

# Modeling applications conference to be held in October

by Huiwei Shen, AICP, FDOT Systems Planning Office

The 1997 Florida Transportation Modeling Applications Conference will be held October 6-8, 1997 at the Daytona Beach Hilton Oceanfront Hotel in Daytona Beach Shores, Florida. The FDOT Systems Planning Office is sponsoring this opportunity for Florida transportation

professionals to discuss new transportation modeling techniques and other modeling-related issues. In addition to presenting technical information to transportation modeling practitioners, the conference will also provide transportation policy directions from both the federal and state levels. This two-day (two half-days plus one full day) conference will begin at 1:00 pm on Monday, October 6, 1997 and end at 12:00 noon on Wednesday, October 8, 1997.

The conference program will emphasize practical, innovative, and timely modeling and policy approaches to transportation planning. Some of the topics under consideration for inclusion on the agenda include the following:

- ISTE/NEXTEA requirements
- Federal Travel Model Improvement Program (TMIP) progress
- Freight modeling and goods movement studies
- Air quality conformity update
- Innovative data collection methods
- GIS for transportation modeling: FSUTMS/ArcView integration
- Interactive FSUTMS users' manual
- Intelligent Transportation Systems Modeling
- Generalized nested logit model for FSUTMS
- Variable factors and multiple BPR curves
- Toll Facilities Model update
- Land use and transportation model integration
- Access Management Standards
- FDOT Level of Service Manual
- Site Impact Handbook

### Accommodations

The conference will be held at the Daytona Beach Hilton Oceanfront Hotel. The hotel is located at 2637 South Atlantic Avenue, Daytona Beach Shores, Florida 32118. Single or double occupancy rooms are available to conference attendees for \$67.00 per night. The rate is guaranteed through September 19, 1997; rooms after that date are on a space-available basis at

## Model Task Force Technical Team to meet following the conference

To reduce travel expenses, the Model Task Force Tri-chairs have called for a meeting to be held in conjunction with the Modeling Applications Conference. The Technical Team will meet on Thursday, October 9, 1997 from 8:30 am to 3:30 pm. The MTF Subcommittees for Trip Generation, GIS and Transit are scheduled to meet on Wednesday afternoon, October 8, 1997, from 1:30 pm to 4:30 pm to prepare for presentations to the Model Task Force the following morning.

the prevailing room rates. Hotel reservations should be made directly through the Hilton at 800-525-7350.

### Conference Registration

There will not be a registration fee for attending the conference. To assist us with preparations, however, all participants are encouraged to register with the Systems Planning Office. Registration is requested by September 19, 1997. Please mail or fax your name, address, and telephone and fax numbers to Huiwei Shen at the address below, letting her know of your intention to attend.

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 Systems Planning Office  
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## FDOT Site Impact Handbook distributed

by Pete Tyndall and Terrence Corkery, AICP, FDOT Systems Planning Office

The FDOT Systems Planning Office, in conjunction with district site impact coordinators, completed development of a Site Impact Handbook this past April. This handbook provides guidance to FDOT district staff in the review of developments of regional impact (DRIs), local government comprehensive plan amendments and other traffic impact studies for proposed development sites.

During the past two months, over 500 copies of a draft version of the handbook have been distributed at a series of orientation workshops

offered in each district. These workshops, conducted jointly by the central and district offices, were attended by district management and technical staff, as well as planners from local governments, MPOs and other agencies. The workshops were held to provide an overview of the handbook and to answer technical questions concerning its use.

The Site Impact Handbook, in its current form, is intended to be a pilot document to be put into use for approximately a six-month period. After this trial period, revisions will be made in response to comments submitted by site impact study reviewers throughout the state.

A detailed training workshop will be offered in three or four months after initial comments regarding the draft handbook are received. This training will teach accepted methodologies and to address transportation impacts related to site development. This training will focus on analysis methods for level of service, access management, proper application of travel models, and mitigation requirements.

For information on obtaining a copy of the Site Impact Handbook, call Pete Tyndall at the Systems Planning Office: 850/922-0448.

## Census household data tabulations to be updated

by Christy Palin, Post, Buckley, Schuh & Jernigan, and Terrence Corkery, Systems Planning Office

Last year, FDOT Central Office Systems Planning contracted with the U.S. Census Bureau to prepare a set of special census

tabulations reflecting the ZDATA1 requirements of GEN and several variations on a lifestyle trip generation model. These tabulations were provided for every MPO area in Florida based on census block/TAZ equivalencies previously provided to the Census Bureau. Additional equivalency files were developed for Florida's MPO areas newly established by the 1990 Census.

block/TAZ equivalency tables to the Systems Planning Office by the end of September 1997. It is anticipated that another round of special tabulations will be conducted later in 1998 for MPOs that have not yet completed zone splits. Please contact Terry Corkery for information on the specific format required for the equivalency tables: 850-488-9746 or SunCom 278-9746.

## Program ensures adequate count coverage for two-digit networks

by: Wade White, Gannett Fleming, Tampa

Wade White of Gannett Fleming has developed a utility program to help check for adequate traffic count coverage with the new double-digit facility type and area type coding. The program is written in FORTRAN and operates on DOS, X32 and UNIX platforms. A copy of the compiled program with a default label file is available on the FSUTMS bulletin board. The program can also help identify facility types and area types that do not have a do not appear in the label file which may have been mis-coded in the highway network file. The only criterion to use the program is that the network must be double-digit. If the network contains geographic location codes (GL), summaries can be generated for individual subareas. Call Wade with any questions or comments: 813-882-4366.

During the past year, a number of MPOs have begun preparing for their next plan updates. As part of this effort, many MPOs have been revising their traffic analysis zone boundaries. At the same time, several non-MPO counties have initiated contracts for model development and validation studies. In response to recent requests, FDOT Systems Planning is beginning preparations for another round of census tabulations using updated TAZs.

Census tabulations will be developed for those counties with new or updated TAZ equivalency files. Two types of tabulations will be created: new lifestyle and standard GEN trip generation stratifications. These files may be used for ZDATA1 development in upcoming model validation efforts.

