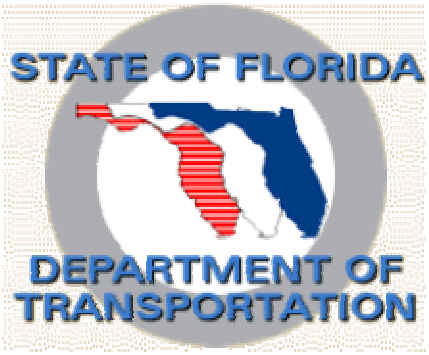
FSUTMS-TransCAD
Interim Standards and Medium-Term Enhancements

A White Paper of the
Florida Statewide Model Task Force



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INTRODUCTION

The Florida Statewide Model Task Force desires to facilitate a smooth transition to the new FSUTMS-TransCAD by defining a series of interim standards and enhancements that will help ensure consistency in the transportation modeling process in Florida. This document serves as a white paper to identify the various candidate items for which interim standards and enhancements may be defined and implemented within a reasonable time frame. The objective of this white paper is to provide an initial set of interim standards and enhancements for various aspects of FSUTMS-TransCAD. The white paper considers the following candidate items for the development of interim standards and enhancements:

- User interface
- File naming
- File/directory structure
- Model structure/logic
- TransCAD procedures to be used as standard/default methods
- Default model parameters/coefficients
- Input and output files (databases, networks, and zone data)
- Database field names
- Network coding standards
- Standard GIS themes/templates
- Roadway geography
- Standard reports/outputs

1. USER INTERFACE

The Model Task Force considered several different options for a FSUTMS-TransCAD user interface. The intent is to provide a standard FSUTMS front-end from which users can access specific geographic models or modeling steps that they wish to run. The advantage of having a user interface that is resident within TransCAD is that there is no need to update the user interface with every new version of TransCAD. Any external interface, on the other hand, would have to be updated and maintained with each release of FSUTMS-TransCAD.

It has been decided to develop a user interface within FSUTMS-TransCAD that is similar to the previous FSUTMS launcher. A very basic and important part of the Florida version of TransCAD should be a "splash screen" announcing the name "FSUTMS" after a user launches the program. The MTF shaped several ideas for an initial FSUTMS interface screen with Figure 1 representing an example of such a screen.

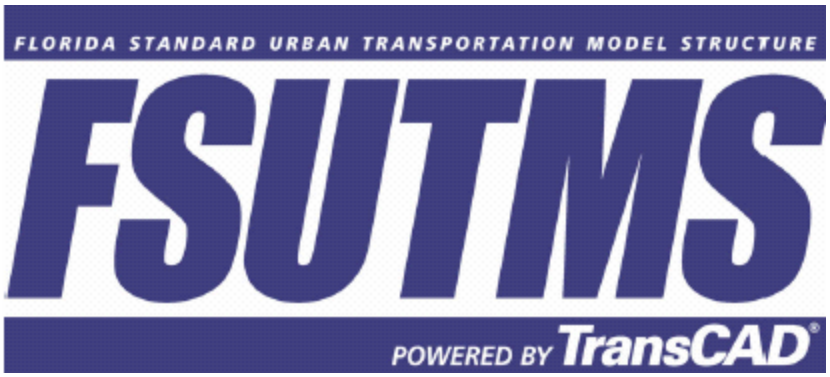


Figure 1. Splash Screen

After the splash screen is momentarily displayed, the initial interface will contain a map of Florida with all MPO and regional model boundaries displayed. The models actually installed on the user's computer will be highlighted. A frame on the left side of the screen will list all the models in the state, grouped by FDOT District. A sample screen is shown in Figure 2.

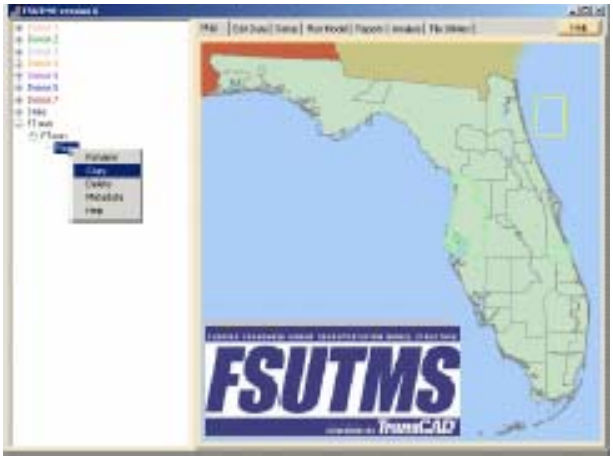
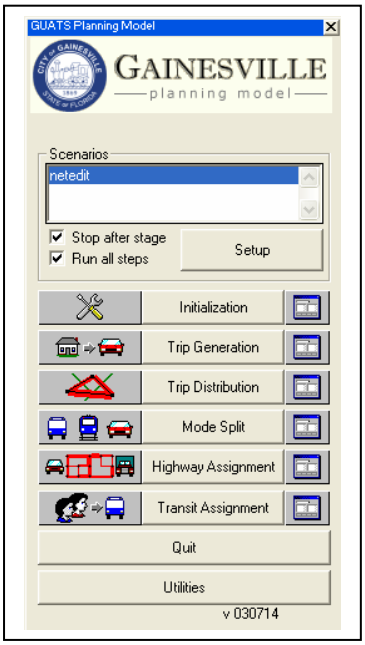


