solution strategies that might be deployed to address them and therefore considered it important to identify those that can and can not be accommodated in current modeling tools. The purpose of some of the new tools that are being developed is to be able to address every issue and model every solution strategy by looking at the decision making process of every individual in the population.

This section summarizes the deliberations and considerations of the blue ribbon panel with respect to the identification of transportation policies and solution strategies that might be of interest to transportation planners in the state. Once again, the list is not necessarily intended to be comprehensive, but representative of the variety of considerations that go into developing modeling directions.

1. ***Highway-Oriented Policies:*** Highway-oriented policies include those strategies that serve different purposes including bringing about mode, time of day, or route/destination shifts in travel behavior and operational improvements to the highway system. The different strategies that come under this category include:
 - a. *Capacity increases:* Adding capacity to the highway system in the form of new highways or new lanes on existing highways continues to be a major strategy for tackling congestion.
 - b. *Maintenance of Traffic:* Maintenance of traffic is an important issue with respect to the number of lanes available and traffic diversion plans under different conditions.
 - c. *ITS:* Intelligent transportation systems include a range of technology solutions and deployments that are aimed at enhancing traffic flow and providing information to travelers. IDAS is a new planning tool that is aimed at being able to perform planning analysis and evaluation of alternative ITS deployments.
 - d. *Signalization:* Signalization enhancements constitute operational improvements that models may be expected to tackle; this calls for more detailed network representation at the level of intersection signalization characteristics.
 - e. *Pricing strategies:* There are a range of pricing strategies including parking pricing, congestion pricing, and time of day pricing that are intended to alter behavioral patterns. Models should be able to simulate the effects of pricing policies.
 - f. *Incident management:* The panel recognized that 50 percent of delay on all freeways is due to non-recurring incidents. Incident management techniques are aimed at reducing the delay due to such incidents. Models should be able to model the impacts of alternative incident management plans. While this may not

be so critical from a 20-year forecasting perspective (one can not hope to forecast incidents 20 years into the future), it may be important from a real-time simulation standpoint.

- g. *Construction management*: During highway construction, lanes may be shut down and the shut down may vary by time of day. Models should be able to model impacts of lane shutdowns and traffic diversion that may result from such shutdowns. In this context, dynamic traffic assignment techniques that are intended to potentially capture the real-time routing of traffic in response to traffic and lane conditions are worthy of attention.
2. ***Transit-Oriented Policies***: Transit-oriented policies include a range of options that bring about changes to transit level of service. Policy actions include:
 - a. *Fares/Pricing*: As in the highway context, transit fares and pricing strategies continue to be an important ingredient in transit planning. Such strategies include not only the actual fare paid (dollar cost) by travelers but also fare options (such as multiday passes, unlimited transfer, etc.).
 - b. *Service changes*: Transit service changes include hours of service, frequency and headway, route and stop locations, route and stop amenities, on-board amenities (bikes on buses), and other service characteristics that might affect travel patterns.
 - c. *HOV changes*: High occupancy vehicle strategies may be considered both a transit and highway strategy. HOV has already been incorporated into many models currently in place; may need to consider further enhancements as HOV strategies become more varied (e.g., HOT lanes).
 - d. *LRT/BRT initiatives*: Light rail transit and bus rapid transit initiatives are being included in increasing numbers of long range transportation plans. Models should be able to evaluate the performance and impacts of these alternative transit technologies.
3. ***Demand Spreading Policies***: There are several travel demand management strategies and transportation control measures that are aimed at spreading (or even eliminating) travel demand. In addition to pricing strategies (already mentioned under highway-oriented strategies), other demand spreading policy actions include:

- a. *Flex-time*: Flextime includes the range of options aimed at changing the time of travel, particularly for the commute trip (that is more peak-period oriented). Flexible work hours, flexible store hours, and other time of day flexibility that can greatly affect travel patterns may be worthy of capturing in models.
- b. *Parking policies*: Many areas are considering parking restrictions, parking pricing strategies, and other parking oriented measures that may affect travel patterns.
- c. *Carpooling strategies*: Carpooling incentives and strategies are aimed at bringing about a mode shift; however, this mode shift may also affect time of day choice, destination choice, route choice, etc. Models should be able to reflect the host of changes to travel patterns that might results from carpool incentives.
- d. *Technology and E-Commerce*: Technology and electronic revolution has brought about major changes in the way people do business and pursue their lives. Telecommuting, teleshopping, teleworking, etc. are manifestations of the technology revolution. Models should be responsive to technology effects.

In this context, it is important to note that travel demand or behavioral patterns may be affected in numerous ways as a result of these strategies. Trip chaining patterns may be altered; thus one may conjecture that tour based approaches that attempt to represent travel patterns at the level of the trip chain are more able to respond to behavior-altering policies. Similarly, one might consider the effect of day-shifting (beyond simple time of day shifting which occurs in the same day). In day-shifting, one might move an activity/trip from a weekday to a weekend day as a result of a demand altering policy. The question arises as to how a daily model of demand aimed at capturing the typical weekday can represent day-shifting effects. Such methodological issues, however, may not play a big role from a software platform decision standpoint.

- 4. *Land Use Strategies*: There are a host of land use policies and strategies that are of interest to transportation planners in today's context of integrated land use – transportation planning.
 - a. *Transit oriented developments*: Transit oriented developments, pedestrian oriented developments, and neo-traditional land developments are new land use patterns that models need to be able to represent.

- b. *Mixed land use strategies*: New land development patterns are emphasizing mixed land development patterns. Models should be able to reflect the effects of such mixed land use strategies where people may begin to walk and conduct more short intra-zonal trips.
 - c. *Zoning regulations*: Models are expected to be able to assess the impact of zoning regulations on land patterns and travel patterns.
 - d. *Non-motorized travel initiatives*: Newer land use strategies call for the enhancement of pedestrian and bike facilities and the consideration of pedestrian-friendliness factors in modeling travel demand.
 - e. *DRI and concurrency*: In Florida, development of regional impacts (DRI) studies and concurrency continue to play a major role in shaping land use and transportation impacts of land development patterns. It should be possible to apply models at the level of individual land development projects and assess projects in the context of concurrency requirements.
5. *Other Policies*: There are other multimodal policies that may have a bearing on modeling methodology and selection. These include, but are not limited to:
- a. *Truck policies*: Many states and urban areas (including Florida) are considering alternative truck mobility options including truck only lanes, truck restrictions by time of day, and other strategies geared towards enhanced truck mobility. Models should be able to assess the impacts of alternative truck mobility strategies.
 - b. *Intermodal connectivity*: Major emphasis is being placed on enhancing intermodal connectivity at airports, rail terminals, truck terminals, seaports, and other intermodal facilities.

What are the modeling directions in which the state should proceed to model the travel behavior impacts of these and other transportation policy actions and be able to assess their effects on the transportation system? The blue ribbon panel attempted to address this question by identifying and debating alternative modeling directions.

6. MODELING DIRECTIONS

The panel viewed modeling directions from three perspectives. In the first perspective, termed “strategic”, the panel addressed conceptual paradigm shifts that are occurring in the travel modeling arena. In the second perspective, termed “tactical”, the panel addressed practice-oriented items that define the model structure and features. In the third perspective, termed “details”, the panel examined model specification type issues, i.e., the “nuts-and-bolts” of the models. Each of these perspectives is briefly described in the sections below.

6.1 Strategic Directions

Strategic directions refer to conceptual paradigm shifts that are occurring in the transportation modeling arena. Some of the strategic questions addressed by the panel include:

1. ***Four-step vs. Activity-based Modeling:*** The major paradigm shift towards activity based modeling is contributing to the increasing interest in the adoption of tour based models. Portland, San Francisco County, New Hampshire, and most recently Columbus, Ohio have moved towards the development and implementation of tour-based models that move away from the traditional four-step trip-based modeling approach. However, the panel felt that these approaches may not yet be ready for full-scale adoption in Florida. There is no software or platform in which these methods and approaches have been implemented in a readily usable form. These methods call for the development of customized software and code, possibly within an existing package such as EMME/2 or TransCAD, for implementation. Thus it would not be possible to evaluate alternative software platforms based on their activity based modeling methodology because none of them have such a model embedded yet. However, the panel felt that the state should consider being in a position to possibly conduct a demonstration project for the new activity-based or tour-based modeling approaches and be mindful of data collection opportunities that may help pave the way for developing and implementing such models in a more long-term model enhancement program. Software platforms should be examined with respect to their ability to incorporate customized code and input-output routines in the context of developing and calibrating new modeling paradigms in the state. The state should consider the evolutionary path that may best facilitate the transition to new activity and tour-based modeling approaches. It is not necessary that the entire model has to be switched over at once; one can just modify one step of the

modeling process (say, mode choice) into an activity based or tour based framework. Thus, the transition can be incremental and the evolution can be gradual.

2. ***Trips vs. Tours:*** A few panel members felt that the recent move towards tour-based modeling suggests that many models will become tour-based models in about 10 years. There was a variety of opinions among panel members with regard to the move towards activity-based and tour-based approaches and therefore, the panel agreed that flexibility (to accommodate emerging approaches) is an important consideration in software selection. However, as in the previous item, it is not really possible to evaluate alternative software platforms based on their ability to handle tours. There are no packages that perform tour-based analysis as a standard option; the user must develop customized code and implement within the package. As mentioned previously, the state should be mindful of this trend when it considers alternative modeling platforms. The use of tours as a basis for analysis allows one to better represent inter-dependency among trips, for example, mode choice is done at the level of the tour as opposed to the individual trip.
3. ***Aggregate Application vs. Sample Enumeration (Market vs. Individuals):*** Traditionally, models have been applied at aggregate or market levels. In recent times, there has been increasing attention paid to the disaggregate application of models where pseudo-sample enumeration (i.e., microsimulation) techniques may be applied. In such approaches, models are applied at the level of the individual person and then aggregated up to desired markets. Once again, this is not likely to be a criterion for software selection as this is not a standard capability in any software package yet (except TRANSIMS perhaps); however, the state should be mindful of this emerging trend in model application.
4. ***Temporal Considerations:*** There are different temporal considerations in model development and application. What is the temporal resolution that needs to be adopted for models? Trip tables may be derived by time of day, but the trips may still be assigned in a static assignment. Dynamic assignment methods involve assigning trips while considering the dynamic nature of the network; there is considerable variability in the network and therefore paths continuously change and trips are constantly re-routed to reflect new conditions on the network. Finally, real-time traffic microsimulations follow the movements of individual vehicles along a continuous time axis; such models

are often referred to as microscopic traffic models as opposed to traditional trip table based macroscopic traffic models. There is a move towards mesoscopic traffic flow models where individual vehicles are tracked in time steps, thus providing a middle ground between macroscopic and microscopic models. The ability to implement or interface with more real-time traffic microsimulation approaches should be considered as a possible criterion for choosing a software platform. However, validation of mesoscopic traffic microsimulation models may be an issue.

5. **TRANSIMS:** The adoption of TRANSIMS would involve buying into the total package – both software and modeling approach. The business plan involves the user interacting with a front end graphical interface to provide necessary input data while the model itself is run at a central location. At this time, it is premature to make any decision regarding TRANSIMS as there has not yet been a full-scale application of the model. The Portland effort is still ongoing and the state can take a “wait-and-see” approach with respect to TRANSIMS. One might however consider separating out the back end of TRANSIMS (namely, the traffic microsimulation module) to do a real-time simulation at a regional scale. It is difficult to advise the state on whether to prepare for TRANSIMS because it is not yet certain whether TRANSIMS is a viable option. A few panel members felt that the state should consider TRANSIMS as an option only after a large and successful track record of TRANSIMS implementation has been developed around the country.
6. **Variability of Behavior and Traits:** There is considerable variation in human behavior and traits both between persons and within persons over time. There is variability in trip characteristics, variability in traffic volumes from one day to the next, and so on. How does one account for that variability? The random variation in behavior could best be accomplished through probabilistic processes where different answers are obtained every time a simulation run is done using a different random number seed. It is not certain whether this will be received well as people like to see the same answer every time the model is run. The ability to reflect random variability in behavior may be important, but is not likely to be a consideration in software platform selection.
7. **Household vs. Person:** Different models use different behavioral units for modeling travel behavior. Most models use the household or person as the unit of analysis for trip generation and then trips as the unit of analysis for distribution and mode split. In its

new tour-based models, Portland is using the person as the basis for modeling travel at all three stages of the process. Once again, this strategic issue does not really distinguish between alternative software platforms. All software platforms can equally accommodate (or not accommodate) household or person level travel modeling.

8. ***Freight Modeling Considerations:*** Modeling freight movements is gaining increasing importance all over the country. Regardless of whether one adopts “truck” based freight models or “commodity” based freight models, there is a need to be able to perform “multi-class traffic assignment” where mixed traffic can be loaded simultaneously onto the network. The ability to perform multi-class assignment is an important consideration in model software selection.
9. ***Integrated Transportation – Land Use Model:*** The feedback relationships between land use and transportation are important in the current planning context and are likely to remain important in the foreseeable future. It is critical to ensure that the land use and transportation models used in the state can be linked together to facilitate a feedback loop between them. The use and application of integrated land use – transportation models is complex; most such models are location specific and difficult to validate. As long as the software chosen by the state can accommodate feedback loops with the land use model used in the state, this issue will be adequately addressed.
10. ***Induced Travel:*** If induced travel is an issue, then one would need the model system to accommodate a feedback loop such that network accessibility and level of service measures feed back into the trip generation step of the process. In this way, the number of trip productions/attractions can be made sensitive to changes in transportation system performance. The panel felt that induced travel is not a significant enough issue to warrant major shifts in modeling paradigms. Induced travel, if present at all, is very small and pales in comparison to the destination, mode, and time of day shifts brought about by capacity expansions.

In summary, there are several strategic modeling directions that the state should consider as it moves forward, particularly from a long term model development perspective. However, many of these strategic considerations do not necessarily distinguish one software platform from another. These are considerations that the state should keep in mind as networks are developed, new data are collected, and special scripts and routines are written. Modeling

platform chosen in the state should at least be capable of accommodating specialized modules in a flexible framework.

6.2 Tactical Directions

Tactical directions address various dimensions that define the model system. Under this category, the panel considered the following items:

1. ***Spatial Aggregation:*** Spatial aggregation refers to the geographical resolution used for modeling travel. Whether one is operating at the zonal level or the individual address level, it is important to ensure that the model has virtually no limits on the number of zones or entities that can be modeled. Similarly, with respect to network resolution, it is desirable to have the model accommodate any number of links without running into software and hardware limitations. As the number of zones and/or links increases, so do the sizes of trip tables, network files, and matrices. It is important to consider the data compression and handling capabilities of the software when making a choice among alternative options.
2. ***Market Segments:*** What are the market segments for which the model is able to provide information? Variables such as income, car ownership, etc. that may define market segments of interest should be available in the model and the model itself should be able to provide information for individual market segments. Again, this may not necessarily be a software selection issue; it is concerned more with model definition.
3. ***Model Forms:*** The software chosen by the state should be flexible enough to accommodate all the different model forms that may be used in various steps of the modeling process. For example, in trip generation, the software should be able to accommodate both regression and cross-classification based forms. In trip distribution, the software should be able to accommodate both logit-based destination choice models and gravity models. In mode choice, the model should accommodate multinomial logit and nested logit forms. The software should be flexible to accommodate customized scripts in each of these steps both in the present and future.
4. ***Trip Purposes, Modal Alternatives, and Time of Day Periods:*** The number of trip purposes, modal alternatives, and time of day blocks used in the modeling process may vary from area to area depending on the characteristics of the region. In general, the trend has been towards increasing the number of trip purposes, modal alternatives, and

times of day for modeling travel. The software chosen by the state should not have any limits with respect to the number of trip purposes, modal alternatives, and time of day periods that may be used. In addition, data compression and handling capabilities become an issue here again because of the potential proliferation of trip tables and matrices as additional purposes and times of day are used.

5. ***Auto Ownership Model:*** Forecasting auto ownership is an important component of travel demand modeling as auto ownership is one of the drivers of trip generation. Currently, the state does not have an auto ownership forecasting model within FSUTMS. It would be preferable to have an auto ownership forecasting model implemented within FSUTMS. This is a relatively simple improvement that can yield significant gains. Auto ownership modeling is a consideration in software selection only to the extent that alternative options provide the flexibility to incorporate customized auto ownership models.
6. ***Model Feedback:*** Model feedback is critical to ensure that, at a minimum, all steps in the modeling process are using the same speeds for modeling travel. It makes no sense to have the trip distribution, mode choice, and traffic assignment steps using different speeds (and therefore travel times) for modeling travel. Even though it has been discussed in the modeling arena for many years, feedback has not been implemented on a widespread basis. Model feedback should ensure that there is a feedback loop from assignment to the trip distribution step and the feedback loop should continue until there is convergence, i.e., no further change in travel times. Thus, trip distribution, modal choice, and traffic assignment would be based on the same speeds/travel times. It is not necessary to incorporate feedback into the trip generation step as induced travel is not really an issue. There are different methods for performing feedback including the method of successive averages and Evans algorithm. Preliminary information indicates that there are several software packages which incorporate feedback mechanisms. The panel recommends that model feedback be included as one of the criteria for model selection.
7. ***Speed Issues:*** Appropriate speeds should be used at all steps of the modeling process. The incorporation of feedback in the transportation modeling process will help accomplish this. In addition, the state should examine the speed-flow curves that are currently used in the model and ensure that they are consistent with traffic

characteristics in the real world. This is not necessarily a software related issue, but a tactical issue to ensure that the model adopted by the state reflects current best practice in speed-flow relationships.

8. ***Peak Spreading and Time of Day Modeling:*** Time of day modeling provides a mechanism to account for variations among different times of the day with respect to travel characteristics and transportation system characteristics. Most time of day models continue to use fixed factor approaches where time of day factors are applied to trip tables to obtain time of day based trip tables. While this is a good first step, it does not allow one to account for peak spreading. Time of day choice models that include level of service variables as explanatory variables may be utilized to account for peak spreading effects (proportion of travel that occurs in peak period depends on level of service in peak period). Software chosen by the state should be able to accommodate time of day choice modeling routines that would allow the modeling of peak spreading phenomena. Software should be examined to see whether internal capabilities exist to handle peak spreading as part of the assignment process.

In summary, tactical considerations include items that help define the scope, form, and level of detail of the travel demand model. Several of these items are critical to the software selection process and the state should include them as part of an evaluation scheme.

6.3 Detail-Oriented Modeling Enhancements

Detail-oriented modeling enhancements are concerned with the actual “nuts-and-bolts” of the model. Items worthy of consideration under this category include:

1. ***Network Details:*** The ability of the model to incorporate significant network detail is an important consideration in software selection. Some of the items within this category include:
 - a. ***Network completeness:*** This refers to the inclusiveness of the network. Does the network include all local streets, turn lanes, and so on? Can the software handle such completeness in network representation? Are there any limits on the number of links that can be utilized in the network?
 - b. ***Network control:*** Intersection control, signal timing patterns, and other intersection penalties are important components of a network as capacity

limitations are often associated with nodes (as opposed to links). The extent to which the software can accommodate intersection control information and the influence of intersection control on traffic flow is an important consideration in software choice. Some software platforms such as QRS II indicate that they do accommodate intersection control in the network representation. The ability to calculate delay and perform other internal calculations is also an important consideration in software platform choice.