Any MPOs that have completed zone splits and other TAZ modifications for an upcoming model validation may wish to be included in this next round of census tabulations. MPO planners should work with the appropriate FDOT district modeling coordinator to submit updated census

## Tampa Bay Users Group goes online

by Richard Ranck, TBFGU Secretary  
Transportation Engineering, Inc.,

Starting in September, the Tampa Bay FSUTMS Users Group is expected to have a working web site that will inform members of future planning events, meetings and goings on. In essence, it will serve as an online version of the users group's newsletter. It will also contain an updated membership listing with e-mail and company site links, as well as links to transportation planning-related sites.

The tentative URL is:  
[www.concentric.net/~Rranck/tbfgu.htm](http://www.concentric.net/~Rranck/tbfgu.htm).

Further information may be obtained by sending e-mail to [richard.ranck@tei-fl.com](mailto:richard.ranck@tei-fl.com).

# Feds applaud FDOT's activity-based modeling research

by Bob McCullough, P.E., FDOT Systems Planning Office; and Ike Ubaka, AICP, FDOT Public Transit Office

The Research Center of the Florida Department of Transportation recently allocated funds for a multi year initiative aimed at developing and testing a multimodal activity-based travel demand modeling system. The research effort will be directed by Dr. Ram M. Pendyala, assistant professor in Civil and Environmental Engineering at the University of South Florida in Tampa. The project is expected to commence within the next few months and continue for a period of four years. The project consists of a short-term phase to be completed within the first two years and a long-term phase to be completed in the ensuing two years.

The U.S. Department of Transportation, which is the primary sponsor of the Travel Model Improvement Program (TMIP) at the national level, recognized the significance of the FDOT research initiative and expressed an interest in working more closely with FDOT in the area of activity-based modeling. To this end, the U.S. Department of Transportation invited the FDOT research team to meet with TMIP officials and discuss the ongoing and future FDOT research efforts in activity-based modeling. The meeting was held from 1 pm to 5 pm on July 24, 1997 at the USDOT building in downtown Washington, D.C.



The meeting was attended primarily by individuals who play a key role in the Travel Model Improvement Program. The attendees included:

- Fred Ducca, Federal Highway Administration (FHWA)
- Ron Fisher, Federal Transit Admin. (FTA)
- Sam Zimmerman, FHWA
- Ed Weiner, Office of the Secretary
- Ken Vaughn, FTA
- Brian Gardner, FHWA
- Jerry Everett, FHWA
- Robert Czerniak, Visiting Faculty to FHWA
- Elaine Murakami, FHWA
- Robert Noland, Environmental Protection Agency
- Kim Fisher, FHWA

Bob McCullough, in his opening presentation, provided a broad overview of the institutional structure that supports travel model improvement efforts within the state of Florida. He described the statewide model task force and emphasized the decentralized nature of its composition and function. He also provided an overview of the strategic initiatives that the FDOT Central Office has been pursuing in the research arena to be consistent with the directions set forth by the federal TMIP.

In the next presentation, Ike Ubaka described efforts being made in Florida to improve the state of the practice in transit systems modeling. He discussed the challenges associated with transit planning and modeling and identified modeling needs that are unique to the transit industry. He outlined several key limitations of traditional travel demand modeling procedures with respect

to their ability to model transit systems and, in closing his presentation, noted that any new generation of modeling systems should overcome those limitations. He described several ongoing transit modeling research initiatives that constitute a significant component of the state's overall travel model improvement efforts.

Finally, Ram Pendyala made a presentation describing the methodological approach underlying the development and implementation of a multimodal activity-based modeling tool for the state. Activity-based time use and travel behavior data are going to be collected in Dade County and Volusia County in the Fall of 1997. The ensuing model development and implementation effort will use the activity-based data to estimate and validate various model components. In the short term, an activity-based model of trip generation and trip chaining will be interfaced with FSUTMS. In the long term, a more comprehensive activity-based travel model will be developed in conjunction with TRANSIMS, the next generation of travel modeling tools under development at the Los Alamos National Laboratory (LANL).

The meeting proved to be a great success with all of the attendees commending the efforts of the state in the area of activity-based travel modeling. The U.S. Department of Transportation and TMIP offered a strong vote of confidence and approval of the research initiatives being undertaken by FDOT. The meeting concluded with a unanimous call for a close cooperative relationship between FDOT and TMIP in the development and implementation of activity-based travel modeling tools.

## Federal TMIP prepares for next phase of TRANSIMS

by Ram M. Pendyala, Civil and Environmental Engineering, University of South Florida

For the past two years, the Los Alamos National Laboratory (LANL) has spearheaded the development of a new generation of travel demand modeling tools called TRANSIMS. This effort, being undertaken within the overall scope of the USDOT's Travel Model Improvement Program (TMIP), is aimed at developing an integrated set of travel and air quality forecasting tools that can be applied under a wide range of operational, policy, and multimodal conditions.

During the course of the developmental effort, LANL is undertaking interim operational tests of model components as they are completed. These

tests, referred to as IOCs (Interim Operational Capabilities), provide a means by which LANL can assess the performance of model components under real-world conditions. The first component developed and tested was the Traffic Flow Microsimulator, which simulates the movements of vehicles and travelers on a multimodal network. Dallas-Fort Worth served as the IOC test site for this component. This IOC study is now completed and LANL is now getting ready to move to the next phase of TRANSIMS development and testing.

The model component to be developed and tested

next is the Intermodal Route Planner. Given a set of activity engagement needs and preferences, the Intermodal Route Planner generates daily activity and travel plans that satisfy those needs. The planner is able to determine the sequence, timing, and linking of activities over a 24 hour period. Based on these activity engagement patterns, route plans that would allow an individual to undertake the activity pattern are generated. The route planner can adjust route plans to account for delays or other factors that may warrant changing the activity pattern. Portland, Oregon has been chosen to be the IOC test site for this component of TRANSIMS. At this time, it is

anticipated that the IOC test will get underway within the next two or three months and continue for about one year.