Figure 2. Map Area Selection Screen

This screen will serve several functions. It will show model coverage areas throughout the state, including areas where models overlap. It indicates clearly which models have been installed on the user's machine. Users would be able to click on either the map or text list to bring up dialog boxes displaying information about each model, such as whether the model is an official MPO-adopted model, and where the latest model data can be obtained (contact person or website address). If that specific MPO or regional model has previously been installed on the user's system, a button would be available in the dialog box to launch the model.



After a model is launched, a TransCAD map of the network and the model-specific graphical user interface (GUI) would be displayed. The GUI allows the user to run all or some of the model steps, and provides some modeling utilities, such as drawing certain themes. The interface allows editing data and creating themes of the input data. Pressing the "Setup" button allows the user to create and modify scenarios (alternatives), and to view and modify model parameters. Values accessed here are stored in a special table, similar to PROFILE.MAS. Figure 3 shows a sample graphical user interface.

Figure 3. Sample GUI

The FSUTMS Model Manager Interface that will be developed by Caliper Corporation for Florida will include the following modules:

- Scenario Manager
- Model Builder
- Parameter Editor

Scenario Manager

The Scenario Manager provides the starting point for managing scenarios, running models and viewing their output.

Scenarios are defined by three sets of data:

- The input/output data files.
- The TransCAD models and the steps to run.
- The parameters that will guide the execution of each step.

The Scenario Manager will simplify the management of multiple scenarios by organizing them in a tree that will enable users to quickly create and edit base scenarios and sub-scenarios. Base scenarios define a default set of data files, models, steps, and numeric parameters. Users will be able to standardize file naming conventions and folder structures for each base scenario. The Scenario Manager will allow users to set a standard naming convention for the files and folders used as input and output data. These file naming standards will be shared across scenarios.

Sub-scenarios are variations of base scenarios that inherit default settings from one base scenario, and overwrite some of their settings, such as one input file or a numeric parameter. Users will be able to create and maintain base and sub-scenarios in a simple, standardized fashion, using a tree-based user interface. The scenario manager will include functions for adding time stamps, comments and reports about the settings for each scenario. The settings for each scenario will be stored in XML files with an extensible, standardized format.

The Scenario Manager will also provide a starting point for launching one or more scenarios using a queue, monitor their progress, and launch the visualization of the results in maps and dataviews.

Model Builder

The Model Builder allows users to quickly create the programming logic behind each step of a traffic assignment model. It automatically creates and maintains shells for each GISDK macro in a model. The user can edit the GISDK source code produced by the Model Builder by writing a few lines of code or by inserting the code produced by the TransCAD batch recorder into the source code provided by the Model Builder.

The Model Builder simplifies the creation and maintenance of the programming steps of each model by organizing them into classes. A class is a default template written in the GISDK for each step in a model. The Model Builder provides an extensible library of standard base classes that define the logic for the most common steps used in a TransCAD FSUTMS model.

Users will be able to define their own custom steps by first choosing a step among a library of existing base classes, or by defining a new base class. The base class provides a starting point for the GISDK code behind a step, with default input and output data, skeleton programming logic, and the default values for parameters. Users will be able to extend the base class by overwriting and customizing the logic behind each step, for example by adding a custom pre-processing stage of the input data files, adding a custom post-processing of the output dataviews, or adding their own customized utilities.

The definition of the logic for each step in a model and of the TransCAD base classes will be stored in XML and in GISDK source code using a standardized format.

Parameter Editor

The Parameter Editor allows users to edit visually all of the parameters needed to execute each step in a model. The Parameter Editor presents the parameters for each scenario in a paged dialog box. For each scenario, all the numeric parameters needed for each step of the scenario will be presented to the user in a clear, readable and commented fashion, allowing the user to

quickly edit and validate each parameter. For each parameter, the editor will enable users to quickly set the corresponding GISDK variable name, the plain English description, the default value and the allowed numeric range or data type. The parameter files will be stored in XML.