- c. *Network Shape and GIS Functionality*: As GIS technology becomes increasingly advanced, it would be preferable to be able to retain the shape of the network components without having to use stick networks. The ability of a transportation modeling software to retain the accurate and realistic shape of the network in space is an important criterion for transportation model selection.
2. *External Travel*: The current plan in the state to tie all urban and regional models to the new statewide model is a worthwhile effort. Estimation of external trips continues to be a difficult issue for many model applications. While this may not necessarily be a software selection issue, the state should continuously strive to enhance the external travel estimation process in FSUTMS.
3. *Parameters – Variables – Coefficients*: The state should continuously strive to improve the model specification in FSUTMS. Model parameters, explanatory variables, and model coefficients used in FSUTMS need to be updated and enhanced over time. The ease with which alternative software options allow such periodic updates and enhancements and potential customization/flexibility (within individual areas in the state) are important criteria for selecting software.

7. TRANSPORTATION MODEL FUNCTIONALITY AND SOFTWARE SYSTEM CRITERIA

The panel spent considerable time identifying the key functional aspects that should be incorporated in Florida's transportation models as the state moves forward in identifying future directions for transportation modeling. Many of these functional aspects can be directly translated into criteria that can be used to evaluate alternative software options and make a decision regarding the tools that should be included in FSUTMS. However, it should be noted that many of the functional aspects identified here are particularly relevant in the context of

current modeling practice. While many of these aspects are also likely to be applicable in the context of emerging modeling methodologies (e.g., activity based microsimulation methods), there may be additional considerations that are specifically applicable to emerging methodologies. However, in the absence of complete information about the implementation aspects of such emerging methodologies, the panel could not develop a comprehensive list of considerations for these methodologies. As noted earlier, the panel recommends that the state keep abreast of the latest methodologies in travel demand modeling and identify additional considerations as they become known. This would also help make any transition as smooth as possible.

There are many considerations when selecting a software platform for transportation modeling. The important criteria identified by the panel include (the criteria are not listed in any particular order):

1. ***Interface with Other Software:*** It would be preferable to have a transportation modeling software that has interfaces to database management and spreadsheet packages and other planning/modeling and GIS software readily available.
2. ***Data Storage and Input-Output Routines:*** Data handling capabilities are extremely crucial, particularly in an era of greater disaggregation in spatial and temporal dimensions. Similarly, the software input-output procedures should readily interface with user-defined and custom developed software and scripts. Such features may help make the availability of software source code less critical in the future.
3. ***Processing Speed:*** As transportation models become increasingly disaggregate and complex, the processing speed of the software is an important consideration.
4. ***Highway and Transit Path Builders:*** Highway and transit path building tend to be time- and computationally intensive processes. The algorithmic efficiency with which alternative software build highway and transit paths should be examined.
5. ***GIS and Spatial Analysis Capabilities:*** Transportation data and networks are increasingly becoming available and stored in GIS formats. The GIS functionality available in the transportation modeling software is an important consideration in model selection. The spatial analysis capabilities (for example, transit stop and route buffering) of the software should also be examined. The ability to represent data

related to non-traditional modes such as bike and pedestrian paths is another possible consideration.

6. **Network Editor:** Network editing is a major part of transportation modeling. The ease and speed of network editing is directly related to the ease and speed with which alternative scenario analysis can be accomplished. The quality of the network editing capabilities should be examined carefully.
7. **Report Generation:** The reports generated by the model should be clear, useful, and easy to understand. The quality of the reports generated by the model should be another criterion for consideration.
8. **Wrapper:** The transportation modeling software package should come with a high-quality wrapper and graphical user interface. The panel suggests that the model task force examine the software wrapper (e.g., how are different components of the model tied together, how are different files formatted and named) and graphical user interface prior to making any decision.
9. **Customization Scripts:** In Florida, many areas run customized scripts that specifically meet their planning needs. Software should be evaluated with respect to their ability to accommodate customized scripts easily and in a flexible environment.
10. **Matrix and Link Calculators:** Quite often, one needs to perform matrix manipulations, matrix calculations (transpose, multiplication, addition, etc.), and link calculations as part of the modeling process. Software should be evaluated with respect to the extent to which users can perform such calculations within the modeling process.
11. **Component Applications:** Different transportation modeling software incorporate different component applications. The software can be evaluated with respect to the different component applications that they offer in the context of those applications that may be of greatest interest to the state.
12. **Operating System:** What are the operating systems on which the software will run efficiently? The state should identify the operating systems on which the software should be able to function. Alternative software packages should be evaluated with respect to their ability to run on alternative operating system platforms.
13. **Display:** Modeling systems should provide data, maps, displays, and other information that best facilitate/feed project evaluation and selection processes in the state,

particularly for decision makers. This is an important consideration and should be included as a potential criterion in the decision making process.

14. ***Tie into other Florida Models:*** There are several other models and tools being developed in the state including GIS-TM, ULAM, TLOS, and so on. The ability of the software to be tied into these and other pertinent Florida planning models of interest to the model task force should be a criterion for selecting transportation modeling software for the state.

As mentioned earlier, these criteria are directly applicable to models that are currently in practice. Emerging methods including tour based and activity based models may have additional criteria for consideration. For example, tour based and activity based models may have much greater memory requirements. Similarly, there may be additional network and data collection considerations that play an important role with respect to the adoption or transition to emerging methodologies and tools.

This section has focused on the user functionality and software functionality for identifying transportation modeling software package(s) that best meet the needs of the state. The next section examines management and administrative issues related to software selection.

8. SYSTEMS MANAGEMENT AND ADMINISTRATIVE CRITERIA

One of the most critical components of the success of transportation modeling in Florida has been the extremely strong and effective business system that the state has put into place to help guide the development and application of travel demand forecasting models in the state. The panel felt that the state should not lose or compromise on the transportation modeling business system as it moves forward in identifying future modeling directions. The panel considered it important that the state give due consideration to various administrative and management issues that may affect the transportation modeling business system and environment in the state.

Administrative and management issues considered by the panel include (these are not listed in any particular order):

1. ***Cost/Price:*** One of the biggest issues associated with selecting a software package is going to be related to the purchase price of acquiring the software and the cost associated with implementing it. This category will include such items as:
 - a. Purchase price
 - b. Implementation cost
 - c. Training and support cost
 - d. Transition (labor) cost
 - e. Continuing license agreement and technical support cost
 - f. Upgrade cost
 - g. Cost to consulting community

In this context, it should be noted that the panel felt that implementation costs associated with transitioning to a new platform may truly be the big-ticket item in terms of overall adoption costs (more so than purchase price per se).

2. ***Company Business Model:*** The company business model is an important consideration. How the company conducts business, relates to customers, and serves customer needs are critical ingredients to successful transportation modeling.
3. ***Company Stability and Longevity:*** The stability and longevity of the company are important considerations. As the adoption of transportation modeling platforms is an extremely labor and resource intensive effort, it is important to ensure that the vendor is a stable entity that is likely to remain for a long time into the future.
4. ***Ability to Produce Needed Products Smoothly on Time:*** Regardless of the capabilities of the model, planning agencies and consultants have to produce products on time in a smooth and efficient manner. Such production mode capabilities of the modeling software should be considered in decision making.
5. ***Visual Appeal of Output:*** Decision makers and policy makers would like to see outputs that have visual appeal and are easy to understand and digest, particularly when dealing with the public. The visual output generation capabilities of the software should be considered.
6. ***Ability to Reproduce Results:*** In general, the model should be able to replicate results when subjected to the same conditions.
7. ***Flexibility to Accommodate Future Changes:*** Transportation modeling is a continuously evolving process where enhancements to the model form and specification

are made on a routine basis. The software should be flexible enough to accommodate future changes that the model task force may wish to implement in FSUTMS.

8. ***Ease of Use:*** The transportation modeling software package should be examined for ease of use. Depending on the vision of the model task force with respect to the entities, individuals, agencies, and firms that should be able to run the model, software packages can be evaluated.
9. ***Source Code Availability:*** The availability of source code is not likely to be a major criterion in the current and future context of transportation modeling. In general, vendors do not provide source code; on the other hand, the open architecture nature of the software allows users to develop and incorporate customized programs within the software. While the availability of source code was a major issue at the previous decision point, the panel feels that this may not be such a critical factor any more.
10. ***Vendor Support:*** The model task force should get clear information regarding the extent to which various vendors will provide technical and software support. The cost, time frame for response, and level of support should be evaluated carefully before making a decision regarding transportation modeling software.
11. ***Software Stability and Backward Compatibility:*** The stability of the software is an important consideration. When the software upgrades to a new version, it should be possible to utilize scripts and programs written for an earlier version within the new version. Users should not have to rewrite scripts and routines from scratch every time a new version is released.
12. ***Maturity of Software:*** Different transportation modeling software are at different stages of maturity and development. The current state of maturity and future potential for enhancement of the transportation modeling software packages need to be evaluated to ensure that the state is purchasing a good product that is most likely to see continued support and development in the future.
13. ***Language Longevity:*** Software are written in different programming languages and utilize different types of protocols. If there are any issues related to the longevity of the software as a result of the programming language and protocols followed, they should be considered in the evaluation process.
14. ***Data Portability:*** All areas in the state currently have data and networks in uniform formats that are consistent with FSUTMS. It may be difficult to translate and convert all

databases and networks to new software platforms. The ease with which data and networks can be translated and converted over to the new platform is a major consideration when deciding on a new software platform.

Some of the administrative criteria noted above are negotiable and are not necessarily cast in stone at the time of evaluation. It is suggested the model task force undertake an evaluation of alternative software modeling platforms based on those criteria that are not open to negotiation. If negotiations on a certain software product fail to produce desired results, the model task force can then proceed to the next most favored option and so on.

9. A METHODOLOGY FOR THE EVALUATION OF ALTERNATIVE SOFTWARE OPTIONS

Within the context of the two day meeting, the panel could not decisively identify the comprehensive list of options available to the state for consideration. The model task force will need to conduct some background research to identify the available options. However, the blue ribbon panel spent some time trying to develop a sample list of options. The list is as follows:

1. ***Null Option:*** The null option is one where there is no defined plan for model development and enhancement in the state. Instead, the state retains the current FSUTMS toolbox and simply makes minor improvements or changes based on user requests. Such remedial action is undertaken on an ad-hoc basis.
2. ***Current FSUTMS with Small Scale Enhancement Plan:*** In this option, the state continues to use the current FSUTMS toolbox with a small scale model enhancement plan. Enhancements would constitute short-term minor improvements to the current modeling tools available in FSUTMS.
3. ***Current FSUTMS with Larger Scale Enhancement Plan:*** In this option, the state continues to use the current FSUTMS toolbox with a major commitment demonstrated by the implementation of significant enhancements over a longer time horizon. In this plan, the model task force defines a reasonably ambitious model enhancement agenda and helps guide the plan through a periodic evaluation process.
4. ***Citilabs:*** Citilabs has a suite of products available for use including TRANPLAN, TRIPS, Viper, and TP+ for example. Citilabs is now developing a unified package called Cube.

In this option, the FSUTMS toolbox would be considerably changed to include the new Citilabs product(s).

5. ***Caliper Corporation:*** TransCAD is the major product of Caliper Corporation from a full-fledged transportation modeling standpoint. Caliper Corporation also has GIS packages that can be interfaced with other transportation modeling software (other than TransCAD). In this option, the FSUTMS toolbox would be considerably changed to include new Caliper Corporation products.
6. ***INRO Consultants:*** EMME/2 is the major transportation modeling software package marketed by INRO. It is used quite extensively in the Pacific Northwest, Chicago, Europe, and Canada. Once again, this option would entail making significant changes to the FSUTMS toolbox.
7. ***AJH and Associates:*** QRS II is the transportation modeling software package marketed by AJH and Associates.
8. ***PriceWaterhouse Coopers:*** PriceWaterhouse Coopers is the vendor that is developing a commercial version of TRANSIMS. The blue ribbon panel does not feel that this is an option that can be chosen in the short-term, although it is possible in the longer term.
9. ***Others:*** There are other transportation modeling software such as TMODEL, VISSIM, and so on that the model task force may wish to consider. Some preliminary background research will help identify these options and their potential viability as candidate alternatives for consideration in the state.
10. ***Specific Software Applications:*** Within the context of evaluating transportation modeling software, the task force may also wish to examine specific planning software tools for their continued or potential inclusion in the FSUTMS toolbox. These may include ULAM, IDAS, TLOS, RTFAST, IMPLAN economic input-output model, site analysis software, and other specific purpose planning software.

The blue ribbon panel also felt that the options noted above are not necessarily mutually exclusive. The model task force may wish to consider the possibility of combining alternative options to comprise the new FSUTMS toolbox. In fact, the combining of options (particularly by including the first or second options within option packages) may help make the transition to any new tools very smooth.

The blue ribbon panel suggests that evaluative matrices be constructed for assessing alternative options with respect to their performance on various criteria. The blue ribbon panel developed sample evaluation matrices to illustrate the format in which software evaluations may take place. Within the scope of the two day meeting and without elaborate information about the software options, the blue ribbon panel felt that it could not fill in the information for the matrices.

Matrices provide a means of rating the various options with respect to various criteria of interest. Within each matrix, the options may be rated on a scale of 1-3 or any other rating mechanism that the model task force would like to adopt. Essentially, the rating mechanism is a means by which the strengths and weaknesses of each option can be effectively summarized and compared against other options.

Table 1
Matrix of Ratings with Respect to Ability to Analyze Transportation Policy Actions

Policy Action	Option 1	Option 2	Option 3	Option N
1	..					
2		Likelihood of need Extent of Use Overall importance to program Can software handle the study?				
3						
..						
M						

Table 2
Matrix of Ratings with Respect to Software Functionality and Administrative Criteria

Functionality/ Administrative Criterion	Option 1	Option 2	Option 3	Option N
1	..					
2		Dollar values for cost/price criteria Assessment of how option performs				
3						
..						
P						

10. AN ACTION PLAN FOR THE STATE

In closing the meeting, the blue ribbon panel spent some time discussing an action plan that the model task force might consider as it embarks on the critical task of identifying the future of transportation modeling in the state. Based on the discussion, the panel developed the following broad action plan and time schedule for consideration by the model task force:

Step 1: Blue Ribbon Panel Meeting

The first step occurred with the organization of the blue ribbon panel meeting on April 2-3, 2002. The blue ribbon panel helped initiate the process through the following tasks:

- Development of a preliminary list of criteria against which alternative model options can be rated and compared
- Development of a preliminary "modeling needs" list that addresses contemporary and future planning issues and transportation policy considerations
- Development of a preliminary action plan for moving towards a decision about the future of transportation modeling in Florida

Step 2: Vendor Presentations and Demos

The second step is about to occur on the afternoon of April 17, 2002 when several major software vendors are scheduled to make presentations and demonstrate their products. The vendors scheduled to present are Citilabs, INRO, Caliper Corporation, and PriceWaterhouse Coopers. These presentations and demos will offer the model task force initial insights into the capabilities, functionality, and methods that have been incorporated into the different products. The blue ribbon panel suggested that the criteria identified in Sections 7 and 8 of this report be provided to the vendors prior to the April 17 presentations so that they may customize their presentations to address the criteria of potential interest to the model task force. In this way, the model task force can maximize the benefit obtained from the presentations.

Step 3: Model Task Force Discussions

The third step would involve the model task force deliberating and fine-tuning the list of various criteria identified in this blue ribbon panel report at its meeting of April 18, 2002. The model task force may utilize the opportunity afforded by the April 18 meeting to assess the list of planning issues and needs and array of transportation policy actions to see if there are any

other needs that need to be added. For example, are there any specific issues related to the transportation disadvantaged or tourists that need to be added to the needs/issues list? Are there any specific transportation policy actions that need to be added to the policy action list? Likewise are there any issues and policy actions that are currently on the list that can be deleted (not important to the state) or merit modification?

Similarly, the model task force can discuss the lists of criteria identified in Sections 7 and 8 of this report. Are the criteria important to the state? Are there any additional criteria that need to be added to the list and/or are there any existing criteria that may be eliminated or modified to better meet the needs of the state? The model task force should try to refine the lists of criteria and prepare more formal matrix templates that can be used for evaluating alternative software options. The model task force should also consider refining the list of options (model alternatives) at this meeting.

Step 4: Conduct Research Study on Options

Following the April 17-18 meetings, the model task force should embark on a rigorous data collection effort where detailed data are collected for each option. This effort may include several tasks:

- ***Data from Vendors:*** Detailed information regarding various software products including their capabilities, methods, data formats, interfaces, and functionality may be obtained directly from vendors. Vendors may be asked to provide additional and longer presentations that constitute full-fledged demonstrations of the software. Vendors may also be asked to provide free examination copies of their packages to different agencies in the state for a trial examination period.
- ***Literature:*** There is some literature available regarding the potential capabilities about various transportation models (e.g., Urban Transportation Monitor articles on travel demand modeling software). A 1996 ITE publication also provides guidance on how to select a travel demand model. The model task force should review the literature to gather additional information useful to the decision making process. There is considerable literature on alternative land use modeling strategies, economic input-output modeling strategies, and ITS and transit models that may also be reviewed as part of this task.

- **Data from Users:** There are two types of model users. One category of users includes model developers while the second category includes those who only apply models (and do not develop them further or write customized scripts). Both types of users should be contacted for information regarding their experience and use of the various modeling software. The model task force may wish to undertake targeted site visits to have face-to-face meetings with users of various software packages and learn from their experiences. These contacts with users can also be used to frame additional questions that can be given to vendors for their response.
- **Benchmarking:** All of the different model software options should be put through a benchmarking test. All of them should be subjected to the same application, problem, and/or network and data. Benchmark tests and comparisons can be performed to evaluate alternative modeling software options with respect to various criteria that the model task force considers important.

During the data collection process, additional resources may also be brought to bear. The blue ribbon panel members have expressed a willingness to help the state as needed in the future in the evaluation process. The data collected in this stage should be used to fill evaluative matrices such as those shown in the previous section. These matrices will serve as decision support matrices for identifying most preferred options or combinations thereof for incorporation into FSUTMS.

Step 5: Assess Differences and Identify Preferred Options

When the evaluation matrices are filled up, it is likely that there will be several criteria on which all of the available options score equal ratings. At the two extremes, there may be some criteria or methods that all software are able to equally accommodate and then there may be other criteria or capabilities that all software simply do not address at this time. This affords the model task force an opportunity to reduce the dimensionality of the problem/matrices. The model task force should filter the evaluation matrices so that only those criteria upon which the software perform differently (and therefore can be distinguished from one another) are retained in the evaluation matrices. Decision making should be done using the criteria that are left in the evaluation matrices. Differences among software options can then be isolated effectively and the most preferred options can be identified.

Step 6: Address Administrative Issues that are Negotiable

As mentioned earlier, there are several administrative criteria that may be negotiable. For the most preferred options or combinations thereof, the state should initiate negotiations on these administrative criteria. These may include training programs, data conversion assistance, cost and price packages, technical and on-site support, upgrade policies, licensing agreements, and availability of source code. These negotiations should yield additional data that can be used to fill the remaining cells in the evaluation matrices, namely, those that deal with negotiable administrative criteria.