In preparation for the IOC, TMIP has invited a few individuals with expertise in activity-based modeling of travel behavior to a brainstorming workshop session to be held September 4 and 5 in Los Alamos, New Mexico. The workshop is intended to provide an opportunity for LANL to get informed about the various activity-based modeling approaches that have been or are being developed around the country. LANL will use discussions at the workshop session as the basis

for the development of the activity-based model to be adopted in TRANSIMS. In addition to myself, the following individuals have been invited to participate in the workshop:

Fred Ducca, Federal Highway Administration  
Sam Zimmerman, Federal Highway Administration  
Ron Fisher, Federal Transit Administration  
Ken Vaughn, Federal Transit Administration  
Mark Simons, Environmental Protection Agency  
Frank Koppelman, Northwestern University  
Eric Pas, Duke University

Konstadinos Goulias, Pennsylvania State University

Keith Lawton, Portland Metro  
Mark Bradley, Mark Bradley Consulting and Research

The TRANSIMS project team will be represented by LaRon Smith, Richard Beckman, Chris Barrett, and Kai Nagel.

Further information on TRANSIMS and TMIP is available at the web site, <http://tmip.tamu.edu> or by contacting Lynette Engelke at the Texas Transportation Institute (which is coordinating TMIP outreach activities) at (817) 277-5503.

## Model Task Force approves new highway network procedures

by Huiwei Shen, FDOT/Central Office; Rob Schiffer and Wiatt Bowers, PBS&J Tallahassee

New standards and procedures for coding and validating FSUTMS highway networks were approved by the Model Task Force Technical Team at their April 9, 1997 meeting in Orlando. Adoption of a two-digit highway network methodology is the culmination of a year-long project entitled "The HNET Procedural Enhancements Study." Approval was given to new two-digit area type and facility type definitions, validation input speeds and capacities, and other capacity-related model parameters (variable UROAD factors and BPR curves).

Two-digit area types, approved by the MTF, were the same as those recommended by the task force's HNET Subcommittee and were based largely on area types developed for the Tampa Bay RTA. Changes were made to the recommended two-digit facility type definitions in the 90-99 category (toll facilities) due to the specific needs of toll modeling.

Two sets of input validation speeds were approved: the first (HNET speeds) based on network validation tests carried out for the Jacksonville, Pensacola, and Indian River models, and the second (SERPM speeds) based on speeds used in the SERPM model which reflect mid-block free-flow speeds documented in the FDOT Level of Service Manual. HNET speeds reflect typical travel conditions along a corridor including the deceleration, delay and acceleration that result from signalization. Applying HNET speeds in three test areas resulted in validated networks without extensive effort in friction factor adjustments. On the other hand, SERPM speeds are closer to the posted speeds and are generally higher than the HNET speeds. The MTF recognized that use of the SERPM speeds may require adjusting friction factors and using congested skins as input to trip distribution in order to achieve

better validation results.

Capacities approved by the MTF were developed from the 1995 FDOT LOS Manual Tables 5-1 through 5-3, entitled "Generalized Peak Hour Directional Volumes." LOS "E" volumes from these tables were converted to capacities per lane for compatibility with FSUTMS. Capacities for default facility types (FT 10, 20, etc.) assume LOS Manual signal spacing densities are greatest for CBDs, followed by Fringe and OBD, residential, and rural (in that order). The adopted input capacities are compatible with the latest revisions to the Highway Capacity Manual.

To fully realize the advantages of a two-digit coding methodology, other capacity-related parameters such as UROAD factor and BPR curves were also examined. The UROAD factor is used to convert roadway capacity (LOS E) to a "practical capacity" at which trip diversions occur. Validation testing indicated that model performance was generally best when using practical capacity values based on a hybrid of LOS C/D. A default file of variable UROAD factors was adopted by the Model Task Force to be used as a starting point for model validation efforts. (It should be noted that according to the LOS Manual, LOS C is not achievable for certain roadway categories. It was also found that, in some instances, capacities based on LOS C from the LOS Manual would be far too low relative to the earlier Model Update Task C capacities.)

Use of LOS E capacities with a set of variable UROAD factors enables greater flexibility during model validation, as congestion levels and the LOS at which trips divert may vary by different facility type and area type groupings and from one urban area to another.

Another capacity-related model enhancement is the recommendation of applying multiple BPR curves. The rationale behind this recommendation is that speed/delay relationships (and levels of trip diversion) differ by facility type. Final validated BPR curves (grouped into four categories of facility type) from the SERPM IV model are recommended as a starting point for future validation efforts where the application of BPR curves is desired.

Efforts are currently underway by the Urban Analysis Group to incorporate multiple CONFAC, UROAD, and BPR values, by facility type, within an optional input file named VFACTORS.yya. Values included in the VFACTORS file will be used to replace the default values when the tilde (~) character under the VARIABLE FACTORS statement in PROFILE.MAS is deleted. Tests of this new feature are currently being performed by the Systems Planning Office.

Work is proceeding on producing the HNET Technical Report and the HNET Users Manual. Copies of the new two-digit area type and facility type codes and definitions may be obtained by contacting Huiwei Shen at (850)488-4642. A copy of new default SPDCAP, UROAD, and BPR files may be obtained from the FSUTMS Bulletin Board. Suggested two-digit plot control files are also available from the FSUTMS Bulletin Board. Questions and comments on implementation of the new HNET procedures are always welcome.

## D-4 study recommends new employment data sources

By Shi-Chiang Li, FDOT/District 4; Rob Schiffer and Christy Palin, PBS&J/Tallahassee

The FDOT/District 4 ZDATA2 study is nearing completion. The study, whose goal is to evaluate, recommend, and develop alternate procedures for producing base year and future year FSUTMS ZDATA2 files is in its final phase. Base year ZDATA2 files for each MPO area within District 4 have been developed, and land use forecasting methodologies are presently being applied.

Base year ZDATA2 files prepared for Broward and Palm Beach Counties are currently being used as input to model validation studies presently underway by FDOT/District 4. Previous articles in *Florida Transportation*

*Modeling* described procedures used for address matching and ZDATA2 development in these two counties. In recent months, efforts have been focused on Indian River, St. Lucie and Martin Counties. As with Broward and Palm Beach Counties, base year ZDATA2 files for these northern three counties are being developed using 1996 Contacts Influential data along with ES-202 data for comparison and validation purposes.