Caliper Corporation will be issued a contract to develop a special FSUTMS user interface for review by the Model Task Force. An initial prototype of the user interface would be presented for Model Task Force review and comment at the May 4-5, 2004 meeting of the Model Task Force in Daytona Beach. The user interface to be shown to the Model Task Force should include a prototype using one of the converted models to the extent possible. The Model Task Force will provide comments and direction to Caliper Corporation for finalizing and completing the user interface.

2. FILE NAMING

FSUTMS has had a strong tradition of standard file names. Some of the names are logical and intuitive, and others are legacies from old software and the mainframe. A new file naming convention has been established for FSUTMS-TransCAD. This convention attempts to maintain some of the FSUTMS traditions while taking advantage of long file names.

The file name will contain four parts: (1) a data description (2) an alternative description (3) a "U" or "P" designation, and (4) a suffix.

(1) The data description name will consist of up to 8 characters, with no blanks allowed. There will be a hyphen after the data description.

(2) Next will be the alternative description consisting of three parts: a 3-character study area abbreviation, followed by a hyphen; 2 characters representing the year, followed by a hyphen; and up to 5 characters for the alternative, followed by a hyphen.

(3) Next will be either a "U" or "P" character to designate whether the file is user-supplied (U) or program-generated (P), followed by a period. This designation will help users to identify immediately all the data files necessary to submit a model run, similar to the current convention of using "YYA" or "AYY" suffixes.

(4) The 3-character suffix specified by TransCAD program requirements will conclude the file name.
Example: zonedata-mia-01-a4hov-u.dbd
(Note: file names are not case-sensitive)

(5) Special characters such as "+", "!", "@", "#", "$", "%", "&", "*", "(", ")", "=", "{", "}", "[", "]", "<", ">", "/", "?", "\", and "|" should not be used anywhere in the file name. Similarly, the use of blank spaces within file names should be avoided as much as possible.

As an illustration, Appendix A lists the names used in the Gainesville model conversion process, and depicts how the names would appear after applying the new standard. While some adjustments may be required and some files may be combined or eliminated, the file names presented in Appendix A represent a good starting point.

3. FILE/DIRECTORY STRUCTURE

The traditional FSUTMS model places all files for an alternative in a single folder. In order to take advantage of new file management systems, a new directory structure will be established for FSUTMS-TransCAD.

As an interim standard, it is suggested that a Master Directory be established. This Master Directory will contain a series of directories with one directory for every alternative or scenario run. The Master Directory would have the same name as the model and would contain only input files.

Each alternative would have its own directory. The directory name would include the model name and the alternative name. Within each directory, there will be four subdirectories, with each subdirectory having a name that includes the model name, alternative name, and subdirectory name.

- INPUT: This subdirectory would include all input files, such as network and zone data and model parameter files (e.g. trip rates or mode choice model parameters). This would be a complete set of the files needed to run the scenario.

- TEMP: This would include files generated by the model program that would not be permanently saved (for example, skim matrices). This directory would remain accessible throughout the time when the alternative is being analyzed and validated but could be deleted thereafter to save storage space. The program would be set up to store these files in this directory.

- OUTPUT: This would include all output files that would be permanently saved (e.g. assigned highway volumes and speeds, transit boardings). Any data needed for subsequent analyses (such as air quality) would be stored here. The program would be set up to store these files in this directory.

- REPORT: This would include any reports generated using the model results. The program would be set up to store these files in this directory.

To start a new scenario, the user would create a directory named for the specific scenario, based on the file naming conventions adopted for FSUTMS-TransCAD. The four subdirectories would be created, and the input data from the "parent" scenario would be stored in the INPUT directory. Then any necessary changes to the input data (e.g. network edits, zone data changes) would be made prior to running the model.

The above standard would result in the duplication of some or all input files across scenario directories. However, having all files associated with a scenario together provides a roadmap for future reference and audit purposes, especially in light of the decreasing cost of disk storage space.

4. MODEL STRUCTURE/LOGIC

The change of model platform offers an opportunity to modify and enhance the model logic and structure. However, in general, the change in platforms does not necessarily require a change in structure and logic. The most compelling reasons for changing the model structure/logic would be: (1) there may be better procedures, (2) to eliminate the UTPS-based legacy procedures, and (3) TransCAD makes better procedures available.