Step 7: Decision Meetings and Action Schedule

Following the completion of all data collection efforts and negotiation, the model task force should consider holding a final series of decision meetings that can help ensure that there is a broad base of support for the chosen option(s). The model task force can also use these meetings to develop an action schedule, timeline, and evolutionary path that may be needed to facilitate any software transitions that might be necessitated by the chosen options.

The blue ribbon panel recognizes that, if the state were to decide to change some of the software options in the FSUTMS toolbox, a gradual evolutionary path wherein simultaneous model systems are available for a certain time period would have to be developed and planned. It would not be possible to do a full scale conversion in a short time frame. Users should play a key role in shaping the development of any transition plan that might be developed by the model task force. The time frame and schedule associated with Steps 4 through 7 are more uncertain due to the need to coordinate with vendors and research project selection schedules. Nevertheless, it is likely that the model task force will be able to make significant progress towards identifying the future of transportation modeling in Florida by its Fall meeting. Transportation modeling software selection is a major decision that has tremendous implications for transportation modeling and planning in the state. As such, the panel felt that the state should undertake a careful and deliberate process as it moves forward in identifying transportation modeling software to be adopted in the state.

Future Direction for Florida's Transportation Models

Florida Statewide Model Task Force **BLUE RIBBON PANEL**

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April 2-3, 2002

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- Dennis Hooker, Metroplan Orlando
- Shi-Chiang Li, FDOT District 4

Model Task Force Subcommittee Chairs

- Frank Baron, Freight Subcommittee
- Mike Neidhart, Trip Distribution Subcommittee
- Imran Ghani, Trip Generation Subcommittee
- Gary Kramer, Land Use Subcommittee
- Glen Ahlert, GIS Subcommittee
- Kevin Feldt, Nominee for Transit Subcommittee

Blue Ribbon Panel Members

- Patrick Costinett, Parsons Brinckerhoff Quade & Douglas
- David Hartgen, University of North Carolina at Charlotte
- Dane Ismart, Louis Berger Group
- Kenneth Kaltenbach, The Corradino Group
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- Tom Rossi, Cambridge Systematics
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- Bob McCullough, Administrator, FDOT Central Office Traffic Modeling Section
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- Ram Pendyala, Panel Moderator, University of South Florida Civil Engineering Department

BLUE RIBBON PANEL MEETING AGENDA

Tuesday, April 2, 2002

8:00 AM	Introductions	Panel Moderator: Ram Pendyala Panel Members/Attendees
8:15 AM	Welcome Remarks	MTF Tri-Chairs: Danny Lamb Dennis Hooker Shi-Chiang Li
8:45 AM	Florida Standard Model Overview Setting Direction for Blue Ribbon Panel Expectations and Desired Deliverables	MTF Tri-Chairs (Panel Members/MTF Participation)
9:45 AM	Break	
10:15 AM	Question and Answer Session	Panel Members/MTF Participation
11:15 AM	Fine-Tune Meeting Strategy and Approach	Panel Members Participation (MTF Non-Participation)
12:00 Noon	Lunch	
1:30 PM	New Concepts in Transportation Modeling <i>Conceptual Changes and Paradigm Shifts</i> <ul style="list-style-type: none">• Trip chaining• Induced travel• Integrated land use/transportation models• Microsimulation approaches• Activity-based methods• Agent-based models• Other	Panel Members Participation (MTF Non-Participation)
3:00 PM	Break	
3:30 PM	New Concepts/Paradigms in Transportation Modeling (continue discussion) <ul style="list-style-type: none">• Review of tools/platforms in context of conceptual changes and paradigm shifts	Panel Members Participation (MTF Non-Participation)
5:00 PM	Adjourn	

Wednesday, April 3, 2002

8:30 AM	Recap of Day-1 Discussions	Panel Members/MTF Participation
9:00 AM	New Concepts in Transportation Modeling <i>Practice Changes</i>	Panel Members/MTF Participation

- Time-of-day modeling
- Trip attraction models
- Multimodal and intermodal modeling
 - Bus
 - Rail
 - Non-motorized modes
 - HOV
 - Paratransit
- Urban truck modeling (goods and services)
- Land use sensitivity/modeling
- Air quality modeling
- Network and spatial microsimulation
- Auto ownership modeling
- Feedback in transportation modeling
- Destination Choice/Trip Distribution Enhancements
- Other

10:00 AM Break

10:30 AM New Concepts in Transportation Modeling Panel Members Participation
Practice Changes (continue discussion) (MTF Non-Participation)

- Levels of accuracy in transportation models
 - Long range transportation plans
 - Highway elements
 - Transit elements
 - DRI and site impact analysis
 - Daily vs. peak period/hour models
 - Network microsimulation analysis
- Achieving desired level of accuracy
 - Model validation standards

12:00 Noon Lunch

1:30 PM New Concepts in Transportation Modeling Panel Members Participation
Technology and Software Platforms (MTF Non-Participation)

- Review of tools/platforms in context of practice changes
- Discussion on software platforms – Strengths, capabilities, and data requirements
 - FSUTMS
 - Citilabs Products
 - EMME/2
 - TransCAD
 - QRS II
 - TRANSIMS
 - Other
- Maintaining common modeling platform while enhancing flexibility
- GIS tools for transportation modeling

- Graphical user interfaces
- Output visualization
- Input and output database formats/structures
- Other technology and software issues

3:00 PM	Break	
3:30 PM	Development of Recommendations Format/Outline of White Paper/ Blue Ribbon Panel Report	Panel Members Participation (MTF Non-Participation)
4:30 PM	Wrap-up/Feedback to MTF	Panel Members/MTF Participation
5:00 PM	Adjourn	

Future Direction for Florida's Transportation Models

Florida Statewide Model Task Force **BLUE RIBBON PANEL**

Metroplan Orlando • 315 East Robinson Street, Suite 355 • Orlando, Florida 32801
Phone: (407) 481-5672 • Fax: (407) 481-5680
April 2-3, 2002

MISSION STATEMENT

PURPOSE

The Blue Ribbon Panel is being assembled to provide independent and objective counsel to the Florida Statewide Model Task Force on the future directions for transportation modeling in the State of Florida

OBJECTIVES

The objectives of the Blue Ribbon Panel are as follows:

- ❑ To advise the Model Task Force on emerging and new directions/approaches to transportation modeling
- ❑ To assess the current modeling process/procedures/methods used in Florida with respect to their strengths and limitations in meeting future transportation modeling needs and incorporating emerging and new directions/approaches
- ❑ To inform the Model Task Force about other available and emerging modeling tools and platforms with respect to their capabilities and suitability to meet Florida's future transportation modeling needs

TASK ASSIGNMENTS

The Blue Ribbon Panel will provide direction on how best to:

- ❑ Address modeling needs and issues identified by the Model Task Force
- ❑ Keep Florida advancing with new modeling approaches
- ❑ Integrate new technologies and methodologies into Florida's transportation modeling process
- ❑ Determine accuracy/confidence levels for different model applications

Specific work assignments include:

- ❑ Identifying modeling capabilities (e.g., policy analysis capabilities) that should be incorporated into Florida's transportation modeling process
- ❑ Reviewing the current Florida modeling system with respect to its strengths and limitations in addressing the identified modeling capabilities
- ❑ Providing information about available software and platforms with respect to their:
 - Ability to address the identified modeling capabilities
 - Compatibility with new modeling approaches
 - Integration and interface with existing models
 - Limitations
 - Practical issues
 - Data needs
 - Computing equipment, training, and cost
 - User-friendliness
 - Nationwide/worldwide modeling community support
- ❑ Providing advice/plan on:
 - How to conduct an evaluation of alternative modeling software and platforms
 - Executing a smooth transition to new software/platforms, if desired
 - Resource (time, cost, personnel) commitments for a transition to new software/platforms, if desired

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LIST OF ATTENDEES

1. Frank Baron, Miami Dade MPO
2. Jeanette Berk, Advanced Planning Inc.
3. Terry Corkery, FDOT Systems Planning Office
4. Patrick Costinett, Parsons Brinckerhoff
5. Kevin Feldt, Jacksonville Transportation Authority
6. Imran Ghani, FDOT District 2
7. David Hartgen, University of North Carolina at Charlotte
8. Dennis Hooker, Metroplan Orlando
9. Dane Ismart, The Louis Berger Group
10. Ken Kaltenbach, The Corradino Group
11. Gary Kramer, Pensacola-Fort Walton Beach-Panama City MPO
12. Danny Lamb, FDOT District 7
13. Shi-Chiang Li, FDOT District 4
14. Bob McCullough, FDOT Systems Planning Office
15. Eric Miller, University of Toronto
16. Vidya Mysore, FDOT Systems Planning Office
17. Mike Neidhart, Volusia County MPO
18. Ram Pendyala, University of South Florida
19. Tom Rossi, Cambridge Systematics

20. Jim Ryan, Federal Transit Administration
21. Huiwei Shen, FDOT Systems Planning Office
22. Suraya Teeple, FDOT District 2

CHAPTER II

SETTING THE STAGE FOR MODEL EVALUATION

1. INTRODUCTION

The BRP meeting was immediately followed by a Model Task Force (MTF) meeting where members and attendees discussed the BRP report and recommended that a model evaluation study be undertaken to identify new and improved modeling tool(s) that should be included in the FSUTMS toolbox. In response to the MTF recommendation, the FDOT Systems Planning Office initiated a research study in August 2002 with the University of South Florida Department of Civil and Environmental Engineering to conduct an evaluation of alternative modeling tools available in the market and identify those that would merit consideration for inclusion in the FSUTMS toolbox.

2. MODEL TASK FORCE MEMBER RATINGS OF EVALUATION CRITERIA

At the Model Task Force meeting, six groups were formed with approximately nine members each. The members were given the lists of criteria pertaining to Modeling Methods, Software, and Planning and Policies that were developed by the Blue Ribbon Panel and asked to rank them with respect to their importance on a scale of 1 through 5. Number 1 signified that the criterion was not important, while number 5 meant that the criterion was extremely important. The members were also allowed to assign a 0, which would mean that the criterion was not an issue at all. The members were to assign a number to each of the criteria, calculate a group average, and submit the score. The following criteria were eliminated from any further evaluation as a result of the group rankings:

- ❑ Maintenance of traffic
- ❑ Carpooling strategies
- ❑ Flextime
- ❑ Technology (telecommuting)
- ❑ Incident management
- ❑ Construction management

- Language longevity

It was also decided to separate TRANSIMS from the model evaluation study as it was not considered a tool that could be widely implemented across the state in the very near term (within a one-year time frame). TRANSIMS is a new generation of long range travel demand model forecasting systems that may be implemented in the state with support from the USDOT on a long term basis.

A motion was made and passed to include a users' survey as part of the evaluation study. The survey would obtain data from the users regarding their experiences with various transportation modeling software; the results of the survey would be documented as part of the data collection effort of the study.

The following shows a summary of the average importance ratings given by model task force members to the various software criteria identified by the Blue Ribbon Panel.

Summary of MTF Importance Ratings on Software Criteria

Planning and Policies Criteria

<i>Score</i>	<i>Criterion</i>
5	Capacity deficiencies and congestion
4	Transportation – land use interaction
4	Resource allocation and project selection
4	Air quality
4	Capacity increases
4	Intermodal connectivity
4	Transit service changes
4	LRT/BRT initiatives
4	Access/egress options
4	HOV changes
4	Transfer centers
4	Freight mobility strategies
4	ITS
4	Pricing strategies
4	Transit fares/pricing
4	Truck policies
3	Equity
3	Parking policies
3	Economic impacts of transportation
3	Safety and emergency evacuation
3	Signalization

3	System preservation,maintenance & operations
2	Maintenance of traffic
2	Carpooling strategies
2	Flextime
2	Telecommuting
2	Incident management
2	Construction management

Methodology and Software Functionality Criteria

<i>Score</i>	<i>Criterion</i>
5	Network editor
5	Flexibility to accommodate future changes
5	Vendor support
5	Flexibility to accommodate emerging methods
5	Ability to analyze different modal alternatives
5	Ability to reproduce results
5	Peak spreading and time of day modeling
5	Interface with other software
5	Display
5	Ability to accommodate time of day periods
5	Model feedback
5	Network shape and GIS functionality
5	GIS and spatial analysis capabilities
4	Processing speed
4	Operating system
4	Model trips
4	Report generation
4	Matrix and link calculators
4	Implementation cost
4	Ability to produce products smoothly on time
4	Software stability and backward compatibility
4	Data portability
4	Integrated transportation – land use modeling capability
4	Ease of use
4	Spatial aggregation/resolution in zones and net work
4	Four-step process
4	Ability to analyze large numbers of trip purposes
4	Data storage and input-output routines
4	Customization scripts
4	Flexibility to accommodate alternative model forms
4	Network completeness
4	Tie into other Florida models
4	Using the consistent speeds in the model steps
4	Highway and transit path builders
4	External travel
4	Wrapper
4	Component applications
4	Purchase price

- 4 Company stability and longevity
- 4 Aggregate application vs. Microsimulation
- 4 Visual appeal of output
- 4 Maturity of software
- 4 Freight modeling considerations
- 4 Ability to analyze different market segments
- 4 Company business model
- 4 Activity-based approaches
- 3 Auto ownership model
- 3 Model tours
- 3 Dynamic assignment
- 3 Source code availability
- 3 Stochastic modeling of travel behavior
- 2 Language longevity

3. STEERING COMMITTEE MEMBERS

With the approval of the Model Task Force, a study steering committee that would provide guidance and oversight was established for the study. The study steering committee was divided into three “teams”, i.e., the consultant team, the District team, and the MPO team, to help facilitate coordination and task assignments. The study steering committee composition is as shown in the table below:

Name and Agency	District Team	MPO Team	Consultant Team
Danny Lamb, FDOT District 7	X		
Dennis Hooker, Metroplan Orlando		X	
Shi-Chiang Li, FDOT District 4	X		
Frank Baron, Miami-Dade MPO, Freight Subcommittee		X	
Mike Neidhart, Volusia MPO, Trip Distribution Subcommittee		X	
Imran Ghani, FDOT District 2, Trip Generation Subcommittee	X		
Gary Kramer, West Florida RPC, Transportation Land Use Subcommittee		X	
Kevin Feldt, Jacksonville Transit Authority, Transit Subcommittee		X	
Scot Leftwich, FDOT District 5	X		
Suraya Teeple, FDOT District 2	X		
Bill Olsen, FDOT Turnpike District	X		
Paul Larsen, Palm Beach County MPO		X	

Bud Whitehead, Hillsborough County MPO		X	
Ossama Al-Aschkar, Broward County MPO		X	
Ken Kaltenbach, The Corradino Group			X
Dan Macmurphy, URS Corporation			X
Mike Doherty, URS Corporation			X
Tom Rossi, Cambridge Systematics			X
Wade White, Gannett Fleming			X
Rob Schiffer, Cambridge Systematics			X
William Roll, Tindale-Oliver			X
Arturo Perez, Leftwich Consulting Engineers			X
Dane Ismart, Louis Berger Group			X

The first meeting of the steering committee was held in Orlando on August 27, 2002. At this kickoff meeting, the steering committee defined the study approach, outlined the roles and responsibilities of steering committee members, and specified how vendor participation would take place in the model evaluation process.

4. Vendor Participation

In order to ensure that the study benefits from the latest developments in transportation modeling, an invitation to transportation modeling vendors was published in the October issue of the Urban Transportation Monitor. The invitation asked vendors interested in participating in the Florida MTF model evaluation study to submit product literature, demo CD's, and other materials describing the product(s) to the MTF for possible inclusion in the study. The following invitation to vendors was published in the Urban Transportation Monitor:

Transportation Modeling Software Review Study

Agency: Florida Statewide Model Task Force

Deadline: October 15, 2002

Contact: Prof. Ram M. Pendyala, University of South Florida, Department of Civil and Environmental Engineering, ENB118, Tampa, FL 33620; Ph: (813) 974-1084;
Email: pendyala@eng.usf.edu

Description: The Florida Statewide Model Task Force is conducting a comprehensive review and evaluation of travel demand forecasting software

packages to meet the future transportation planning needs of the State. Transportation modeling software vendors interested in participating in the review process are invited to submit a package that includes product brochures, publications describing features, capabilities, and real-world applications of the modeling software, and other informational materials (e.g., demo software, multimedia promotional materials, etc.) that illustrate the potential of the software to meet current and future state and metropolitan transportation planning needs. All materials must be sent to the contact address furnished above. The Florida Statewide Model Task Force, at its sole discretion, will screen interested vendors and software packages for possible inclusion in the review study; submission of a package does not guarantee participation in the review process. Vendors will be notified by October 30, 2002 if they have been selected to participate in the review study.

In response to the invitation, two entries were received. The first was the INDEX-4D software from Criterion Engineers and Planners and the second was B-node, a procedure often used in the Northern Virginia District of Virginia DOT. Upon a careful review of these products, the steering committee felt that both of these are special purpose tools addressed to specific applications outside the scope of the current study that is focused on comprehensive transportation modeling packages. However, the steering committee asked that such special purpose tools be considered for possible inclusion in the FSUTMS toolbox, perhaps as part of a subsequent research study.

The steering committee expressed a desire to use a Florida transportation model for studying, demonstrating, and evaluating the alternative software packages. The steering committee agreed to use the 1999 Broward County Planning Model as the common test against which the performance of the software packages would be evaluated and compared.

Four vendors were invited to participate and present two-day hands-on computer-based workshops to the steering committee. Each vendor was provided the 1999 Broward Model network and databases about one month in advance of their respective workshop thus giving each vendor the same amount of time to work with the Broward Model in preparation for the

two-day workshop. Each vendor was provided a copy of the Blue Ribbon Panel report, the original scope of work for the model evaluation study, and the Florida Modeling Newsletter (<http://www11.myflorida.com/planning/publications/modnews/ModnewsV20.pdf>) providing the list of criteria of interest to the MTF.

Workshops were held in Fall 2002 as per the following schedule:

October 16-17, Orlando	VISUM	ITC/PTV	(http://www.itc-world.com)
November 6-7, Atlantic Beach	CUBE/TP+	Citilabs	(http://www.citilabs.com)
November 19-20, Tampa	EMME/2	INRO	(http://www.inro.ca)
December 4-5, Orlando	TransCAD	Caliper	(http://www.caliper.com)

Steering committee members were asked to attend all workshops so that they would become familiar with the strengths and capabilities of each package. At each workshop, vendors demonstrated the varied capabilities of their respective software while giving the steering committee members hands-on exposure to the operation of the software. In addition, the vendors provided information about planned future enhancements that would be incorporated into the software. Finally, all vendors provided a description of their organizational structure, business model, and training and support infrastructure.

CHAPTER III

MODELING SOFTWARE PACKAGES

1. INTRODUCTION

This chapter provides a brief overview of the four primary software packages considered by the study steering committee. As mentioned earlier in the report, the project steering committee considered the following four software:

- ❑ TransCAD (Caliper Corporation)
- ❑ CUBE/TP+/Voyager (Citilabs)
- ❑ VISUM (ITC/PTV)
- ❑ EMME/2 (INRO Consultants)

In this chapter, a brief overview of each software is presented using information provided by the software vendors.