The three northern counties, Indian River, St. Lucie and Martin Counties, required different approaches to address matching and developing ZDATA2 files. An enhanced 1995 TIGER/Line file was obtained from the county property appraiser's office for Indian River County. St. Lucie and Martin Counties did not have enhanced street network files, so the 1995 TIGER/Line files were used to address-match the data for these counties. The 1995 TIGER/Line files were incomplete in several areas, specifically along the US 1 corridor requiring manual matching of unmatched records by MPO staff. Once the address-matching process was complete, a preliminary ZDATA2 file was developed for each county.

The data validation process identified issues to be addressed for each county. In Indian River County, many businesses in the Sebastian area were assigned TAZs in Vero Beach. This error was attributed to coding of the street network file, and was corrected by manually matching those addresses assigned to incorrect TAZs.

A second issue was low service employment totals for Martin and St. Lucie Counties. Contacts Influential did not provide employment information for many public sector organizations in these two counties, so the data were supplemented with employment totals obtained from MPO staff.

One final issue, occurring in all three counties, was that industrial/agricultural employment totals were low when compared with the 1990 FSUTMS ZDATA2 file and the ES-202 totals. This under reporting was caused by incomplete information on citrus industry employment. A report entitled *Citrus Highway Corridor Planning and Design Report* was used to obtain the missing employment information. This report, produced in 1993, focused on providing a better transportation system for the citrus industry in these three counties. ZDATA2 files were developed.

Mike Brown, of Transportation Planning Services, is presently refining the two land use models selected for analysis in this study to meet the individual needs of each county. The ZDATA2 Technical Review Committee decided to use the Urban Land Use Allocation Model (ULAM) and the Simplified Land Allocation Model (SLAM), for development of future year ZDATA2 files. The completed 1996 ZDATA2 files will be used as the base year for land use models. All necessary input data have been collected for each county. The land use models will be validated for each county, and adjustments will be made as necessary. Mike Brown, of Transportation Planning Services, is presently refining the two land use models selected for analysis in this study to meet the individual needs of each county. The ZDATA2 Technical Review Committee decided to use the Urban Land Use Allocation Model (ULAM) and the Simplified Land Allocation Model (SLAM), for development of future year ZDATA2 files. The completed 1996 ZDATA2 files will be used as the base year for land use models. All necessary input data have been collected for each county. The land use models will be validated for each county, and adjustments will be made as necessary.

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## Southeast Florida Users Group news

At our last meeting on September 4, Rob Schiffer from PBS&J's Tallahassee office made a presentation on the Statewide Model and its applications.

The next meeting will be a training course on the X-32 version of SERPM-IV by Ken Kaltenbach of The Corradino Group. The class will be held on November 7, 1997 from 9:00 to 3:30. Space is limited so contact Shi-Chiang Li at (954) 777-4655 to reserve your place.

The Lifestyle Trip Generation Report "Enhanced FSUTMS Trip Generation Model" (August 1997) is now available. For copies, send your request to Shi-Chiang Li at FDOT District Four.

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## Over 60 attend FDOT freight modeling workshop

by Terrence Corkery, AICP, Systems Planning Office

In the past, travel models have focused primarily on passenger trip forecasts with little attention paid to freight movement. In keeping with FDOT's mission of ensuring the safe and efficient movement of people and goods, the Department is emphasizing the need to analyze truck traffic and other freight carriers in Florida's travel forecast models. In an important first step towards implementing a freight traffic methodology within Florida's standard model (FSUTMS), the Systems Planning Office conducted a freight modeling workshop, May 5-7

in Daytona Beach.

The workshop, attended by transportation modelers and planning policy makers from throughout Florida, presented a mix of policy issues and technical applications pertaining to freight movement forecasts. Stefan Natzke and Dane Ismart from the FHWA Headquarters Office and Alan Horowitz of the University of Wisconsin-Milwaukee were the main presenters at the two-and-a-half day workshop.

The initial methodology for modeling commercial truck traffic will be based on FHWA's Quick Response Freight Modeling procedures. Although these procedures are based on national averages, data specific to Florida's MPOs will eventually be developed. As more refined methods of quantifying truck traffic emerge, public agencies will be able to work in partnership with freight carriers to resolve congestion problems that increase the cost of delivering goods.

# District Four implements enhanced GEN model

by: Shi-Chiang Li, FDOT (District 4) and Kenneth D. Kaltenbach, Sunil Saha and Sridhar Ramasami, Carr Smith Corradino

## Background Study and Modified Trip Production Structure

The trip generation model (GEN) was one of the first pieces of the FSUTMS process that was developed. Work on the GEN model began in the late 1970's, and was based on survey data collected in the 1960's and 1970's. While FSUTMS has provided a consistent and accessible modeling process for Florida MPOs, the state-of-the-art has progressed and new data, techniques and more powerful computers have become available. Repeated application of the GEN model has identified deficiencies, especially in Southeast Florida. These deficiencies show up as too many trips from retirement communities, and other model inaccuracies. All too often traffic from the retirement communities appears as work trips paired with employment locations.

In response to this issue, District 4 decided to examine alternative trip generation models. In a research study conducted in cooperation with the FAU/FIU Joint Center for Environmental and Urban Problems, alternative trip production models which can explain more of the variation in household trip rates than the existing FSUTMS trip production structure were examined. Based on research findings, FAU/FIU recommended a household cross-classification structure to enhance the FSUTMS trip generation model stratified by (a) Full-Time Workers (0, 1, or 2+), (b) Presence or Absence of Children, and (c) Vehicle Availability (defined as households with more cars than workers, or those with the same or fewer cars than workers). This structure is sometimes called the "lifestyle" model.

To support this investigation the FDOT Central Office acquired a Census Special Tabulation Product, STP #266. STP #266 classifies households by Workers, Presence of Children, and Vehicle Ownership, at the TAZ-level, for all urbanized areas in Florida. FAU/FIU researchers then used the STP #266 data and a travel characteristics data set collected for the 1991 Palm Beach Travel Patterns and Transit Needs Study to demonstrate the merits of the new structure. A key finding of the feasibility test was that zones fully occupied by retirees no longer produce home-based work trips. Encouraged by the feasibility testing results, the District 4 Planning Office initiated a project to implement the new trip production structure.

One of the tasks of the implementation project was to develop trip production rates for Palm Beach and Broward Counties for the new model. This required the project consultant (Carr Smith Corradino) to reexamine the proposed trip-production variables. Statistical analysis

showed that Workers, which has a great explanatory power for the HBW trips, does not perform well for the home-based non-work trip purposes. The project consultant then tested the other variables and recommended that the Number of Persons in a household be used instead of Workers for the home-based non-work trip purposes. Statistical analyses showed that (a) Vehicle Ownership and Presence of Children are significant variables for all trip purposes; and (b) Workers is significant for explaining home-based work and, to a lesser extent, shopping and school trips. The Number of Workers is better than Persons only for the HBW trip purpose.

An analysis of the STP #266 file also revealed that more than 36 percent of households in Palm Beach County have no workers. This suggests that Workers would be a poor choice for estimating non-work trips in areas with a large number of retiree households. Further analysis of the Palm Beach travel characteristics data set revealed that some home-based work trips are generated from households reporting no full-time Workers, which suggests that "All" workers might be a better variable than full-time Workers.

Based on this analysis, the Department decided to employ two separate sets of variables for the lifestyle model. The first set uses Workers, Presence of Children, and Vehicle Ownership for the HBW trip purpose. The second set uses Number of Persons, Presence of Children, and Vehicle Ownership for the remaining home-based trip purposes. To support the implementation of this structure, the Department's Central Office obtained another special tabulation, STP #283, from the Census Bureau. The data from this tabulation were used to compile the lifestyle zonal data set, ZDATA1A, as well as to develop the stratification model. The Trip Generation Subcommittee assembled by District 4 to oversee the project decided to replace vehicle availability with vehicle ownership because vehicle ownership data are widely used elsewhere in modeling and planning.

## Trip Production Methodology

The statistical software SPSS was used to develop alternative analysis of variance (ANOVA) and regression models for each trip purpose from 1991 Palm Beach County and 1996 Broward County home interview travel surveys. Average trip rates for each cell were calculated from the surveys. However, few cells had 25 or more observations, which is a rule of thumb for the number of observations needed for a reliable estimate. Thus, it was decided to base the trip rate estimates on statistical models. Multiple Classification Analysis (MCA) was used to derive

the cell values of the ANOVA model, and in turn the averages of MCA and regression were used to derive the cell rates. Some adjustments were made to cell values to enforce a logical relationship between the cells.

It was found that at the 95 percent level of confidence, HBW trip rates are significantly different for each county. Furthermore, home-based shopping trip rates are not significantly different. For the other trip purposes, strong conclusions could not be reached because the differences in trip rates were not consistent between the cells. As a result, separate analyses were conducted for each county under the same general model structure so that available local data for each county could be used.

Stratification curves were needed to allocate aggregate zonal level data to the discrete classes used in the trip production matrices. These curves will estimate, for example, the number of households with zero, one, or two or more workers, given the average number of workers per household. The curves were developed from the STP#283 tabulation using polynomial regression. The statistical results of the polynomial models show that significant relationships exist for each model, and the variability in the data is explained highly in each case. The trip generation model implements the stratification model to calculate the discrete row and column sums from the aggregate values. A further allocation to the cell level (specific number of workers, and autos for households with or without children, for example) is carried out through a "Fratr-factoring" technique starting the STP#283 year 1990 data. This process made good use of the detailed data available in the Census by preserving the uniqueness of each TAZ.

## School Trip Distribution Process

School trips were divided in two broad categories: public and private. Public schools were further divided into elementary, middle, and high school. Because most public school students attend schools in their local school district, the trip table is fairly well established. The model takes this structure into account by using separate processes for public and private schools. Trip tables are directly built for the public school students while the private school students are distributed using a conventional gravity model.

## Separate Truck Trip Purpose

Recent ISTE requirements have placed a greater emphasis on freight and truck traffic. Truck trips have different characteristics than auto trips such as travel patterns and vehicle operating



characteristics. Thus, the truck-taxi purpose was replaced by a trip purpose that contains only truck trips, and taxi trips were combined with NHB trips. The truck model was borrowed from the Southeast Regional Planning Model IV (SERPM IV) which in turn was adapted from the Greater Vancouver Regional District (GVRD) model. Transferability of the GVRD truck trip generation model was assessed by comparing its predictor variables to FSUTMS ZDATA.

**Revised Internal-External Trip Process**

The current FSUTMS model takes a traditional approach to IE trips, treating them separately and independently from internal trips. While this approach works well in isolated areas, it has problems in MPOs that are part of a larger urban area. The problem is usually seen as an overestimation of traffic near a study area boundary. The reason for the overestimation is the overload of IE trips across the study area boundary. The modified IE process eliminates IE trips as a separate trip purpose. IE trips are now handled as part of the internal trip purposes. The distribution process will calculate the IE and EI trips (they will be present in the internal trip tables). The centroid connector to the external stations is used in calibration to adjust the distribution of IE trips, as it represents the aggregate travel time for external travel.

**Revised Non-Home-Based Trip Production Process**

The enhanced trip production model develops a study area-wide control total for the number of NHB trips using cross-classification trip production rates. The control total is then allocated to TAZ's in proportion to the FSUTMS NHB regression equation trip ends. This modification strengthens the computation of NHB trips which account for almost one-third of all trips.

**Summary and Conclusion**

The new structure offers several advantages over the existing FSUTMS structure:

Significantly improved explanatory power by using the lifestyle variables which show stronger correlations with trip making behavior. The enhanced trip generation process eliminates the anomaly of producing home-base-work trips from retirement communities.

Simplifies the trip rate cross classification structure. The new structure uses 16 cells for HBW trips and 28 cells for the other trip purposes. The current FSUTMS structure uses 30 cells for each trip purpose.