2. SOFTWARE OVERVIEW

An overview of the software packages is presented here in the order in which the vendor workshops were held.

2.1 VISUM

VISUM is a comprehensive, flexible software system for transportation planning, travel demand modeling and network data management. VISUM is used by over 600 organizations on six continents for metropolitan, regional, statewide and national planning applications. Designed for multimodal analysis VISUM allows users to integrate all relevant modes of transportation (i.e., SOV, HOV, truck, bus, train, pedestrians and bicyclists) into one consistent network model. Assignment procedures and 4-stage modeling routines meet the requirements of all the different modes.

VISUM is PC-based using MS Windows and offering open data and image exchange into the total Windows environment via clipboard or other interfaces. This open concept allows users to

design their own applications using Visual Basic. In 2003 VISUM will be available under a new object-oriented architecture.

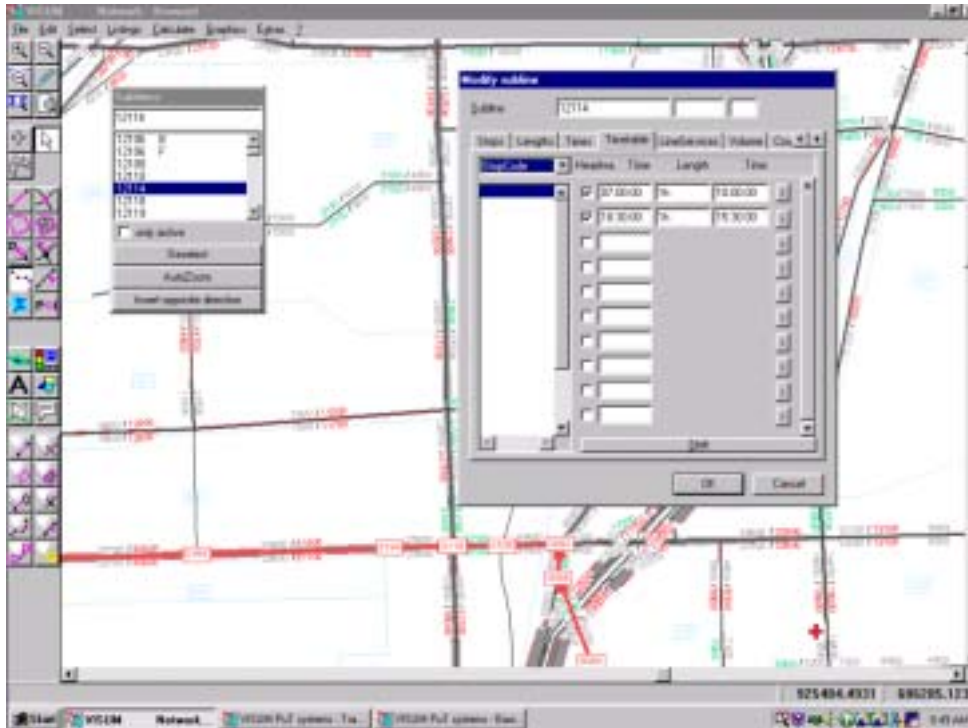


Figure 3.1 VISUM Screen

VISUM's easy-to-use graphical interface enables users to rapidly design network scenarios, flexibility importing and exporting data and reliably manage data. VISUM can be used for conventional four-step modeling, including equilibrium highway assignment and frequency based transit assignment.

Beyond conventional modeling, VISUM offers many specialized and advanced methods, such as activity based models, dynamic methods or advanced transit models. Fully integrated with the microscopic traffic simulator VISSIM, the pvt Vision Suite offers strong demand modeling and engineering tools.

VISUM is offered to the user community at a variety of product levels. They are as follows:

BASE – Package suited for small MPOs

- ❑ For network sizes up to 400 zones, 2000 nodes, 5000 links and 1000 transit routes.
- ❑ Includes full planning capabilities; multimodal networks and assignment for highway and transit; four-stage modeling; all interfaces; flow evaluations; matrix manipulations

LARGE – Package suited for most MPOs

- ❑ For network sizes up to 1500 zones, 12000 nodes, 30000 links and 5000 transit routes.
- ❑ Includes full planning capabilities; multimodal networks and assignment for highway and transit; four-stage modeling; all interfaces; flow evaluations; matrix manipulations

X-LARGE – Package suited for large MPOs

- ❑ For network sizes up to 5000 zones, 250000 nodes, 500000 links and 20000 transit routes.
- ❑ Includes full planning capabilities; multimodal networks and assignment for highway and transit; four-stage modeling; all interfaces; flow evaluations; matrix manipulations

Larger versions of the software are available upon request

All VISUM software licenses include the following:

- ❑ Software and hardware lock(s);
- ❑ Electronic version of users manual;
- ❑ Bound users manual (except for academic licenses);
- ❑ Free software updates for one year from date of purchase (Academic licenses 3 years);
- ❑ Four hours of hotline technical support (first license only) for one year from date of purchase; and
- ❑ Ability to upgrade to higher level for the difference in purchase price (Requires current maintenance agreement).

Several additional products and services are available from the vendor including:

- ❑ TRIBUT: Bi-criterion toll assignment in VISUM.
- ❑ Academic license for universities and research organizations (included single license for VISUM Large plus unlimited number of licenses for 30 zones).
- ❑ Additional hardcopies of manual.

The vendors offers a maintenance agreement. The maintenance agreement is as follows:

- ❑ Free software updates
- ❑ Four hours/maintenance agreement/year or 4 hours of technical support within first year of purchase. For full details of our technical support policy, [click here](#).
- ❑ Cost: 15% per year based on the total current price of all licenses owned

Multiple license discounts are offered for users who purchase multiple licenses. The discount terms are as follows:

- ❑ Only applies to licenses purchased through single point of contact.
- ❑ Only applies to licenses of the same type.
- ❑ From 2 to 5 licenses 35% each. Academic price \$200 for each additional license.
- ❑ From 6 to 10 licenses 50% each.
- ❑ More than 10 licenses 70% each
- ❑ Agency/corporate/academic institutional licenses, 10 times single license price.

The vendor provides strong technical support through various mechanisms including:

- ❑ Hotline technical support (eligible users only) - visum.hotline@itc-world.com
- ❑ Annual user group meetings
- ❑ Web page discussion board

Training classes are provided by the vendor on the following basis:

- ❑ Available on a cost, time, and materials basis
- ❑ Location: User's office or ITC's office
- ❑ Customized to user's needs (Beginners or Advanced)
- ❑ Basic training package includes:
 - \$1,000 preparation fee
 - \$1,000 per training or travel day
 - Travel Expenses
 - Maximum of six person class size per instructor

The primary contact for the VISUM software package is:

Wolfgang Scherr, Principal, wscherr@itc-world.com

Tel. (302) 654-4384; Fax. (302) 654-4384

2.2 CUBE/TP+/Voyager

Cube is a complete travel forecasting family of software products that provides capabilities for the comprehensive planning of transportation systems. Cube functionality encompasses urban, regional, and long distance travel forecasting, freight forecasting, multimodal microsimulation, matrix estimation and air quality analysis. Users of Cube combine Cube Base, the system interface, with one or more Cube Extensions depending on their planning tasks. This structure allows the professional planner to add functions as required without the need to learn a new interface or create multiple planning databases.

An important attribute of Cube is its direct use of ArcGIS from ESRI, the world leader in GIS technology. Cube also easily incorporates other external or user-developed software. Cube's broad range of capabilities provides answers to all types of planning questions from testing new public transit alternatives to road pricing strategies to new developments to new freight terminals. With Cube, one can generate decisionmaking information quickly using powerful modeling and GIS techniques, statistics and comparisons, high-quality graphical output, and a variety of reporting methods. Cube empowers one to make smarter decisions more quickly by uncovering key indicators for evaluating planning alternatives.

Cube is a modular, tightly integrated, full-featured product line for the transportation planning process, covering passenger demand, freight demand, microsimulation, air quality and reporting. Cube Base is easy to use yet provides exceptional data management, model design, scenario application and reporting. Cube consists of the latest technologies and methodologies combined with the Citilabs products used by over 2000 customers around the world. The incorporation of this long heritage into Cube provides compatibility with models developed with other legacy packages and a solid software platform. At the same time, Cube takes advantage of new programming technologies to provide greater flexibility and interaction with complementary products.

Cube Extensions

Cube Voyager is the Cube Extension for personal travel forecasting, offering advanced methodologies for the study of urban, regional and long distance multimodal systems.

Cube Cargo is the Cube Extension for freight forecasting, offering specific methodologies for studying freight demand using a commodity-based approach.

Cube Me is the Cube Extension for estimating statistically optimized base year travel matrices. Cube ME will update existing matrices to the current year or estimate entire matrices.

Cube Polar is the Cube Extension for estimating air quality emissions. Cube Polar allows the modeling of most vehicles and fuel technologies.

Cube Dynasim is the Cube Extension for conducting detailed traffic microsimulations. Cube Dynasim provides flexible, advanced methodologies for the simulation of automobiles, trucks, buses, and rail vehicles. Cube Dynasim Views provides 3D graphical displays.

A modular system, Cube is comprised of:

Cube Base

Cube Base is the user interface for the entire Cube system and provides interactive data input and analysis, GIS functionality via ArcGIS, model building and documentation, and scenario development and comparison. Links between the model, the data, and GIS are a single click away, making the development and application of models easy to use. Cube Base allows one to run models developed with Cube Voyager, Cube Cargo, Cube ME, Cube Dynasim, Cube Polar, TP+, TRIPS and TRANPLAN.

Cube Voyager

Cube Voyager uses a modular and scriptbased system flexible enough to incorporate methods ranging from fourstep to discrete choice to activity-based models. Advanced methodologies provide junction-based capacity restraint for highway analysis and multipath transit pathbuilding and assignment. Other features include highly flexible network and matrix calculators and unrestricted data sizes.

Cube Cargo

Cube Cargo offers specific methodologies for studying freight demand using a commodity-based approach. A wide variety of policies and infrastructure improvements can be tested, from pricing strategies to freight-specific facilities. Freight forecasting using Cube Cargo can leverage existing passenger data and models.

Cube ME

Cube ME has been developed specifically for estimating and updating base year automobile, truck and public transit trip tables. Cube ME enables the user to exploit a wide variety of data that contributes to matrix updating and matrix development. Cube ME has been used successfully on many varied studies around the world.

Cube Dynasim

Cube Dynasim can be used to conduct detailed multimodal microsimulations. Cube Dynasim is linked directly to the other Cube Extensions, allowing data and results to be easily shared, and provides flexible, advanced methodologies for the simulation of automobiles, pedestrians, trucks, buses and rail vehicles. Cube Dynasim Views provides 3D graphical displays.

Cube Polar

Cube Polar is the Cube Extension for calculating air quality emissions and energy consumption. Cube Polar takes highway network assignments from Cube Voyager, TRIPS and TP+ and produces estimates dependent on vehicle classifications, fuel characteristics, and speed profiles.

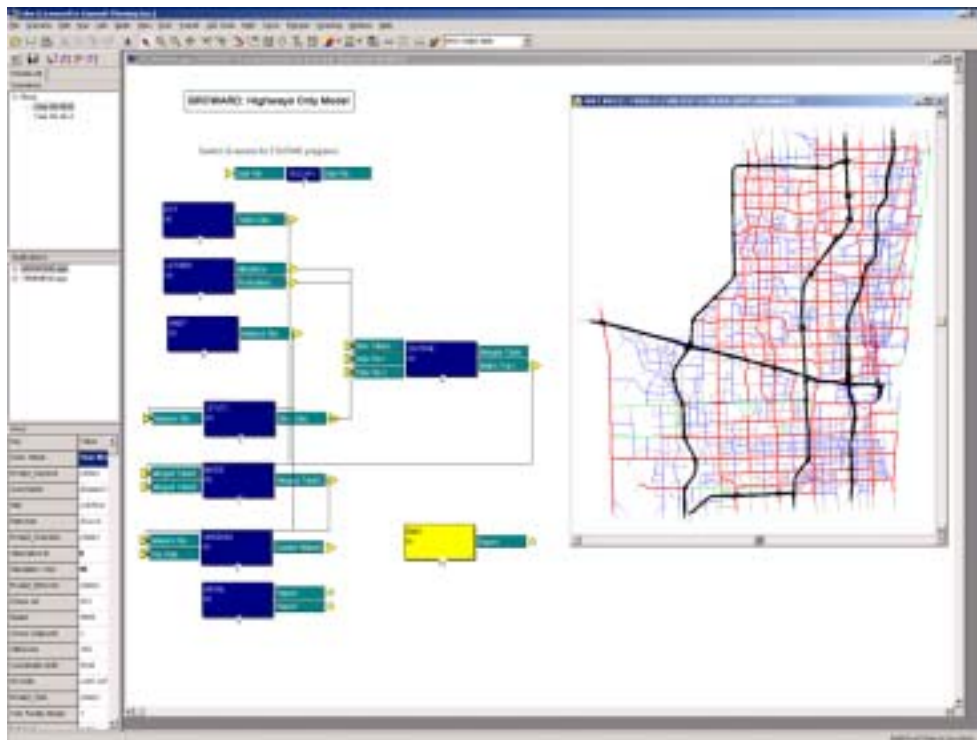


Figure 3.2 CUBE Screen Capture

Citilabs strives to provide a reasonable level of assistance via telephone / fax / mail / email in respect of users' inquiries and endeavor to answer as fast as is reasonably possible questions relating to the behavior or performance of the software. Citilabs is committed to meeting the training needs of its user community through course offerings designed for both beginning Citilabs software users as well as intermediate to advanced users and by hosting training sessions four times per year. Citilabs will conduct training twice per year at its offices in the San Francisco Bay area located in Jack London Square on the Oakland California waterfront. Citilabs will also be taking its training courses on-the-road twice per year to selected cities in order to provide training opportunities for those who may have difficulty attending at the San Francisco Bay area offices. If clients have specific training needs that are not met by the regular course offerings, they can contact Citilabs who would be happy to work with the clients on an individual basis to develop appropriate training for specific needs.

The primary contact for the Citilabs suite of software packages is:

Wade L. White, wwhite@citilabs.com or Michael Clarke, mclarke@citilabs.com

Tel. (510) 663-5200; Fax. (510) 645-1817

2.3 EMME/2

EMME/2 is a state-of-the-art system for planning the transportation of people on multi-modal networks. It offers the planner a comprehensive and flexible set of tools for demand modelling and analysis, as well as network analysis and evaluation. EMME/2 has been designed to satisfy varied and evolving needs. It is currently being used by over 600 organizations on 5 continents.

EMME/2 provides the ability to efficiently structure and handle the large amounts of data and results involved in transportation planning projects. With EMME/2, the transportation infrastructure that spans the study area is represented by a multi-modal network. Thus, all the relevant means of transportation can be modelled in an integrated way.

- ❑ A network data set consists of modes, nodes, links, turns and transit lines. Associated with each of these elements are all relevant attributes, including assignment results and user defined attributes.
- ❑ Up to 30 modes (such as car, truck, bus, train, walk, etc.) may be defined. The subset of applicable modes is then specified for each link.

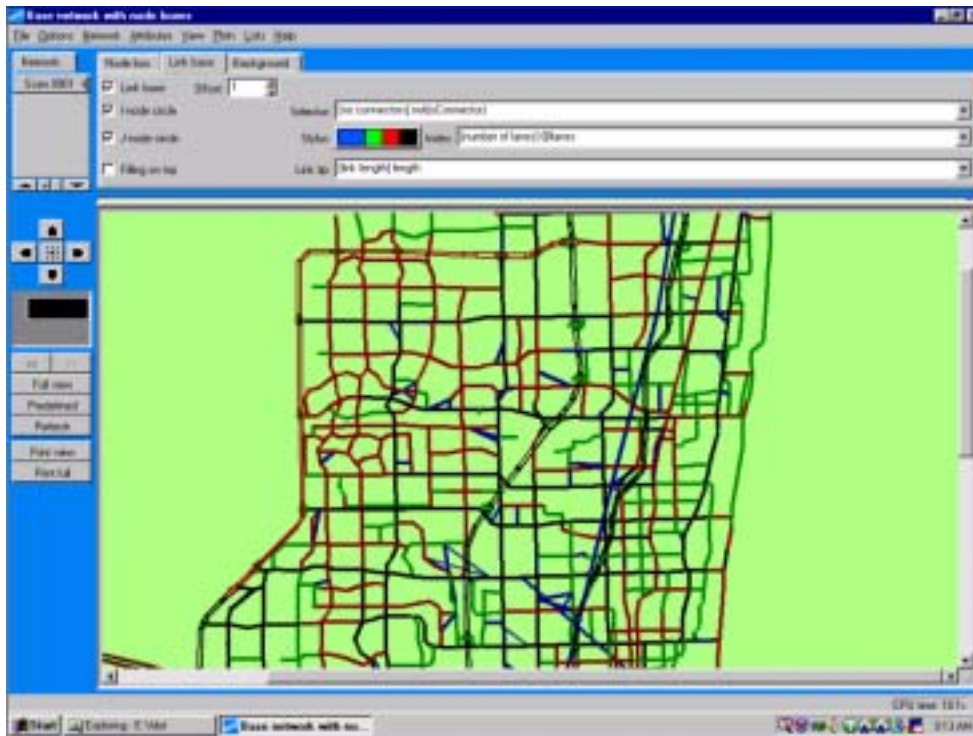


Figure 3.3 EMME/2 ENIF Screen

- ❑ Since all modes are integrated into one consistent network, it is possible to model the interactions between the vehicles that share the same infrastructure. For example: the impact of car traffic on bus speeds, or the contribution of buses to road congestion.
- ❑ A data bank may contain several scenarios, each describing a given network option (base year, infrastructure alternatives for future years, etc.). The interactive-graphic capabilities of EMME/2 make it easy to create and compare different scenarios.
- ❑ In an EMME/2 data bank, all zone-related data are stored in the form of matrices. Matrices may contain results as well as input data: demand and travel times by O-D pair, socio-economic data by origin or destination, etc.
- ❑ Zone groups may be defined according to any user criteria: district, municipality, level of income, etc. These groups allow the production of aggregate matrices, as well as easy access to submatrices and zone subsets.
- ❑ All the functions used in EMME/2 (for example in the calculation of link travel times) are defined by the user.
- ❑ No limitation is imposed on the functional forms used: the functions are specified as algebraic expressions using operators and keywords.

- ❑ There is no need for user coded subroutines: the functions are an integral part of the data bank.
- ❑ Data and results can be imported from and exported to other types of software such as GIS or traffic control programs.

The flexible framework provided by EMME/2 encourages the use of modelling techniques best suited to particular planning problems. This is often referred to as the “glass box” approach. EMME/2 can be used to implement virtually any travel demand forecasting model, from the classical 4-step model to multi-modal assignment with direct demand functions, as well as models based on trip chains.