Eliminates the need to stratify household by single- and multi-family. This is important because the 2000 Census is not likely to collect this statistic.

Allows direct use of zonal household

classification data found in the 1990 Census to allocate the households in each TAZ to the cross-classification cells. This is a major enhancement of the current household classification distribution process which uses the DUWEIGHT curves. The DUWEIGHT curves distribute zonal household characteristics by using the areawide averages, which masks the uniqueness of each zone. Uses an indexing process to simplify the forecast of future zonal household classification distributions. If no specific projection is available, the future zonal household classification distribution of a given zone can be depicted by a direct reference to a similar existing zone.

Explicitly models truck traffic as an independent trip purpose to meet the ISTEPA emphasis on freight movement planning. With a separate assignment process, the new truck modeling process is also a better forecasting tool for pavement design and capacity analysis.

Explicitly models school trips as an independent trip purpose. The new school trip modeling process enhances the model accuracy by using school zones as the basis for distributing public school trips.

Improves the IE trip process by eliminating the surcharge of IE trips to the model boundary areas for the models with adjacent large urban areas.

# New FSUTMS version promises greater convenience

In the fourth quarter of 1997, the Urban Analysis Group (UAG) will be releasing Version 9.0 of the URBAN/SYS suite of software: TRANPLAN, NIS and a new TPMENU (TRANPLAN launcher). This software will require WINDOWS 95+ or WINDOWS NT to execute. DOS, OS/2 and WINDOWS 3.x systems will not be supported after Version 8.0+ of the URBAN/SYS software. UNIX versions for the IBM RISC 6000, Hewlett Packard ULTRIX and SUN Solaris systems will be available.

The following features will be included:

- o Launching from WINDOWS 95+ and WINDOWS NT.
- o Multi-class equilibrium highway assignments with additional toll road modeling features.
- o Data-Base Capable (DBC) networks which permit extended link/node attributes and direct GIS interfaces via DBF files.
- o Automatic generation of auto connectors for transit network access with DBC connections to the highway network.

- o Improved documentation, with consistent sample networks for highway and transit references.
- o Additional reporting and plotting options.
- o Software optionally distributed on compact disks

**Florida (FSUTMS) Users**

UAG is developing Version 5.3 of FSUTMS, for use on DOS, Windows95+ and WindowsNT systems. A new Windows-based FSUTMS launcher will be available for Windows95+ and WindowsNT systems, for the convenience of FSUTMS modelers. New features included in Version 5.3 are as follows:

- o Additional model selections for selected urban areas: Miami, Orlando, Tampa Bay, Southeast Florida, etc.
- o Variable factors by facility type -- UROAD factors (modeling level of service adjustment), CONFAC (conversion factor from hourly to daily capacities), BPR coefficient (permits other than the 0.15

- default in the BPR equation), and BPR exponent (permits other than the 4.0 exponent)
- o Inclusion of the Statewide Model into the FSUTMS menu structure.

UAG will be establishing a FSUTMS area on the UAG web site for access by consultants -- public agencies will access theFDOT web page on the Internet. The FSUTMS area will contain general contact and support information. UAG-provided FSUTMS software will reside in this area as well -- consultants may download, after password verification, FSUTMS and URBAN/SYS software for which they are licensed.

FDOT is developing a FSUTMS web page which will contain the modeling newsletters, FSUTMS hints and tips, and updated executable programs. The full version of FSUTMS will not be available on the FDOT web site; it will continue to be distributed by the Systems Planning Office.

# District Six automates level of service database

by Robert P. Wallace, PE, Tindale-Oliver and Associates

## Introduction

The Dade County State Highway System Network consists of 1,302 links, 569 centerline miles and 2,573 lane miles. This network required over 200 FDOT spreadsheets in order to complete a level of service analysis. The resulting level of service from these spreadsheets was then manually entered into a Microstation base map of Dade County to produce the annual level of service map. According to Albert Dominguez and David Henderson of FDOT District 6 Planning, this effort took several man-months of Consultant and District 6 Planning staff time. Realizing the cost and effort of this time consuming process to produce an annual level of service analysis, FDOT District 6 Planning engaged the services of Tindale-Oliver and Associates (as a subconsultant to Wilbur Smith Associates) to develop an automated database application to calculate the level of service of the roads that make up the Dade County State Highway System Network. This article discusses the development, implementation, and use of the FDOT District 6 level of service application.

## Development of GIS Base Map Segmentation

A base map of Dade County in ArcInfo format was obtained from the FDOT Central Office. Tindale-Oliver and Associates developed an identification numbering system for the links making up the Dade County State Highway System Network. This numbering system was based on the segmentation contained in the FDOT level of service spreadsheets (discussed below). The numbering system consisted of an eight character string, with the first three characters being the State Highway System road number, followed by a five character segment identification number. Segment identification numbers were assigned in increments of ten and ordered to follow the standard FDOT convention of south to north and west to east. Because the segmentation contained in the FDOT Dade County base map obtained from the Central Office was very general (segments were defined from one end of the county to the other end of the county), the 1994 Tiger Files for Dade County were used to determine the relative location of segment breaks consistent with those being used in the FDOT spreadsheets. The segment identification numbers were then stored as an internal attribute in the geographic database for each segment. These numbers are identical to the segment identification numbers developed for the database files discussed below.

**Conversion of Spreadsheets to Database and Linkage to GIS Base Map** - This work effort involved the conversion of information from over 200 FDOT spreadsheets to a single spreadsheet.

This spreadsheet, prepared by Walter Keller and Associates for FDOT District 6 Planning, contained a tabular listing of the variables required for level of service analysis. Tindale-Oliver and Associates converted this spreadsheet to a specific FoxPro database file structure for use in calculating level of service. The segment identification numbers developed as part of the GIS base map segmentation were then entered into the FoxPro database file. The linkage of the database segment identification numbers to the identification numbers in the ArcInfo geographic database provides the capability to thematically map any attribute maintained in the State Highway System database files.

**Linkage of Traffic Count Stations to Database Links** - Using a Microstation base map of traffic count stations, an ArcInfo layer was developed depicting the location of all traffic count stations in Dade County as of March 1995. This traffic count station layer was then used to assist in the assignment of traffic count station numbers to each segment included in the State Highway System Database. Linkage of the FDOT District 6 traffic count stations to each link contained in the State Highway System Database allows for the automatic uploading of the officially adopted AADT volumes for District 6. This process involves converting a text file of AADT volumes to a specified DBF file format. Once the DBF file is created the AADTs contained in the file can be automatically uploaded to the State Highway System Database and a level of service analysis can then be performed.

**Update of Level of Service Application Software** - This work effort involved the updating of software previously developed by Tindale-Oliver and Associates that replicates the level of service calculations contained in the 1985 Highway Capacity Manual. The updated software was required to replicate the level of service calculations contained in the 1994 Highway Capacity Manual. Additionally, the software calculations were required to also replicate the level of service determination procedures set forth in Florida's Level of Service Standards and Guidelines for Planning, 1995. In order to determine the accuracy and reliability of the updated level of service software, 45 test segments were selected and approved by FDOT District 6 Planning. Examples of each type of roadway facility found in Dade County were represented in the test segments which were selected for the analysis. The level of service calculations from the updated software were then compared to the spreadsheet models created by FDOT. This comparison involved staff from

Tindale-Oliver and Associates, FDOT District 6, and the FDOT Central Office.

In nearly all cases, the comparison of the two methodologies resulted in identical level of service values. The primary exception occurred when using the FDOT spreadsheet model ArtPlan 2.0 and R2LN-TAB. Upon review of the comparison, it was determined that an artificial limitation on the g/C ratio used by ArtPlan 2.0 created inconsistencies between the ArtPlan 2.0 results and the updated Tindale-Oliver level of service software. These issues were documented and discussed with Kurt Eichin of the Central Office. An updated version of ArtPlan (Release 2.1) was recently released that resolves all of the discrepancies. Similarly, for the R2LN-TAB spreadsheet, it was determined that the discrepancy between the Tindale-Oliver and Associates updated level of service software and the R2LN-TAB spreadsheet was due to an error in the spreadsheet look-up function which was used to determine the additional capacity created by the addition of passing lanes. Documentation of this issue was provided to Kurt Eichin of the Central Office who indicated concurrence with this problem. Thus, in all cases, it was determined that the updated Tindale-Oliver and Associates level of service software accurately produced level of service results consistent with the 1994 Highway Capacity Manual procedures and associated software. The results of the test segment comparison discussed above are more fully documented in the FDOT District 6 Level of Service and Duration of Congestion Technical Memorandum.

## Level of Service Analysis for 1993 Conditions

The initial level of service analysis was completed for 1993 conditions based on information contained in the FDOT spreadsheets provided to Tindale-Oliver and Associates. Information contained in this table indicates that the percent of vehicle-miles of travel with a volume-to-capacity ratio of less than 1.0 is 52 percent. Stated another way, 48% of the vehicle-miles of travel are occurring on over saturated roads.

**Addition of Section Numbers and Beginning/Ending Mile Posts to Database** - The level of service analysis performed for FDOT District 6 was based on the segmentation previously discussed in the section entitled Development of GIS Base Map Segmentation.

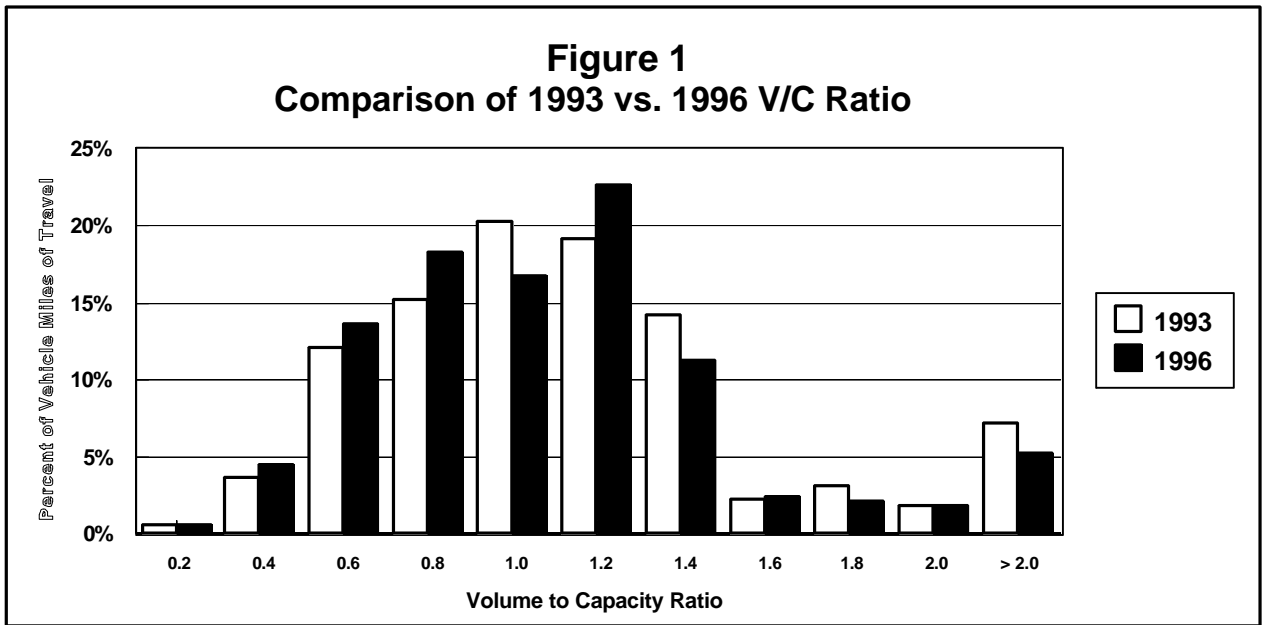


At the time the database was developed, FDOT District 6 had not selected a standard GIS software. Since the initial data collection effort, FDOT District 6 is now using ArcInfo and ArcView GIS software packages. These software packages have the ability to perform dynamic segmentation of data attributes. FDOT District 6 staff now desires to be able to dynamically

display attribute information, requiring the identification and data entry of section number and beginning and ending mile post information for each link in the database. Tindale-Oliver and Associates obtained a Roadway Characteristics Inventory extract file of intersection breaks and used this information to establish the beginning and ending mile posts for each segment contained in the State Highway System databases. This information provides FDOT District 6 staff with the capability of performing dynamic segmentation of RCI data, as well as attributes contained in the State Highway System databases.