- ❑ An interactive calculator evaluates expressions involving zone-based data. This versatile tool can be used for a wide variety of purposes, including the implementation of trip generation/attraction models and mode choice models.
- ❑ An efficient procedure balances a matrix in order to satisfy totals for origins and destinations (and also a third set of totals, if specified by the user). This tool is especially useful for implementing trip distribution models.
- ❑ Another tool performs generalized “matrix-product” like operations, involving intermediate zones. It may be used to implement trip chaining models, such as park-and-ride, and for many other applications.

EMME/2 provides an equilibrium road assignment procedure in which:

- ❑ The demand can be a fixed O-D matrix, or specified as functions (for example mode choice or direct demand functions)
- ❑ In addition to travel time, the effect of cost can be considered
- ❑ Several classes of road users, which may perceive or use the network differently, can be assigned simultaneously, yielding a true global equilibrium
- ❑ Background traffic (such as transit vehicles) can be modelled
- ❑ Travel times and other trip attribute matrices (distance, etc.) can be computed
- ❑ Generalized “select link” and other path-related analyses can be performed
- ❑ Other types of assignment, such as stochastic or all-or-nothing, can be carried out.

EMME/2 provides a multi-path transit assignment for modelling and analyzing:

- ❑ Many modes (such as bus, train, walk, bicycle...)
- ❑ Transit times dependent on travel times on the road network
- ❑ Different perceptions of travel time components
- ❑ On-board congestion (through an equilibrium assignment implemented as a macro)
- ❑ Many trip attribute matrices: travel time components, distance, etc.
- ❑ Transit network usage: “select line”, analyses of boardings/alightings, etc.
- ❑ Individual trips (address to address).

A timetable based assignment is also provided in EMME/2.

The comprehensive set of tools offered by EMME/2 provides flexibility in the choice of analytical methods, and in the generation of reports and graphics. All the elements of the data bank may be displayed, using various tools that include:

- ❑ Interactive/graphic editors: for entering and updating network data
- ❑ Network scattergrams: especially useful for comparing predicted/observed values
- ❑ Matrix histograms: useful for displaying and comparing travel time distributions
- ❑ Shortest path builders: excellent tools for validation and accessibility studies
- ❑ Scenario comparison: for quick evaluation of the impact of proposed changes.

Annotations can be superimposed on any plot, in order to display rivers and shorelines, street and site names, company logos, etc. Annotations can be created interactively or using information available outside EMME/2, for example from a GIS.

Elements of a plot can be colored according to user specified criteria. The user may create color indices based on the desired combination of attributes. For example, links can be colored according to speed, level of service, number of lanes, road type, district, etc.

EMME/2 provides interactive calculators for network and matrix data. The user specifies a calculation as an algebraic expression using keywords (representing the relevant attributes or matrices) and operators (mathematical and logical).

The network calculator evaluates expressions involving network attributes (both data and results). Calculations may be restricted to a subset of elements, selected through a powerful mechanism based on attribute values. This versatile tool can be used to:

- ❑ Validate and calibrate network data
- ❑ Implement evaluation and impact analysis methods
- ❑ Produce user defined network statistics and summaries.

The matrix calculator can be used to implement evaluation methods based on demand and service levels, as well as various types of demand models. In order to automate repetitive, lengthy or complex procedures, EMME/2 includes macro language facilities.

- ❑ Even the most complex travel demand forecasting model can be implemented.
- ❑ Macros can be created on-line in EMME/2, and refined using a text editor.
- ❑ Macros make it easy to transfer models from one application to another.

With its flexible design and continuous development, EMME/2 satisfies the varied and evolving needs of transportation planners all over the world. EMME/2 can be used to address a wide variety of transportation planning problems, from inter-urban highway studies to urban road, public transport and multi-modal studies. Here are just a few examples of the modelling and analysis possibilities:

- ❑ Changes in road and/or transit infrastructure, and socio-economic characteristics
- ❑ Short and long term changes in transportation services
- ❑ Environmental impact and energy consumption
- ❑ Traffic restrictions or privileges; for example trucks, HOV (car pool) lanes, etc.
- ❑ Toll roads (urban, regional or national level)
- ❑ Park-and-ride and other combined trips
- ❑ Smoothing and adjustment of demand matrices
- ❑ Focussing on sub-areas.

EMME/2 has a well-established user base of over 600 organizations on 5 continents.

- ❑ Users' Group Meetings, international and regional, are held regularly.
- ❑ In many countries, INRO's agents provide assistance with new installations, training and ongoing applications.
- ❑ For its international clientele, EMME/2 supports international character sets, plot titles in several languages, and the representation of left-hand traffic. EMME/2 was initially

developed at the Centre for Research on Transportation, at the University of Montreal. The software is now enhanced and distributed by INRO Consultants Inc.

- ❑ EMME/2 is available on PCs (under DOS and Windows), and on many workstations and servers (under UNIX).
- ❑ Applications may have up to 6,000 zones, 48,000 nodes, 120,000 links, 12,000 transit lines and 240,000 transit stops.
- ❑ Strong technical support is provided by phone, FAX or Email. Additional services available from INRO include hands-on training sessions.
- ❑ New releases, which are produced regularly, incorporate enhancements in response to user requests and exploit technological advances.

The primary contact for the EMME/2 software package is:

Dr. Michael Florian, mike@inro.ca

Tel: (514) 369-2023; Fax: (514) 369-2026

2.4 TransCAD

TransCAD is a Geographic Information System (GIS) designed specifically for use by transportation professionals to store, display, manage, and analyze transportation data. TransCAD combines GIS and transportation modeling capabilities in a single integrated platform. TransCAD can be used for all modes of transportation, at any scale or level of detail.

TransCAD provides:

- ❑ A powerful GIS engine with special extensions for transportation
- ❑ Mapping, visualization, and analysis tools designed for transportation applications
- ❑ Application modules for routing, travel demand forecasting, public transit, logistics, site location, and territory management

TransCAD has applications for all types of transportation data and for all modes of transportation, and is ideal for building transportation information and decision support systems. TransCAD runs on readily-available hardware under Microsoft Windows 98, Me, NT, 2000, and XP and embraces virtually all desktop computing standards. This has two important benefits:

- ❑ One can acquire and install TransCAD on a cost-effective basis

- ❑ One does not have to build custom applications or complicated data interchange modules to perform transportation analysis with GIS data

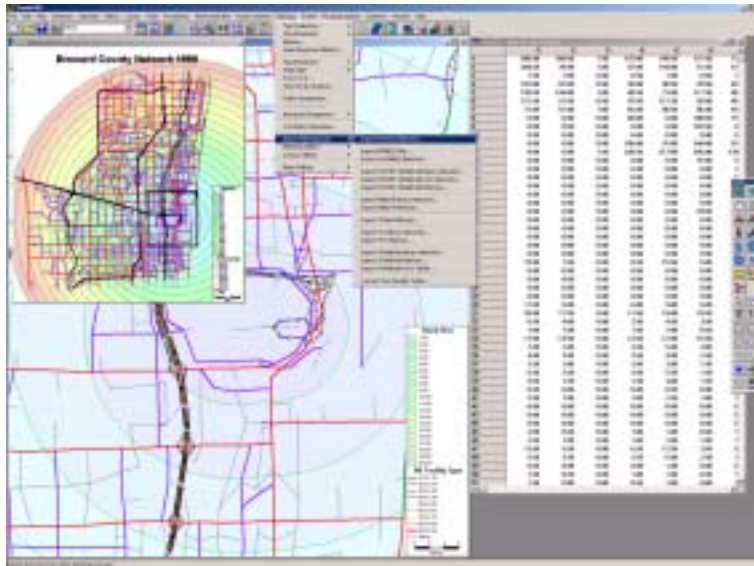


Figure 3.4 TransCAD Screen

TransCAD is a state-of-the-art GIS that one can use to create and customize maps, build and maintain geographic data sets, and perform many different types of spatial analysis. TransCAD includes sophisticated GIS features such as polygon overlay, buffering, and geocoding, and has an open system architecture that supports data sharing on local- and wide-area networks.

TransCAD extends the traditional GIS data model to include transportation data objects such as:

- ❑ Transportation networks
- ❑ Matrices
- ❑ Routes and route systems
- ❑ Linear-referenced data

These extensions make TransCAD a strong data management and analysis tool for working with transportation data. One can use the GIS functions to prepare, visualize, analyze, and present work, and use the application modules to solve routing, logistics, and other transportation problems with great ease and efficiency. Networks and matrices can be of virtually unlimited size.

Transportation Networks are specialized data structures that govern flow over a network. Networks are stored in a highly-efficient way, enabling TransCAD to solve routing problems very quickly. Networks can include detailed characteristics such as:

- ❑ Turn delays or restrictions
- ❑ Overpasses, underpasses, and one-way links
- ❑ Intersection and junction attributes
- ❑ Intermodal or interline terminals, transfer points, and delay functions
- ❑ Zonal centroid connectors
- ❑ Link classifications and performance functions
- ❑ Transit access, egress, and walk transfer links

Matrices hold data such as distance, travel times, and origin-destination flows that are essential for many transportation applications. TransCAD provides functions for creating and manipulating matrices, and tools for spatial analysis and advanced visualization of matrix data. This combination lets one see and understand transportation flows and network characteristics in new and different ways.

Routes and Route Systems indicate paths taken by trucks, rail, cars, buses, or individuals traveling from place to place. TransCAD includes tools to create, display, edit, and manipulate routes, and unique display technology for mapping routes in a clear fashion. One can organize a set of related routes into a single route system layer, and include route attributes, stop locations, and vehicle schedules.

Linear Referencing identifies the location of transportation features as a distance from a fixed point along a route. TransCAD can display and analyze these data sets without conversion, and includes dynamic segmentation functions to merge and analyze multiple linear-referenced data sets. This makes TransCAD a natural choice for the following types of information:

- ❑ Facility infrastructure and operations data
- ❑ Accident locations
- ❑ Pavement or rail condition ratings
- ❑ Traffic flows and transit ridership data
- ❑ Facility alignments
- ❑ Capital project data

With TransCAD, one can create high-quality map output using dozens of thematic mapping styles and options, unlimited colors, and fully-scalable line styles and TrueType map symbols. With a few clicks of the mouse, MapWizard[®] automatic mapping technology helps one create color and pattern coded maps, dot-density maps, scaled-symbol maps, and maps with integrated pie charts and bar charts. TransCAD also provides specialized mapping functions for transportation applications:

- ❑ Automatic display of one-way streets
- ❑ Dynamic map labeling that adjusts to the scale of the map
- ❑ Built-in highway shields that result in maps of publication quality
- ❑ Route system maps that show overlapping routes side-by-side for greater visibility
- ❑ Desire line maps that show region-to-region flows

Additional tools let one visualize data that cannot be displayed using a conventional GIS:

- ❑ Intersection diagrams that illustrate flows and turning movements
- ❑ Strip charts that depict facility characteristics and their variation along a route
- ❑ Interactive tools for editing geographic features and for defining turn restrictions and delays

One can see the data associated with map features in tabular form. One can see data for a single feature, or display data for an entire layer in a dataview. One can use dataviews to add and delete records, edit values, create formula fields, or compute statistics.

Page layout tools help the user to design and create professional presentations that combine the results of any analyses into a single powerful display. The user can print maps and layouts on any printer or plotter, or save them to vector or raster formats. One can also save work as JPEG or PNG files for use on a web page.

One of the best reasons to use a GIS is to unearth and analyze the geographic components of data. One can create bands (buffers) around map features, create districts, define areas of influence, and find shortest paths. TransCAD also makes it easy to overlay and aggregate data and calculate statistics.

One can use TransCAD to ask and answer geographic questions: Where are areas with the highest population density? How many people live within one, two, and three miles of a transit stop? TransCAD answers these and many other types of questions. One can integrate census statistics with local data to identify geographic characteristics that impact the local region and operations. TransCAD can be used to enhance decision making through its GIS functionality.

One can automatically create bands around any number of map features and then analyze the characteristics of those areas. Using TransCAD, one can find out how many customers live within a certain distance of a store, compute the demographic characteristics around potential store sites, analyze the neighborhoods most affected by noise pollution from a highway, or determine accessibility to facilities.

TransCAD lets users join smaller areas into districts and compute the attributes for each one. For example, one can group ZIP Codes together to create sales territories, land parcels to create zoning districts, or city blocks to create school districts. One can also determine the areas closest to a certain facility (e.g., a university or hospital) by building areas of influence, then estimate the attributes within each area to determine areas that are under- or over-served.

With TransCAD, one can analyze and display surfaces on a two-dimensional map or as a 3D map. Users can create contour maps of elevations and then determine the viewshed for any location, either at ground level or at a particular height. For example, one can find areas of weak service from a transmission tower. One can also create surfaces that represent data values, such as measures of air pollution or levels of radon gas, over a geographic region.

Application Modules

TransCAD fully integrates GIS with demand modeling and logistics functionality. There are many reasons why it is valuable to have a GIS as part of a planning or routing and logistics package. First, GIS makes it possible for models to be much more accurate. Network distances and travel times are based on the actual shape of the road network and a correct representation of highway interchanges. Also, with networks one can specify complex road attributes such as truck exclusions, delays at intersections, one-way streets, and construction zones. Second, the

entire modeling process is more efficient. Data preparation is greatly facilitated and the database and visualization capabilities catch errors before they cause problems. A third advantage is the GIS itself. In TransCAD, different modeling equations can easily be derived and applied for different geographic subareas. Similarly, TransCAD brings new and much-needed capabilities for measuring geographic accessibility. Lastly, the GIS approach provides a graphical solution that is easily understood. Users can convey highly technical information to the non-practitioner in a very straightforward and understandable manner.

TransCAD can solve problems of virtually any size. Application modules in TransCAD are fully integrated with GIS functions for improved performance and ease of use. This makes TransCAD ideal for many types of transportation applications including:

- ❑ Network Analysis
- ❑ Transit Analysis
- ❑ Transportation Planning and Travel Demand Modeling
- ❑ Vehicle Routing and Logistics
- ❑ Territory Management and Site Location Modeling

Network Analysis

Network analysis models are used to solve many types of transportation network problems:

- ❑ Shortest path routines can be used to generate the shortest, fastest, or least-costly route between any number of origins and any number of destinations, with any number of intermediate points.
- ❑ Network partitioning can be used to create service districts based on accessibility, perform drive-time analysis, or evaluate possible facility locations. When you perform network partitioning, you can also calculate the network distance or travel time from specific locations.
- ❑ Traveling salesman models construct efficient tours that visit any number of points on a network.

Transit Analysis

TransCAD also has special tools and procedures for creating and working with transit networks. Transit fares can be specified as either flat or zonal. Using transit networks and fare structures,

one can solve shortest path problems and calculate transit path attributes (i.e. skims). One can also have separate and fully integrated networks for non-motorized travel modes. For example, one can include pedestrian links when doing transit network analysis.

Transit networks can also be used for performing transit assignment. One can estimate the number of passengers that utilize links in a transit network as a function of transit level of service. These models produce link level and aggregate ridership statistics. TransCAD includes an array of sophisticated transit network assignment procedures.

TransCAD is the only GIS with specific extensions for public transit. TransCAD can perform data management for complex transit systems and has applications in customer information systems, scheduling, and marketing.

Transportation Planning and Travel Demand Modeling

Transportation planning and travel demand models are used to predict changes in travel patterns and the utilization of the transportation system in response to changes in regional development, demographics, and transportation supply. TransCAD is GIS-based and fully integrates GIS and planning tools for trip generation, trip distribution, mode split modeling, and traffic assignment. TransCAD includes all of the traditional UTPS models, quick response models with reduced data requirements, and advanced disaggregate demand models.

Trip Generation/Production models included with TransCAD estimate the number of trips, by purpose, that are produced or originate in each zone of a study area. Trip Attraction models predict the number of trips attracted to each zone or to a particular land use. Trip Balancing methods are provided so that the number of attractions equals the number of productions. Trip Distribution models are used to predict the spatial pattern of trips or other flows between origins and destinations. Mode Split models are used to analyze and predict the choices that individuals or groups of individuals make in selecting the transportation modes that are used for particular types of trips. P-A to O-D and Time of Day tools enable one to convert productions and attractions to origins and destinations, decompose a 24-hour trip table matrix into hourly trip tables, convert person trips to vehicle trips, and apply peak hour factors.

Traffic Assignment models estimate the flow of traffic on a network and allow one to establish the traffic flow patterns and analyze congestion points. TransCAD provides a full complement of traffic assignment procedures that are used for modeling urban traffic. These procedures include numerous variants that are tailored for modeling transit, as well as intercity passenger and freight traffic.

Advanced Highway Assignment procedures included with TransCAD allow for generalized-cost traffic assignment, HOV assignment, multimode vehicle assignment, multiple user class traffic assignment, combined trip distribution/assignment, and assignment with volume-dependent turning delays and signal optimization.

There is a new master, multimodal equilibrium traffic assignment procedure that simultaneously assigns cars, trucks, and buses to the road network. There can be multiple user classes for cars (e.g. HOV users) as well as different classes (e.g. sizes) of trucks. This procedure includes the option of using exact entrance to exit tolls by vehicle class and differential values of time to be used in calculating generalized cost. Network exclusions keep each class of traffic restricted to the links that it is permitted to use. Some vehicles, such as fixed-route buses, can be pre-loaded on the multimodal network. Among the reporting options is a breakdown of link traffic by vehicle class and type.

Vehicle Routing and Logistics

TransCAD includes a comprehensive library of logistics procedures that apply to all modes of transportation and can be used to solve a variety of logistics problems.

Vehicle Routing/Dispatching

TransCAD provides a set of tools that solve various types of pickup and delivery routing problems. These tools are used to prepare input data, solve the routing problem, and provide tabular and graphical output of the resulting routes and vehicle schedules. The TransCAD procedures can solve many variations on the classic vehicle routing problem, including restrictions on the time when stops can be made, the dispatching of vehicles from multiple depots, and the use of non-homogeneous vehicle fleets. The vehicle routing procedure in TransCAD is also capable of solving problems involving mixed pickup and delivery. Once a

solution is found and the results displayed graphically, users can edit the routes interactively by adding or removing stops. Once stops have been added or removed, users can perform a re-optimization of the route so as to minimize time window violations.

Arc Routing

Arc routing problems are a class of problems that involve finding efficient ways to travel over a set of links in a transportation network. Arc routing has a large number of public and private sector applications, including street sweeping, solid waste collection, snow plowing, mail delivery, and other door-to-door operations. In a typical arc routing problem, people or vehicles are dispatched from one or more depots to traverse a set of service links. The result of an arc routing problem is a set of one or more routes that cover all the service links with the minimal amount of deadheading.

Network Flow and Distribution Analysis

TransCAD includes a set of procedures for solving network flow problems. These problems involve efficient delivery of goods or services, and arise in transportation and many other contexts. The transportation problem involves identifying the most efficient way to service a set of destinations from a set of origins. For example, a company may be interested in finding the least-cost solution for shipping commodities from its warehouses to its vendor locations. The minimum cost flow problem is a more general version of the transportation problem that takes link capacities into account. For example, the procedure can be used to find multiple paths when capacity constraints make it impossible to utilize the shortest path for an entire shipment. Matching problems try to find the best one-to-one matching between two groups of objects where there is some quantitative measure to be minimized or maximized. For example, one can efficiently assign work to service centers.

Territory Management and Site Location Modeling

TransCAD procedures for regional partitioning, clustering, and facility location have broad applications in transportation and marketing. Clustering routines assemble customers, facilities, or areas into groups that are compact and can be serviced efficiently. Districting models group Census tracts, ZIP Codes, counties, or other regions into territories that are compact and

balanced. Location models evaluate the costs and benefits of any number of proposed facility locations.

Territory Definition

TransCAD provides convenient automated procedures for defining territories:

- ❑ Partitioning involves creating groups of features in a layer based on proximity or measures of similarity. The partitioning procedures in TransCAD support applications in service territory alignment, sales and marketing, political redistricting, and many other disciplines. The partitioning model attempts to produce districts that are contiguous, compact, and balanced.
- ❑ Clustering is the grouping of features into compact clusters where there may also be limits on the size of each cluster. You can specify a maximum cluster size or capacity, which limits the number of features assigned to each cluster. The clustering procedure in TransCAD is very flexible and can be used to solve problems in many disciplines such as sales force deployment and vehicle fleet management.

Site Location Analysis

Site location problems involve choosing the best location for one or more facilities from a set of possible locations. TransCAD can address virtually all types of location problems. For example:

- ❑ One may want to determine the number of facilities that are required to guarantee a prescribed level of service. One may also need to account for financial or operational constraints, such as an upper limit on the number of facilities you are able to add, or a fixed budget for adding facilities.
- ❑ Revenues and profits depend on the choice of facility locations. In these cases, one may need to trade off the cost of adding a facility with the potential revenue benefit.
- ❑ One may want to maximize the distance between facilities and the population they serve. Landfills and power plants, for example, are often located relatively far from major population centers.
- ❑ One may want to consider the presence of existing facilities. The locations of these facilities obviously affect the choice of locations for new facilities. In addition, one may want to consider both adding new facilities and closing one or more existing facilities.

Map Data

Data Access: TransCAD lets one create maps using local custom data. One can map data from dBASE files and text files directly, or access data from any ODBC compliant data source such as Access, Oracle, SQL Server, and many others. One can also use raster images such as satellite or aerial photographs directly in maps. These images can be used as a means of reference or in conjunction with the map editing tools to create or edit geographic files.

One can map ArcView Shapefiles, MapInfo TAB files, and Oracle Spatial tables directly. With the built-in translators, one can also import geographic data from other desktop mapping, GIS, and CAD packages, as well as many common file formats.

Geocoding: One can link data to map features or locate data on a map using street address or ZIP Code, or by simply pointing to the correct location. In a few easy steps, one can use local custom data to color code ZIP Codes by sales or display the locations of customers.

GPS: A built-in interface to Global Positioning System (GPS) devices lets one track and record location, and build geographic databases as in real time. With a GPS and a laptop, users in the field can create accurate geographic files of public utilities, corporate facilities, geographic features, and more.

TransCAD provides direct data access for:

- ❑ ESRI Shapefiles
- ❑ MapInfo TAB files
- ❑ Oracle Spatial
- ❑ dBASE/FoxPro/X-base
- ❑ Text and binary data tables
- ❑ Raster files including SPOTView, TIFF, GeoTIFF,
- ❑ Orthophoto, ECW, and MrSID
- ❑ All ODBC sources (including Access, Btrieve,
- ❑ DB2, INFORMIX, INGRES, Interbase, NetWare,
- ❑ SQLBase, SQL Server, Sybase

TransCAD provides import/export support for:

- ❑ ARC/INFO
- ❑ ArcView
- ❑ Atlas GIS
- ❑ AutoCAD DXF
- ❑ Defense Mapping VPF and ITD
- ❑ Digital Line Graph • ETAK MapBase
- ❑ Excel
- ❑ Intergraph DGN
- ❑ MapInfo MIF/MID
- ❑ Ordnance Survey NTF
- ❑ TIGER/Line

TransCAD also provides additional support for:

- ❑ Enhanced Metafile
- ❑ JPEG
- ❑ PNG
- ❑ Windows Bitmap

Application Development Platform

TransCAD includes the Geographic Information System Developer's Kit (GISDKTM). GISDK gives one the tools needed to create a wide variety of products for delivering mapping and geographic analysis capabilities to customers. Over 700 functions can be called from Caliper Script, a complete programming language for designing menus and dialog boxes (including toolbars and toolboxes) and for writing macros. The Caliper Script code is stored in resource files that one can edit with a text editor. One can develop:

- ❑ Add-ins that extend the standard interface to provide new capabilities or that automate repeated operations
- ❑ Custom interfaces that focus the user on the capabilities needed for a particular purpose by extending or replacing the standard TransCAD interface
- ❑ Embedded Desktop Applications that call for TransCAD services to add maps to custom programs.

GISDK contains both a debugger and a compiler.

Add-Ins: Add-ins are macros or dialog boxes that are launched within TransCAD. One can create add-ins to provide end-users with easier access to existing software functions; to add new capabilities to the GIS engine; or to create hooks to custom applications. Add-ins can be freely distributed to any TransCAD user without restriction.

The simplest add-ins are macros that run when they are selected by the user. A sophisticated add-in can display dialog boxes that let the user choose the settings or options to use when the macro is executed. The most flexible and powerful add-ins are custom toolboxes that provide users with push-button access to tools that have been programmed. These toolboxes look like the standard toolboxes used in all Windows applications.

Custom Applications: GISDK lets one create a mapping application program with a custom user interface. Users design the menus, toolbars, toolboxes and dialog boxes, and program the application to respond to user actions in any way they want. One can organize and structure custom applications to appeal to a particular audience. One can create applications that are dynamic and that adapt to the capabilities and authorization level of the user. Custom applications are executed like other Windows programs. Add a program icon to any program group and double click to launch the application.

Embedded Desktop Applications: One can develop desktop applications in Visual Basic, Visual C, C++, or any other language, including another application's macro language (e.g. Excel). When the desktop application requires maps or other services, it can pass requests to TransCAD, called as an Automation Server. TransCAD can transfer maps to a users desktop application through the Windows clipboard using metafiles or OLE objects. One can also use GISDK to pass data back to legacy applications using DDE or information stored in files on disk. If, instead, what is needed is a web server application, one should use TransCAD for the Web.

TransCAD User Services

Caliper Corporation provides a comprehensive program of technical support, training, and consulting services to ensure the success of TransCAD applications. Each TransCAD license

includes technical support via phone, fax, or e-mail, free maintenance releases for a period of one full year, attendance at scheduled seminars and user group meetings, and access to the TransCAD technical support section on the World-Wide Web.

TransCAD includes an extensive documentation set containing background information, step-by-step instructions, and a series of hands-on tutorials. On-line help with tooltips and other on-screen visual cues make TransCAD easy to learn and use. Caliper also offers hands-on training for TransCAD in a classroom setting, or on-site at a client location. Training classes can be customized to a client's specific needs and user group.

Caliper also offers a full range of GIS and transportation software development and implementation services. Transportation and GIS professionals provide assistance in assessing data requirements, database strategy and design, database development, and transportation modeling. Caliper also provides custom application and turnkey system development services.

The primary contact for the TransCAD software package is:

Dr. Howard Slavin, howard@caliper.com

Tel: (617) 527-4700; Fax: (617) 527-5113

CHAPTER IV

STEERING COMMITTEE MEETINGS

1. INTRODUCTION

This chapter provides an overview of the steering committee meetings that were held during the model evaluation process. As mentioned in the second chapter, the first kick-off meeting of the steering committee was held on August 27, 2002. During that meeting, the steering committee defined the roles and responsibilities of steering committee members and teams, outlined the tasks to be undertaken in the project, and the roles and services to be provided by the participating vendors. The remainder of this chapter describes the subsequent steering committee meetings held during the course of the study.

2. STEERING COMMITTEE MEETING: DECEMBER 17, 2002

Following the conclusion of the four vendor workshops, the steering committee met in Tampa on December 17, 2002. A special TRANSIMS seminar was held on December 16 to bring information about the latest modeling developments at the federal level to interested steering committee members. This seminar was offered by the TRANSIMS commercialization team from IBM Consulting Services. Most of the steering committee members were able to attend the seminar and take advantage of the opportunity to learn about the latest status of the TRANSIMS development and implementation effort.

The all-day meeting on December 17 was devoted to a discussion of the results of the four vendor workshops and to identify the follow-up steps that would be undertaken as part of the evaluation study. The meeting started with an open discussion among steering committee members of the merits, strengths, and capabilities of the various software. The steering committee members were very complimentary of the efforts of all four vendors and sincerely appreciated the amount of work that they put into the delivery of high quality workshops. The steering committee members also noted that they were impressed by all of the software products and the advances in modeling technology that have occurred in the recent past. The discussion provided the steering committee members an opportunity to share their personal

opinions and perspectives on the strengths, capabilities, and merits of each software product based on the information they obtained primarily from the two-day workshops. Steering committee members also had access to all of the product literature provided by each vendor. Several steering committee members were able to offer additional information about the capabilities of various software packages based on first-hand experience gained from using the software in real project environments.

Following the open discussion, the steering committee members worked together to define the approach for the additional software evaluation that would be undertaken in the study. In order to focus the work efforts of the consultant team, the steering committee voted to prioritize the four software based on a vote of steering committee members. Each steering committee member was asked to rank order the four software packages on a piece of paper. All of the rankings were then summarized to prioritize the software for the next round of detailed evaluation that would be undertaken as part of the study. The rankings indicated the following prioritization:

1. TransCAD
2. CUBE/TP+/Voyager
3. VISUM
4. EMME/2

Following the tally of the votes, the steering committee voted to proceed with the detailed evaluation of the top two software first (i.e., TransCAD and CUBE/TP+/Voyager) and instructed the consultant team to develop the evaluation methodology and scope. The consultant team offered to implement the 2025 Broward County Model in each of the two packages to evaluate the software on their varied strengths and capabilities. The steering committee endorsed the approach and asked that the vendors be notified of their participation in the detailed evaluation stage of the study. The steering committee noted that VISUM and EMME/2 should be retained in the list at this time as additional evaluation may be undertaken on those packages at a later time depending on the outcome of the evaluation of TransCAD and CUBE/TP+/Voyager.

In addition, the steering committee recommended that a survey be administered to several MPO's and State DOT's to learn about their experiences with various modeling software

packages. The consultant team agreed to design and administer a telephone survey to obtain information that might help the steering committee in its deliberations about relative merits and strengths of alternative software packages.

Following the meeting, Caliper Corporation and Citilabs were informed that additional evaluation of their respective software packages was being initiated and that they should provide any additional information, products, databases, procedures, etc. by January 17, 2003. ITC, Inc. and INRO Consultants were informed that the steering committee is proceeding with the detailed evaluation of modeling software packages and that they will be notified if and when additional information about their respective software packages is needed.

Both Caliper Corporation and Citilabs provided some updated materials by the January 17, 2003 deadline. Following the receipt of all of the materials, the consultant team of the steering committee was given specific assignments with regard to the testing and evaluation of TransCAD and CUBE/Voyager. The assignments were as follows:

CUBE/TP+/Voyager Assessment Team

- ❑ Reproduce 2025 Broward Model Highway Assignment Process & Results Using Available Trip Tables - Rob Schiffer
- ❑ Reproduce 2025 Broward Model Transit Assignment Process & Results Using Available Trip Tables - Mike Dougherty & Wade White
- ❑ Demonstrate Selected Utilities, Analyses & Specialized Functions - Dan Macmurphy

TransCAD Assessment Team

- ❑ Reproduce 2025 Broward Model Highway Assignment Process & Results Using Available Trip Tables - Ken Kaltenbach
- ❑ Reproduce 2025 Broward Model Transit Assignment Process & Results Using Available Trip Tables - Arturo Perez & Tom Rossi
- ❑ Demonstrate Selected Utilities, Analyses & Specialized Functions - William Roll

The assessment teams spent a good part of January and February of 2003 performing the tests and incorporating the Broward 2025 model files into the respective software technologies. The

vendors provided technical support and assistance to the consultant assessment teams on an as-needed basis.

2. STEERING COMMITTEE MEETING: FEBRUARY 20, 2003

The steering committee met again on February 20, 2003 in Orlando to listen to the presentations of the consultant assessment team, discuss the results of the consultant team assessment process, and outline the next steps in the evaluation study. On February 19, 2003, the consultant team members and vendors loaded computer systems with the software and sample model files and databases. Interested steering committee members were given the opportunity to work hands-on with the two software and learn about their features and strengths.

On February 20, 2003, the full steering committee meeting started with presentations by the consultant team members. The consultant team members presented the work that they had done using each of the two software packages and provided insights into the features and strengths of the packages. The presentations continued throughout the morning session and into the early part of the afternoon. Following the presentations, each of the two vendors was invited to provide a 30-minute presentation updating the steering committee on recent software developments since the vendor workshop in Fall 2002.

Following the formal presentations, the steering committee members discussed the strengths and merits of each software package. After the discussion, the steering committee members were asked to vote for the software package of their choice by allocating 10 points between the two software packages, TransCAD and CUBE/Voyager. Each steering committee member was also asked to note the team (MPO, District, or consultant) to which he/she belonged.

The results of the vote are summarized in Tables 4.1 and 4.2. The first table named "Vote – 10 Point Scheme" provides the results of the vote according to the 10 point allocation scheme adopted at the meeting. Both TransCAD and CUBE received exactly the same total raw points (110 each). After normalizing the scores to account for different sample sizes in each steering committee group and scaling to a base total of 100 points, TransCAD received 49.3 points while CUBE received 50.7 points.

Table 4.1 Results of Vote – 10 Point Allocation Scheme

	TransCAD	CUBE
MPO Team	5	5
	2	8
	4	6
	6	4
	6	4
	10	0
	6	4
	3	7
MPO Raw Total	42	38
MPO Normalized Average	52.5	47.5
District Team	7	3
	5	5
	6	4
	0	10
	4	6
	3	7
District Raw Total	25	35
District Normalized Average	41.7	58.3
Consultant Team	4	6
	3	7
	4	6
	7	3
	7	3
	2	8
	8	2
	8	2
Consultant Raw Total	43	37
Consultant Normalized Average	53.8	46.3
Grand Raw Total	110	110
Sum of Normalized Averages	147.9	152.1
Final Normalized Average	49.3	50.694

Table 4.2 Results of Vote – Rank Scheme

	TransCAD	CUBE
MPO Team	1	1
	2	1
	2	1
	1	2
	1	2
	1	2
	1	2
	2	1
MPO Total	11	12
MPO Average	1.4	1.5
District Team	1	2
	1	1
	1	2
	2	1
	2	1
	2	1
District Total	9	8
District Average	1.5	1.3
Consultant Team	2	1
	2	1
	2	1
	1	2
	1	2
	2	1
	1	2
	1	2
Consultant Total	12	12
Consultant Average	1.5	1.5
Grand Raw Ranking Total	32	32
Sum of Average Rankings	4.4	4.3
Final Normalized Avg	1.46	1.44

A few steering committee members wondered whether the 10 point allocation scheme may have skewed the voting results if, for example, votes of 10 to 0 were cast. The second table named "Voting – Rank Scheme" examines this issue by simply ranking the software 1 or 2 depending on the points awarded in the 10 point allocation scheme. For example, if a member

gave 6 points to TransCAD and 4 points to CUBE, then TransCAD was given a rank of 1 and CUBE was given a rank of 2. If a member gave 5 points to each software, then both software were ranked 1. These numerical rankings were then added up for each software. Interestingly enough, the raw total score obtained by each software is exactly the same at 32 points. After normalizing and scaling the rankings as in the previous worksheet, TransCAD obtained a rank of 1.46 while CUBE obtained a rank of 1.44. In general, it appears that any lopsided point allocations favored both software equally (for example, each software had one 10 to 0 vote in its favor). In summary, the vote resulted in a clear tie with both software ranked equally by the steering committee.

The steering committee then discussed how the information from the evaluation process can be most effectively presented to the model task force for further action. After some discussion, the steering committee passed the following motions:

First, the steering committee voted to “recommend to the Model Task Force that both TransCAD and CUBE are equally effective in meeting the planning and modeling needs of the state of Florida and that the Central Office be given the flexibility to negotiate with both software vendors to work out the best arrangement for the modeling community in the state”.

Second, the steering committee voted to “have steering committee members provide Suraya Teeple their comments in the form of pros and cons on each of the software packages considered in the model evaluation study. Suraya will work in collaboration with Ram Pendyala to summarize the pros and cons on each software for presentation to the full Model Task Force”.

3. ADDITIONAL NOTES RELATED TO STEERING COMMITTEE

- Following the February 20 steering committee meeting, all steering committee members were asked to provide their comments to Suraya Teeple as soon as possible and no later than March 10, 2003.

- The steering committee approved the formation of a Model Task Force presentation subcommittee consisting of Suraya Teeple, Ram Pendyala, Ken Kaltenbach, and Rob Schiffer.
- The steering committee went through a small transition during the period between the December and February meetings. Wade White had excused himself from all model evaluation steering committee related activities as he accepted a major leadership position with Citilabs, Inc., the vendor for the CUBE suite of products. Hence, he was absent at the February 19-20 steering committee meeting in Orlando and did not participate in the voting process. Steering committee members took the opportunity to thank Wade for his dedicated service on the steering committee and looked forward to his continued participation in the modeling activities of the state in his new position.
- In February 2003, Dr. Michael Florian of INRO Consultants requested that all EMME/2 software packages/bundles be returned to him as soon as possible. Even though he understood that EMME/2 had not been completely eliminated from consideration, he had concluded that it is very unlikely that Florida will adopt EMME/2. All steering committee members were asked to return the EMME/2 software packages/bundles to Huiwei Shen or Ram Pendyala as soon as possible. In addition, steering committee members were given the option to bring the EMME/2 software to the next Model Task Force meeting.
- In order to conduct the user survey, the vendors were asked to provide a list of references. The project team received a list of five references from each of the two software vendors. A full report describing the survey instrument, survey administration process, and results of the survey are provided in the next chapter.
- Based on some of the communications following the February 20 steering committee meeting, a draft agenda for presentations to the full Model Task Force was circulated as follows:
 - Model Evaluation Study – Introduction, Background, Description of Process, Steering Committee Recommendation (45 min) *Ram Pendyala*

- Presentation of TransCAD and CUBE – Software Demonstrations, Relative Strengths, and Software Functionality and Performance (1 hour) *Ken Kaltenbach & Rob Schiffer*
- Summary of Comments and Pros and Cons on Software Packages (20 min)
Suraya Teeple
- Presentation on Agency/User Survey (20 min) *Ram Pendyala*
- Summary and Conclusions – Final Steering Committee Recommendation (20 min)
MTF Tri-Chairs

The next few pages of this chapter provide the agendas of the steering committee meetings.