**Update of Level of Service Variables and Level of Service Analysis for 1996** - Tindale-Oliver and Associates recently completed an update of the information contained in the 1993 analysis to current information maintained in the FDOT District 6 Dade County RCI Database. This effort involved the review of straight line diagrams and aerial photographs, as well as field review to update the number of lanes and road types from 1993 conditions to 1996 conditions. Additionally, a file was obtained illustrating the beginning and ending mile post breaks for traffic count stations. This information was used to review and update, as appropriate, the identification of traffic count station numbers to segment numbers, as previously discussed. Finally, Tindale-Oliver and Associates updated the level of service variables for segments in which data have changed from 1993 to 1996 conditions.

Updating of the LOS variables allowed the calculation of the 1996 level of service for the Dade County State Highway System. As a point of interest, the updated level of service software processes the entire Dade County State Highway System Network consisting of 1,302 segments and over 200 aggregated segments (each



equivalent to one ArtPlan spreadsheet) in just under one minute on a Pentium Pro 200MHz computer. According to District Six's David Henderson, what used to take several months and cost more than \$50,000 can now be accomplished at a fraction of the cost and time with greater accuracy and reliability. This analysis indicates that 54% of the vehicle miles of travel occur on roads with a volume-to-capacity ratio of less than 1.0, with the remainder of travel, 46%, occurring on over saturated roads.

Figure 1, Comparison of 1993 vs 1996 VMT by Volume-to-Capacity Ratio illustrates the changes that occurred between the 1993 and 1996 level of service analyses. The 1996 conditions indicate a slightly improved level of saturation (52% for 1993 vs 54% for 1996), as measured by the percent of vehicle miles of travel with a volume to capacity ratio of 1.0 or less. FDOT District 6 Planning now has a level of service tool that very effectively and efficiently calculates and produces reports on the level of service conditions of the Dade County State Highway System.

**Acceptance of the Level of Service Application Software** - In April 1997, Tindale-Oliver and Associates made a presentation of the updated Level of Service Application Software to the FDOT Level of Service Task Team. This demonstration included the calculation of level of service, the production of several reports and graphics used by the software, and a demonstration of mapping capabilities by displaying the resulting level of service using ArcView. The result of this demonstration was a finding by the Level of Service Task Team that the updated Tindale-Oliver and Associates Level of Service Software adequately demonstrated conformity with approved FDOT Level of Service and Highway Capacity Manual procedures and methodologies.

Subsequent to the FDOT Level of Service Task Team's finding, the software was presented at the joint meeting of the FDOT District Directors of Planning and Programming and the District Planning Managers in July of 1997. Further discussion resulted in determining that the LOS calculation portion of the program may be accepted as an alternative to ArtPlan. Acceptance of the FDOT District 6 Level of Service Application by the Level of Service Task Team and the District Directors represents a significant milestone for both Tindale-Oliver and Associates and FDOT District 6 Planning. In addition to District 6 Planning, the software is currently used by a number of MPOs and governmental entities throughout Florida. These agencies are using the level of service software for long range planning, concurrency, comprehensive planning, and congestion management. Contingent upon some remaining administrative details being finalized, FDOT has pledged to find the Level of Service Applications Software to be an acceptable alternative to ArtPlan on a statewide basis.

**Other FDOT District 6 Applications and Future Enhancements** - In addition to the level of service application, Tindale-Oliver and Associates completed a Duration of Congestion software application that is fully integrated with the Level of Service software application. The Duration of Congestion application processes standard FDOT SPS text files generated from the Survey Processing Software and utilizes this information to evaluate the duration during the day in which the physical or service capacity of a roadway link is exceeded for any 15-minute period. The software application calculates the AM and PM total hours of congestion and vehicle-hours of congestion for each roadway segment in the State Highway System database. This information can be uploaded to the State

Highway System database for further analysis and thematic mapping. Additionally, the Duration of Congestion application produces both tabular and graphic reports on the level of congestion for each 15-minute period. This software application responds to the FDOT Mobility Management System Plan by calculating the times of the day during which congestion is occurring.

Tindale-Oliver and Associates is currently in the process of completing an Urban Traffic Control System (UTCS) module that will have the capability of uploading green-to-cycle-length ratios, cycle lengths, and controller types directly from the Dade County UTCS system into the State Highway System database. This software is being designed to allow the selection of any one-hour time period for which signal timing information is available and to automatically update the applicable variables from the UTCS system to the State Highway System database for level of service analysis. An interesting feature of the UTCS interface program is its ability to obtain peak direction information from processed SPS text files. Using the peak direction information from the SPS text files allows the appropriate signal timings for the signal at the end of the link in the peak direction to be used in the level of

service calculations.

In addition to the modules described above, Tindale-Oliver and Associates has developed other modules for its clients, including a Road Improvement Cost Module, Traffic Counts Processing Module, and Capital Improvement Programming Module. One or more of these modules can be integrated with the basic software shell entitled Transportation Inventory Management and Analysis System (TIMAS) to meet the specific needs of any client. Also, Tindale-Oliver and Associates is in the process of developing several new modules that can be integrated into the overall TIMAS package, as appropriate. These new applications, or modules, include the development of a Corridor Module, Prioritization Module, a Public Transportation Module, a Non-Motorized Transportation Module, and a Continuous Traffic Counts Module. These modules will be to be completed and available within the next six months.

For further information about the full range of capabilities of Tindale-Oliver and Associates and the Transportation Inventory Management and Analysis System, the user is encouraged to contact Robert P. Wallace of Tindale-Oliver and

Associates at (813) 224-8862 or send e-mail at TindOliv@ij.net.

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