Future Direction for Florida's Transportation Models

Florida Statewide Model Task Force Model Evaluation Project Steering Committee

AGENDA

Tuesday, August 27, 2002

- | | | |
|----------|---|----------------------------------|
| 8:30 AM | Introductions | |
| 8:45 AM | Role and Significance of Steering Committee | MTF Tri-Chairs
Bob McCullough |
| 9:00 AM | Study Objectives and Overall Approach | |
| 9:30 AM | Developing List of Vendors/Packages | |
| 10:10 AM | Break | |
| 10:30 AM | Schedule of Activities | |
| | <ul style="list-style-type: none">▪ Project Schedule▪ Steering Committee Meetings▪ Model Task Force Meetings▪ Vendor Demos/Training Sessions (with Locations) | |
| 11:00 AM | Specifications for Vendor Training Sessions | |
| 11:45 AM | WORKING LUNCH BREAK | |
| 12:00 PM | Overview of Work Scope | |
| 12:30 PM | Commence Discussions on Each Task of Work Scope | |
| | Items for Discussion: | |
| | <ul style="list-style-type: none">▪ Roles and responsibilities of:<ul style="list-style-type: none">○ Vendors○ Consultants/Study Team○ Steering Committee○ Model Task Force○ Blue Ribbon Panel▪ Methodology to be Adopted for Task▪ Desired Outcomes/Outputs of Task▪ Time and Resource Requirements by Task | |

12:30 PM Task 2: Characterization of Modeling Software Packages
1:00 PM Task 3: Conduct Survey
1:20 PM Task 4: Analyze Survey Data
1:40 PM Short Break
1:50 PM Phase II: Benchmarking Study
2:50 PM Next Steps – Action Items
3:00 PM Closing Remarks and Adjourn

Future Direction for Florida's Transportation Models

Florida Statewide Model Task Force Model Evaluation Project Steering Committee

AGENDA

Tuesday, December 17, 2002

8:30 AM	Welcome and Opening Remarks	MTF Tri-Chairs Bob McCullough
9:15 AM	Status Review of Model Evaluation Study	
10:00 AM	Break	
10:20 AM	Proposed Methodology for Evaluation of Modeling Packages	
11:20 AM	Definition of Model Performance Measures/Criteria <ul style="list-style-type: none">• Quantitative Measures• Qualitative Measures	
11:50 AM	LUNCH	
1:00 PM	Defining and Designing Evaluation Instruments <ul style="list-style-type: none">• Surveys• Evaluation matrices• Descriptive feedback/comments	
2:00 PM	Methodology for Scoring/Rating/Measuring Performance of Modeling Packages	
2:30 PM	Break	
2:50 PM	Roles, Responsibilities, and Task Assignments of Steering Committee Members	
3:30 PM	Next Steps – Action Items <ul style="list-style-type: none">• Desired deliverables and deadlines• Future Meeting Schedule and Agenda	
4:00 PM	Closing Remarks and Adjourn	

Future Direction for Florida's Transportation Models

Florida Statewide Model Task Force Model Evaluation Project Steering Committee

AGENDA

Embassy Suites, 8250 Jamaican Court, Orlando, FL 32819

Ph: 407-345-8250; Fax: 407-352-1463

Thursday, February 20, 2003

8:30 AM	Welcome and Opening Remarks	MTF Tri-Chairs
8:45 AM	Overview of Consultant Team Assignments	Rob Schiffer
9:00 AM	2025 Broward Model Highway Assignment Process <ul style="list-style-type: none"> ▪ CUBE/Voyager ▪ TransCAD 	Rob Schiffer Ken Kaltenbach
10:00 AM	Break	
10:20 AM	2025 Broward Model Transit Assignment Process <ul style="list-style-type: none"> ▪ TransCAD ▪ CUBE/Voyager 	Arturo Perez/ Tom Rossi Mike Doherty
11:20 AM	Special Utilities, Functions, and Applications <ul style="list-style-type: none"> ▪ CUBE/Voyager ▪ TransCAD 	Dan Macmurphy William Roll
12:00 Noon	LUNCH	
1:15 PM	Special Requests from Steering Committee (Special requests not covered by consultant team will be transmitted to vendor; vendor will be provided time to prepare a demo in response to the special request)	Consultant Team
2:15 PM	Break	
2:30 PM	Vendor Presentations <ul style="list-style-type: none"> ▪ TransCAD ▪ CUBE/Voyager 	Caliper Corporation Citilabs
3:30 PM	Steering Committee Discussion	
4:30 PM	Adjourn	

CHAPTER V

USER SURVEY

1. INTRODUCTION

At the request of the steering committee, the project team conducted a survey of transportation planning agencies around the country to learn about user experiences with various travel demand modeling software packages. This section describes the survey procedures and summarizes the results of the survey.

2. SURVEY OBJECTIVES

The objectives of the survey were to obtain information on:

- ❑ user experiences with and perceptions of Cube/TP+/Voyager and TransCAD
- ❑ the level of effort required for model conversion and software transition
- ❑ ratings of selected vendor and software characteristics
- ❑ plans for software transition(s)
- ❑ other tools used in conjunction with modeling software.

Thus the survey was intended to provide a wealth of data that could assist the steering committee in the model evaluation process.

3. SURVEY SAMPLE

The survey sample included references provided by the vendors and additional contacts provided by several members of the steering committee. After combining the lists of contacts from the vendors and the steering committee members, the final survey sample included the following agencies:

- ❑ Denver Regional Council of Governments
- ❑ Alabama Department of Transportation
- ❑ Southern California Association of Governments
- ❑ Las Vegas, Nevada
- ❑ Iowa Department of Transportation

- ❑ North Central Texas Council of Governments
- ❑ San Francisco Bay Area Metropolitan Transportation Commission
- ❑ City of Charlotte
- ❑ Ohio Department of Transportation
- ❑ Wasatch Front Regional Council (Salt Lake City, Utah)
- ❑ North Carolina Department of Transportation
- ❑ Baltimore Regional Council
- ❑ Metropolitan Washington Council of Governments
- ❑ Atlanta Regional Commission

Of the 14 agencies included in the survey sample, one agency did not provide any feedback regarding travel demand modeling software packages. Of the remaining 13 agencies, seven provided feedback on TransCAD while six provided feedback on Tranplan/CUBE/TP+. No agency had adopted Voyager at the time of the survey in March 2003 and therefore no feedback was obtained for Voyager.

4. SURVEY ADMINISTRATION

The survey was administered through the month of March 2003. The survey was administered via the telephone and all answers and comments were recorded verbatim. Repeated call-backs and e-mail messages were used to obtain the participation of agencies in the survey. Only one agency, that requested not to be identified, refused to participate in the survey. All of the other agencies identified by the vendors and/or steering committee members were contacted and responses to the survey were obtained.

The telephone administration method was found to be effective as it provided a means by which additional probing questions could be asked and customized discussions could be conducted. In addition, it allowed the respondents to freely provide comments without having to burden them with the need to transcribe their comments. All transcription was done by the person administering the survey. The survey was administered by a team of researchers at the University of South Florida College of Engineering.

5. SURVEY FORM

The survey form included all of the questions that were asked of the respondents. The respondents never received the survey form in advance, although a few respondents requested that the survey form be e-mailed to them while it was being administered to them on the phone. The remainder of this section constitutes the blank survey form used by the survey research team for administering the survey.

FLORIDA STATEWIDE MODEL TASK FORCE SURVEY OF TRAVEL MODEL USERS

CONTACT INFORMATION

Name: _____ Position: _____

Organization: _____

Address: _____

Phone: _____ Fax: _____

Email: _____

1. Travel demand modeling software package used currently:

2. For how many years have you used this software package?

If answer to question 2 is greater than 5 years, jump to Qn. 6.
Otherwise continue with Qn. 3.

3. What modeling software package did you use previously?

Reasons for switching to modeling package currently in use:

4. Who performed the conversion of databases, procedures, and other model components for you?

5. How well does the current package replicate previous procedures and results?

Please rate the following on a scale of 1 – 5 for your previous package and your existing package where 1=poor, 2=fair, 3=good, 4=very good, 5=excellent/outstanding. In addition to a numerical rating, please provide comments/notes to explain your numerical rating.

No.	Item	Previous Package Name:	Existing Package Name:
1	Vendor Training		
2	Vendor Support		
3	Vendor Response to Requests for Customized Procedures		
4	Vendor Response Time		
5	Graphical Display Capabilities		
6	Quality of Documentation		
7	Ease of Use		
8	Software Stability, Robustness, Forward/Backward Compatibility		
9	Learning Curve/Time		
10	Flexibility of Software to Accommodate Specialized Procedures		
11	Overall Satisfaction level		

6. Do you plan to switch to a new modeling software package within the next 1-5 years?

If so, which one?

Reasons for switching to a new modeling package within the next five years:

7. Who will perform the conversion of databases, procedures, and other model components for you?

8. How well do you expect procedures and results from your current package to be replicated in the new package?

Please rate the following on a scale of 1 – 5 for your existing package and for the new package that you plan to adopt within the next 1-5 years where 1=poor, 2=fair, 3=average/good, 4=very good, 5=excellent/outstanding. In addition to a numerical rating, please provide comments/notes to explain your numerical rating.

No.	Item	Existing Package Name:	Proposed New Package Name:
1	Vendor Training		
2	Vendor Support		
3	Vendor Response to Requests for Customized Procedures		
4	Vendor Response Time		
5	Graphical Display Capabilities		
6	Quality of Documentation		
7	Ease of Use		
8	Software Stability, Robustness, Forward/Backward Compatibility		
9	Learning Curve/Time		

10	Flexibility of Software to Accommodate Specialized Procedures		
11	Overall Satisfaction level		

Additional Comments/Notes:

.....

6. SURVEY RESULTS

Survey results were compiled in aggregate form so that individual respondents and agencies could not be identified. This section provides a summary of the survey results that was made available to the project steering committee members for their consideration.

Table 6.1 provides a summary of the average numerical ratings obtained by the software on various criteria. The scale used for the ratings is as follows:

- 1 = poor
- 2 = fair
- 3 = good
- 4 = very good
- 5 = excellent/outstanding.

It should be noted that the sample sizes available in this survey are very small. Therefore, the average user ratings shown in the table should be interpreted largely in a qualitative manner rather than a quantitative one. No statistical tests have been conducted to compare the average user ratings between the two software because of the very small sample sizes.

Table 5.1 Average User Ratings of Modeling Software

Item	Caliper	Citilabs	Difference	Winner
Graphical Display Capabilities	4.9	4.2	0.7	Caliper
Documentation	4.1	3.5	0.6	Caliper
Ease of Use	4.6	4.3	0.3	Caliper
Training Classes	4.5	4.4	0.1	Caliper
Overall Satisfaction	4.4	4.6	-0.2	Citilabs
Software Stability, Robustness, Forward/Backward Compatibility	4.7	4.9	-0.2	Citilabs
Technical Support	4.3	4.8	-0.5	Citilabs
Learning Curve/Time	4.4	4.4	0.0	Tied
Flexibility	4.6	4.6	0.0	Tied

From the table, it can be seen that users generally rate both software very well. TransCAD appears to hold an edge with regard to graphical display capabilities, ease of use, and documentation. On the other hand, Citilabs appears to hold the edge with respect to software stability and compatibility and technical support. In general, however, it is found that both software show virtually identical ratings on the various criteria.

Comments from Citilabs (Tranplan/CUBE/TP+) Users

The following is the listing of comments obtained from Citilabs product users:

- ❑ The transition to CUBE/TP+ was a seamless migration from Tranplan. It constituted a natural migration path as all of these packages belong to the same family of programs.
- ❑ We were able to replicate previous procedures and results very well.
- ❑ We will upgrade to Cube/Voyager at earliest opportunity.
- ❑ TransCAD is used in our agency for some post-processing work and display/mapping purposes.
- ❑ Data import/export is very smooth in TransCAD. TransCAD also comes with much ready to use census data and analysis tools.
- ❑ We had to move to TP+ to overcome some memory and problem size limitations that were in the previous software (primarily MINUTP).
- ❑ We already have strong ESRI based GIS enterprise in place. We don't need another one in the form of TransCAD.
- ❑ We have had very good luck interfacing TP+ with ESRI Arc environment.
- ❑ When we considered TransCAD a few years ago, there did not seem to be many metro areas using it.
- ❑ The scripting language in TransCAD appeared harder to master.
- ❑ Data and model conversions to new software mostly done in-house with vendor support and very little consultant support; however, Florida may be different.
- ❑ We found slight differences when replicating previous model results possibly due to integer/floating point computations.
- ❑ We are very happy with TP+ and enjoy their great technical support; transition from Tranplan to TP+ appears easier than transition from Tranplan to TransCAD.
- ❑ TP+ is the best piece of software in the world; Viper is an outstanding network editing/display system.

- ❑ Citilabs is now a well-organized company; they are better than they used to be.
- ❑ TP+ is better than TransCAD for complex modeling tasks needing specialized procedures.
- ❑ TransCAD has bugs; that makes it hard to do things out of the norm.
- ❑ Citilabs has great tech support; they provide amazingly fast response time.
- ❑ Library of user scripts/examples on website is useful resource even though documentation is deficient.
- ❑ Viper is excellent for network editing/path checking.
- ❑ Citilabs provides strong transit modeling capabilities with TRIPS methodologies.
- ❑ Tranplan is still the best travel model out there; everybody still uses it.
- ❑ Training classes were excellent; but they tended to be held in regional centers for several states combined.
- ❑ We will stick with Tranplan until we hear about user experiences with TP+/Cube/Voyager.
- ❑ Florida is a trailblazer in travel demand modeling; we look to Florida for guidance.
- ❑ We looked at TransCAD too; it does provide very nice GIS integration.
- ❑ Citilabs is working towards GIS integration and so we stuck with the same vendor during our model transition process for continuity.
- ❑ TransCAD is only PC-based; we have a very complex model working in a Unix environment.
- ❑ We are in the process of combining EMME/2 with Tranplan. We use Viper for network editing.
- ❑ EMME/2 is a very good software and INRO Consultants provide free training; others charge thousands of dollars.
- ❑ We have high-end experienced modelers; we don't need graphics-based software.
- ❑ We can not provide numerical ratings; user perceptions of software features are purely subjective and depend largely on the level of expertise of the respondent.

Comments from Caliper Corporation (TransCAD) Users

- ❑ We are migrating from Tranplan to TransCAD to keep up with software/hardware advances.
- ❑ We were concerned over continued support and development of Tranplan.

- ❑ The integrated GIS capabilities in TransCAD are a big plus; it was a major factor in our decision to adopt TransCAD.
- ❑ TransCAD communicates very well with other modeling software and GIS products; the import/export features work very well.
- ❑ TransCAD is very versatile; it can be used by high-end model developers to sketch planning end users.
- ❑ GISDK programming script provides excellent flexibility.
- ❑ Documentation is great; professors should use TransCAD manuals as textbooks in travel modeling courses.
- ❑ Caliper does all of the first-cut model/data/network conversions for you; this makes your transition process very smooth.
- ❑ We were able to replicate previous models and results reasonably well; model comparison is hard to do because we changed model when adopting TransCAD.
- ❑ Caliper provides outstanding training classes that are very state-of-the-art.
- ❑ Don't bother calling/sending e-mail to standard tech support lines; go straight to Jim, Paul, or Howard for help because they are great.
- ❑ TransCAD needs an undo button.
- ❑ Caliper is very responsive to special requests and needs; they are very fast to fix the occasional bug.
- ❑ Caliper has very hard working and knowledgeable staff.
- ❑ New folks out of school like the GIS-based graphical aspects; but people used to Tranplan perceive that TransCAD has a longer learning curve
- ❑ The jury is still out; we are in the process of learning/implementing TransCAD and we have had bumps along the way.
- ❑ Tranplan users may become disoriented when using TransCAD because it has a very different user interface.
- ❑ People tend to stay with TP+ or Cube simply because of inertia.
- ❑ TransCAD has very strong graphics capabilities; moving into the modern age motivated us to adopt TransCAD.
- ❑ The quality of tech support depends on the person you get; always go to Jim Lam – he is great.
- ❑ TransCAD will do anything for you.

- ❑ TransCAD has many user inputs/knobs; you need to be careful to make sure you are doing it right.
- ❑ Graphical display capabilities abound in TransCAD, but reporting capabilities are deficient.
- ❑ Sometimes it feels like a GIS with a model appended to it.
- ❑ When we adopted TransCAD, we checked out EMME/2; it looked too complicated.
- ❑ We chose TransCAD from among several packages (EMME/2, TP+, TRIPS) based on written proposals; committee overwhelmingly supported TransCAD.
- ❑ We had to go through fair amount of work to get transit layers right.
- ❑ We will be acquiring Transmodeler (microsimulation) tool when available.
- ❑ Our statewide model is TransCAD based; there are many useful tools to tie into statewide inventory databases.
- ❑ A move into the GIS world and a desire for a more graphical user interface motivated choice of TransCAD.
- ❑ Take your time in the model software transition process; it is a major undertaking.
- ❑ We have used TransCAD for 12 years since Version 1.0.
- ❑ There is great backward/forward compatibility; the vendor able to fix any issues quickly.
- ❑ There are lots of tools useful to end user practitioners.
- ❑ We have been able to replicate previous Tranplan models very well; it is very important to replicate model results for air quality conformity.
- ❑ Caliper can make TransCAD do anything you want; go straight to Caliper for any specialized requests.
- ❑ There is no need to move files across quasi-osmotic membranes; all-in-one package to take reports/displays straight to decision-maker/public.
- ❑ Citilabs is playing catchup to TransCAD.
- ❑ Citilabs has too many products, components, and pieces that user has to throw together and make them work.
- ❑ We chose TransCAD in model evaluation process involving EMME/2, TP+/Viper, and TransCAD.
- ❑ TransCAD has great graphical capabilities; it uses simple database technology and the matrix manipulation and printing capabilities are a big plus.
- ❑ In TransCAD, one is able to customize/present/analyze data effectively.

7. CONCLUSIONS FROM SURVEY

The survey provided valuable information to the study steering committee and the model task force regarding user perceptions and experiences with Citilabs products and Caliper products. In general, the survey showed that the state would be well served by either product line as users conveyed positive perceptions about both software products. It can be seen that Caliper product users like Caliper products and vice versa. At the same time, Citilabs product users like Citilabs products and vice versa. Thus, even though the survey provided a measure of reassurance that both software products are suitable and powerful travel demand modeling tools, it did not provide a means by which the two software products could be clearly distinguished with respect to their suitability for adoption in Florida.

CHAPTER VI

CONCLUSIONS AND RECOMMENDATIONS

1. INTRODUCTION

This chapter provides a summary of the steering committee evaluation and the subsequent conclusions and recommendations developed by the model task force for consideration by the Florida Department of Transportation Systems Planning Office. As mentioned earlier in the report, both CUBE/Voyager and TransCAD were shortlisted for detailed evaluation by the consultant team of the steering committee. A summary of the consultant team's evaluation is presented in this chapter. Following this summary, the resolutions of the model task force are presented as the recommendations coming out of this study. Finally, the transition plan being developed by the Systems Planning Office is included in this chapter.

2. CUBE/VOYAGER AND TRANSCAD

The summary of the evaluation fo CUBE/Voyager and TransCAD by the steering committee is presented in this section.

Network Editor

CUBE/Voyager	TransCAD
<ul style="list-style-type: none"> ▪ Uses Viper by default ▪ Alternately, can check box to automatically link to ArcGIS for editing and analysis of networks; Citilabs is an ESRI partner ▪ Unlimited number of layers now in Viper ▪ Network files can be saved from Viper as TRANPLAN, TP+/Voyager, TRIPS, ESRI shape, or Windows Metafile formats ▪ Network editor fully integrated with Applications Manager 	<ul style="list-style-type: none"> ▪ GIS Based with no size limitations ▪ Can import/export a wide variety of file formats ▪ Attributes are database tables; can be joined to other databases ▪ Attributes can be updated using scripts and external C++ programs ▪ Has specialized tools for improving network accuracy and quality ▪ Includes interactive editing, heads up digitizing, image registration, and tools for separating centerlines into two roadways, changing the directionality of links, conflating links to more accurate locations, and interchange tools that create standard interchanges

Future Change Flexibility

CUBE/Voyager	TransCAD
<ul style="list-style-type: none"> ▪ Cube Base allows for full model integration & database input ▪ Supports five different TDF model software platforms: TRANPLAN, TP+, TRIPS, MINUTP, and Voyager ▪ Inputs and outputs are interchangeable among these software platforms (i.e., import TRANPLAN export TP+) ▪ Voyager understands TP+ scripting and naming conventions ▪ Can interface with external programs ▪ Long-Range Plan for development of additional programs & processes 	<ul style="list-style-type: none"> ▪ Models, GIS and databases are integrated ▪ Wide choice of model methods ▪ ITE rates & NCHRP data built in ▪ Designed for disaggregate models in which the unit of prediction is the household or individual rather than the zone ▪ Can estimate logit and regression models ▪ Can interface with external programs ▪ Scripting language includes a built-in debugger

Vendor Support

CUBE/Voyager	TransCAD
<ul style="list-style-type: none"> ▪ Offices (number of staff): <ul style="list-style-type: none"> ○ Washington, D.C. Office (1) ○ San Francisco (9) ○ London (9) ○ Numerous distributors worldwide ▪ Total of 20+ support staff ▪ Citilabs staff are very familiar with FSUTMS. Mike Clarke authored several of the original FDOT Model Update reports that led to FSUTMS. Victor Su has provided Viper support to FSUTMS users since the mid-1990s. Wade White has over 10 years of FSUTMS experience. 	<ul style="list-style-type: none"> ▪ Boston and D.C. Offices ▪ All support staff and development in the US ▪ TransCAD is supported by a team of 30 professionals most of whom have advanced degrees in transportation, operations research, and computer science. Caliper staff are nationally known for their expertise in transportation modeling and have numerous publications to attest to this fact. Many Caliper staff did Ph.D. theses on travel choice models and traffic assignment methods ▪ Average length of service for Caliper staff is approximately 9 years

Emerging Methods Flexibility

CUBE/Voyager	TransCAD
<ul style="list-style-type: none"> ▪ Flexible: implements a wide variety of models, including OD matrix estimation ▪ Incorporates some European Methods ▪ DYNASIM -- 3-D Micro-Simulation package including all modes of transportation; can include buildings, etc. ▪ CARGO -- freight modeling software ▪ LAND -- land use forecasting model 	<ul style="list-style-type: none"> ▪ Flexible: implements a wide variety of models, including OD matrix estimation ▪ Designed for disaggregate models in which the unit of prediction is the household or individual rather than the zone; this includes activity-based models ▪ The STEP2 model includes population synthesis, residential location choice, work

<ul style="list-style-type: none"> ▪ PROJECT – program designed for traffic impact analysis ▪ COMPACT – simplified four-step model process for small urban areas ▪ IMPACT – designed for air quality, environmental impact assessment ▪ CITIQUEST – survey design software 	<p>location choice, trip frequency and destination choice models, as well as disaggregate nested logit models</p> <ul style="list-style-type: none"> ▪ Can support parcel or block face land use or trip generation models ▪ Time-of-day models are common in TransCAD ▪ Traffic microsimulation under development
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Modal Alternatives Analysis

CUBE/Voyager	TransCAD
<ul style="list-style-type: none"> ▪ Voyager has an advanced Public Transport module ▪ Automatically generates walk and highway access links ▪ Buffering around lines or stops ▪ Boardings and alightings can be displayed with bar graphs ▪ Viper will now automatically split transit network links when editing highway network; prompts for stop or network node ▪ Barriers can be coded in scripting by restricting access to specific nodes or can develop process within ArcGIS ▪ Walk access is typically based on airline distance but can develop sidewalk links – future improved process via ESRI 	<ul style="list-style-type: none"> ▪ Includes a pathfinder that uses fares in determining the best paths ▪ Transit stochastic equilibrium assignment with crowding, capacity limits ▪ Handles local and express service, joint bus-rail assignments, etc. ▪ Model coefficients can be estimated using multiple linear regression, binary logit, and multinomial logit ▪ Can model non-motorized trips ▪ Used by FHWA to develop the freight analysis framework traffic flows and is used by FRA for its railroad network analysis ▪ Used for freight modeling in several areas; Corradino is using it for a freight model in Michigan

Ability to Produce Results

CUBE/Voyager	TransCAD
<ul style="list-style-type: none"> ▪ Several updates each year with continual improvements over a 20+ year period; history of model development dates back to original TRANPLAN and MINUTP ▪ Standard or predominant package in: FL, CA, GA, AL, UT, AZ, PA, OH, VA, MD, NJ, IL, CT, WI, MO, MN, OK, SD, ND, ID, MT, SC, VT, ME, HI, DE ▪ More than 125 MPOs use Citilabs products as the basis for their current models, including all MPOs in the state of Florida ▪ Includes tools for Census data access, survey processing and tabulation, creation of cross-classification tables, computation 	<ul style="list-style-type: none"> ▪ Several updates each year with continual improvements over a 14 year period ▪ Standard or predominant package in: LA, TX, MS, RI, MA, MT, NY, MI, IA, IN, NC, AR, NV, WY, NE, KY, CO, TN ▪ Approximately 125 MPOs have acquired TransCAD for travel forecasting in the last few years and another 25 or so use it for some other aspect of transportation planning ▪ Includes tools for Census data access, survey processing and tabulation, creation of cross-classification tables, computation of statistics on model variables, methods

<p>of statistics on model variables, trip table estimation for roads and transit, and tools for microsimulation, freight, land use forecasting, and impact analyses</p> <ul style="list-style-type: none"> ▪ Negotiating with another vendor to include a wealth of Census data and geographic data 	<p>for visualizing tours and other travel patterns, trip table estimation for roads and transit, and tools for computing LOS</p> <ul style="list-style-type: none"> ▪ Includes a wealth of Census data and geographic data
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Peak Spreading and Time of Day Modeling

CUBE/Voyager	TransCAD
<ul style="list-style-type: none"> ▪ Can handle time-of-day and peak spreading models; such models have been implemented for several MPOs ▪ New and special techniques can be implemented in the scripting language and in external programs 	<ul style="list-style-type: none"> ▪ Can handle time-of-day and peak spreading models; such models have been implemented for several MPOs ▪ New and special techniques can be implemented in the scripting language and in external programs

Other Software Interface

CUBE/Voyager	TransCAD
<ul style="list-style-type: none"> ▪ Applications Manager, included with Cube Base, is used to design, edit, and execute models based on flow diagram interface ▪ Scenario Manager helps organize multiple alternatives ▪ Compatible with Efficient Transportation Decision Making (ETDM) ▪ IMPACT program specifically designed for air quality analysis; interfaces with EMIS and Mobile 6 as well ▪ ESRI Interface – can import/export and directly open shape files and use ArcGIS as editing and analysis tool (alt. to Viper) ▪ Enhanced visual displays both through Viper and ArcGIS interface ▪ Microsimulation model now available 	<ul style="list-style-type: none"> ▪ Graphic interface can be used by non-technical staff ▪ Compatible with Efficient Transportation Decision Making (ETDM) ▪ Can be linked with EMIS and Mobile 6 ▪ ESRI Interface – can import/export and directly open shape files ▪ Graphics outputs makes it easy to combine tabular output, maps, and charts in page layouts for reports and large displays ▪ OLE enabled so that graphics and text in reports and PowerPoint can be automatically updated when data change ▪ Microsimulation model under development

Display

CUBE/Voyager	TransCAD
<ul style="list-style-type: none"> ▪ Completely Windows compliant; can print 	<ul style="list-style-type: none"> ▪ Completely Windows compliant; can print

<ul style="list-style-type: none"> and plot to any Windows device ▪ Colors and line types limited only by your output device and eyes ▪ Interfaces with GIS, via ESRI link ▪ Displays junction-based information such as intersection photographs, turn lanes, signalization types and phasings ▪ Can display raster maps and aerial photos as layers 	<ul style="list-style-type: none"> and plot to any Windows device ▪ Colors and line types limited only by your output device and eyes ▪ Completely integrated GIS; TransCAD relies on GIS and topology for some of its modeling power ▪ OLE enabled so that graphics and text in reports and PowerPoint can be automatically updated when data change ▪ Can display raster maps and aerial photos as layers
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Model Feedback

CUBE/Voyager	TransCAD
<ul style="list-style-type: none"> ▪ Feedback methods can be used for trip distribution/mode choice/traffic assignment ▪ Can incorporate economic / land use feedback; examples include Atlanta and Salt Lake City travel demand models ▪ Can consider intersection and traffic signal details in the traffic assignment process (junction-based assignment) 	<ul style="list-style-type: none"> ▪ Has feedback method for trip distribution / mode choice / traffic assignment ▪ Can incorporate economic / land use feedback; Corradino has built SLAM into the Indianapolis model ▪ Can consider intersection and traffic signal details in the traffic assignment process

GIS Functionality

CUBE/Voyager	TransCAD
<ul style="list-style-type: none"> ▪ Uses ESRI GIS as an alternative to Viper for input, display, and output ▪ Users have the choice, depending on familiarity, to produce visual displays and analyses with Viper or ArcGIS ▪ Complete ESRI functionality is available with interface to Arc environment 	<ul style="list-style-type: none"> ▪ Seamless GIS integration ▪ Maintains topology for all GIS objects ▪ Spatial analysis tools, including joins, buffers, overlays, and rubber sheeting; can translate between map projections on the fly ▪ Joins can be based on geography or values of attributes, or combinations of both ▪ Selection of features by location and values

GIS Analysis Capabilities

CUBE/Voyager	TransCAD
<ul style="list-style-type: none"> ▪ Geocoding via ESRI linkage 	<ul style="list-style-type: none"> ▪ Includes geocoding and address matching

<ul style="list-style-type: none"> ▪ Census JTW mapping and analyses ▪ Survey processing via CITIQUEST ▪ Overlay and estimate data using different zone systems ▪ Translate projections ▪ Estimate walk buffers ▪ All GIS functionality including rubber-sheeting/alignment, conflation, etc. ▪ Automated transit access plus ESRI shape file conversion to network ▪ Estimate impacts of corridors, e.g., relocations, wetlands 	<ul style="list-style-type: none"> on the fly ▪ Build zonal data from Census and surveys ▪ Overlay and estimate data using different zone systems ▪ Translate projections ▪ Estimate walk buffers ▪ All GIS functionality including rubber-sheeting/alignment, conflation, etc. ▪ Use street and sidewalk databases to directly create transit access links, and show pedestrian, auto and bus movements ▪ Estimate impacts of corridors, e.g., relocations, wetlands
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Processing Speed (Dell 2.8 GHz Processor, 1 GB RAM)

CUBE/Voyager	TransCAD
<ul style="list-style-type: none"> ▪ Florida Freight Model Assignment (4,059 zones, 2 iterations) 5 min, 32 sec 	<ul style="list-style-type: none"> ▪ Florida Freight Model Assignment (4,059 zones, 1 iteration) 6 min, 36 sec

Data Conversion

CUBE/Voyager	TransCAD
<ul style="list-style-type: none"> ▪ Can directly run Tranplan/FSUTMS models in CUBE 	<ul style="list-style-type: none"> ▪ Can directly import networks and matrices from Tranplan/FSUTMS ▪ Can read FSUTMS ASCII files

Hardware and Memory Requirements

CUBE/Voyager	TransCAD
<ul style="list-style-type: none"> ▪ No other software required ▪ Windows 2000/XP/NT ▪ Desktop PC's now available under \$1,000 can run CUBE well 	<ul style="list-style-type: none"> ▪ No other software required ▪ Windows 2000/XP/NT ▪ Desktop PC's now available under \$1,000 can run TransCAD well

Data Management and Version Control

CUBE/Voyager	TransCAD
<ul style="list-style-type: none"> ▪ Scenario Manager – toggle back and forth between alternatives ▪ Applications Manager – user interface for editing, display, model development, and execution with flow diagrams ▪ Voyager and TP+ scripting is generally interchangeable 	<ul style="list-style-type: none"> ▪ Includes scripts for a user interface for models that facilitate scenario management ▪ Caliper scripts can handle complex directory structures ▪ Can be a simple directory structure for each alternative

▪ Not limited by 8.3 file names	▪ Not limited by 8.3 file names
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Operating System

CUBE/Voyager	TransCAD
<ul style="list-style-type: none"> ▪ CUBE is completely compatible with Microsoft's latest OS and procedures, including C++ compiler 	<ul style="list-style-type: none"> ▪ TransCAD is completely compatible with Microsoft's latest OS and procedures, including C++ compiler

Report Generation

CUBE/Voyager	TransCAD
<ul style="list-style-type: none"> ▪ Flexible ▪ *.PRN files generated from each model step (akin to FSUTMS *.OUT files) ▪ Standard statistics automatically generated such as trip end summaries and average trip lengths ▪ All network-related steps automatically generate minimum, maximum, average, total and RMS of all attributes 	<ul style="list-style-type: none"> ▪ Has numerous built-in reports, and more are being added ▪ All model run data sent to log files ▪ Log files can be redirected ▪ Any desired report can be generated with scripts ▪ Can be linked with report generators like Crystal Reports

Matrix and Link Calculators

CUBE/Voyager	TransCAD
<ul style="list-style-type: none"> ▪ All mathematical functions are executable within scripting ▪ User-defined decimal precision ▪ Link data can be joined to other databases, such as counts and traffic signal inventories via ESRI & Viper ▪ Matrices can be displayed, edited, transposed, imported and exported All matrix operations can be done interactively or through scripts ▪ Matrices can be accessed from C++ and Fortran 	<ul style="list-style-type: none"> ▪ Interactive calculator can be applied to matrices, links, zones and nodes ▪ Complex operations can be applied with scripts ▪ Link data can be joined to other databases, such as counts and traffic signal inventories ▪ Matrices can be displayed, edited, transposed, imported and exported; all matrix operations can be done interactively or through scripts ▪ Matrices can be accessed from C++ and Fortran

Ease of Use

CUBE/Voyager	TransCAD
<ul style="list-style-type: none"> ▪ Flowchart Based 	<ul style="list-style-type: none"> ▪ Windows Pull Down Menus

<ul style="list-style-type: none"> ▪ Powerful scripting ▪ Wizards/Templates – automated building of basic script; right click for list of parameters and enter values ▪ Allows for easy transition from existing FSUTMS as Viper & Applications Manager interface with TRANPLAN ▪ Model applications can be as simple or complex as desired 	<ul style="list-style-type: none"> ▪ Powerful scripting ▪ Built in recorder builds scripts from an interactive session ▪ Scripts provide custom- Windows dialogs for model applications ▪ Model applications can be as simple or complex as desired
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Spatial Aggregation in Zones and Network

CUBE/Voyager	TransCAD
<ul style="list-style-type: none"> ▪ Zone polygons can be aggregated based on any attribute, automatically producing a new layer or coverage via ESRI link ▪ Attributes can be summed, averaged, etc. ▪ Networks can be simplified based on any attribute ▪ Networks can use dynamic segmentations and route systems via ESRI link 	<ul style="list-style-type: none"> ▪ Zone polygons can be aggregated based on any attribute, automatically producing a new layer or coverage ▪ Attributes can be summed, averaged, etc. ▪ Networks can be simplified based on any attribute ▪ Networks can use dynamic segmentations and route systems

3. MODEL TASK FORCE RECOMMENDATIONS

The model task force met on March 27, 2003 to consider the findings of the study steering committee and develop recommendations regarding the future of travel demand modeling in the state.

During the model task force meeting on March 27, 2003, several presentations were made. These include:

- ❑ An Overview of the Model Evaluation Study
- ❑ Live Demonstration of the CUBE/Voyager Software Package
- ❑ Live Demonstration of the TransCAD Software Package
- ❑ Results of the User Survey
- ❑ Overview of CUBE/Voyager and TransCAD Software Packages
- ❑ Results of the Steering Committee Vote

After considering all of this information, the model task force noted that the study steering committee has essentially deemed both software equally effective from a technical viewpoint.

Therefore, the model task force felt that additional information related to cost, technical support, product updates, and vendor service is needed before a final recommendation can be made to the Central Office. The model task force passed the following resolutions:

Motion 1: The model task force recommends that the Central Office adopt a single software package as the primary engine for FSUTMS.

Motion 2: The model task force directs the Central Office to negotiate with both vendors and report back to the model task force with information so that the model task force may select the primary FSUTMS engine at its next meeting.

Motion 3: The model task force directs the Central Office to work collaboratively with MTF Tri-Chairs (3) and Committee Chairs (6) to identify the list of specific issues/items/parameters to be considered in negotiations and for which information should be gathered for presentation to the model task force at its next meeting.

The model task force decided to hold its next meeting as a half-day session on the afternoon of May 15, 2003. This meeting commenced with an overview summary presentation of the entire model evaluation study as well as a recap of the model task force resolutions from the March 27, 2003 meeting. Then, a presentation summarizing the cost proposals from each vendor was made by the Central Office as per the request of the model task force. After all of the information was presented, the model task force held a vote where each member voted in favor of one package or voted both equally. The vote resulted in 19 members voting in favor of TransCAD, 10 in favor of CUBE/Voyager, and one in favor of both equally. Following the tally of the votes, the model task force unanimously passed a resolution recommending to the Central Office that TransCAD be adopted as the new primary travel demand modeling software engine for FSUTMS. In addition, the model task force urged the central office to develop a rapid transition plan wherein all agencies would receive copies of the TransCAD software package, training classes would be held across the state, and conversions of existing FSUTMS models to the new TransCAD environment would be accomplished as quickly as possible.

4. TRANSITION TO TRANSCAD

The transition to TransCAD is now well underway. The statewide freight and passenger travel demand models are being migrated to the new TransCAD environment. In addition, all local and regional models and databases/networks are being migrated to TransCAD. A customized version of TransCAD, specifically developed to serve Florida's transportation planning needs, is going to be distributed to all public agencies in Summer 2003.

The Central Office is developing a schedule for holding training courses and delivering the new software to public agencies. A questionnaire providing agencies the opportunity to express their desires with respect to timing and location of training classes and receipt of the new software has been distributed. After the questionnaires are collected, the input received will be used to hold training classes and transmit the software in the most effective manner possible.

Appendix A

Presentation to Model Evaluation Study
Steering Committee: August 27, 2002

Appendix B

Presentation to Model Evaluation Study
Steering Committee: December 17, 2002

Appendix C

Presentation to Model Task Force:

March 27, 2003

Appendix D

Presentation of Results of User Survey:
March 27, 2003

Appendix E
Presentation to Model Task Force:
May 15, 2003

Appendix F

Information Sent to Public Agencies:

June 15, 2003

Appendix G

Presentation to Model Task Force on
CUBE and TransCAD