The ability to analyze different modes of transport such as walk and bike modes, time of day modeling, and so on constitute new methods and applications that would be valuable to the modeling community in the state. At this time, the incorporation of such enhancements into the standard FSUTMS structure is being considered a long-term model development effort.

Thus, as an interim standard, it is suggested that the existing model structure/logic be retained in FSUTMS-TransCAD. A series of model flow charts are provided in the *FSUTMS Interactive Users' Library CD* describing the four standard FSUTMS modeling processes as well as the steps contained within each FSUTMS module. In terms of FSUTMS modeling processes, it is generally agreed that the single-path FSUTMS option could be eliminated as this option provides only for the modeling of one network mode (e.g., local bus) with no variations in service by time-of-day (i.e., no peak-period express bus service). If a community has no plans for premium transit service in the future, it might be best that the highway only option be considered, along with enhancements to model high occupancy vehicles as is found in the current Lee County model. On the other hand, if a community plans for any fixed guideway transit, even the multi-path (single-period) option would be insufficient as this process assumes multiple modes only during

the peak (AM) period. This option is only useful if the community's transit plans are limited to peak-period express bus service. The next FSUTMS option is multi-path/multi-period; however, most models in Florida have abandoned this process for some form of nested logit model. The generalized nested logit model, implemented as part of the Northeast Regional Planning Model, might provide the single best transit option for FSUTMS users, due to its flexibility.

It is reasonable to assume that part of the rationale in having multiple transit processes in FSUTMS was borne out of the limitations of software and hardware in the mid-1980s, when TRANPLAN came into use. With these limitations now largely overcome, it would seem reasonable to limit FSUTMS-TransCAD to two basic structures:

- Highway only (preferably with the capability of modeling HOVs)
- Generalized nested logit mode choice (for transit modeling)

At this point in time, as there are a number of unique model structures in use throughout Florida for various reasons (socioeconomic, behavioral, policy, etc.), it would not seem feasible to expect all models to coalesce on one unified structure. However, if FSUTMS-TransCAD could be limited to two standard structures, this would somewhat simplify the modeling process used in Florida and would still enable for variations such as the District 4 and District 7 Lifestyle Models. Various committees of the Model Task Force should continue discussion and research on different methods of trip generation, distribution, and mode choice but for the short term, it is unlikely that all MPOs or FDOT districts are likely to adopt a single Lifestyle Model approach. Since no official MPO or District model has yet to adopt a time-of-day process, this could be considered an issue for evaluation beyond the current FSUTMS-TransCAD interim standards phase.

Within this context, it may be useful to examine database structures and formats. For example, zonal data could be kept in separate ZDATA databases or in the TAZ GIS database. Separate ZDATA files can be "joined" to the zonal GIS database file. The zonal database polygons are not likely to be changed very often. Thus, it may be useful to keep the ZDATA files in separate files at this time. For ease of use, the model software should contain routines to easily execute the database "join" operations.

5. DEFAULT FSUTMS-TRANSCAD PROCEDURES

During the Gainesville model conversion process, the following observations were made:

- Ext – Caliper has programmed a GISDK function that works like the FSUTMS "eemake" program.
- Gen – Caliper has created a GISDK routine that works like standard FSUTMS Gen. However, a wrap-around program that can execute the Tranplan GEN programs may be

needed in the interim to accommodate the several variations of GEN that exist in the state.

- Hnet – Caliper's network builders must be used.
- Hpath – Caliper's path builder and skimmer must be used.
- Distrib – Caliper offers several new options for the gravity model, as well as routines that mimic Tranplan (Singly Constrained Gravity). The Model Task Force should consider the doubly constrained gravity model.
- Tnet, Tpath, Tassign – Caliper has coded routines that are similar to Tranplan's transit routines. The Model Task Force should consider using advanced transit modeling routines that are available within TransCAD.
- Mode – There is a TransCAD nested logit model that functions similar to the Fortran-based nested logit models used in FSUTMS. The TransCAD mode choice model lacks the ability at this time to produce inputs required by the FTA's Summit program, which is critical for all cities contemplating New Starts submissions.
- Hassign – There is a TransCAD user equilibrium model similar to that in Tranplan.
- Heval – Currently, there is no TransCAD equivalent of this step, although users may develop custom reports using TransCAD functionality and features.
- Teval – Currently, there is no TransCAD equivalent of this step, although users may develop custom reports using TransCAD functionality and features.

Based on this the Gainesville model conversion experience and in the interest of efficiency and expediency in model conversion, the conversion of all processes to native TransCAD procedures is being considered a longer-term model development and enhancement effort.

In the interim, the mode step will call up the existing external Tranplan/Fortran mode choice model. The TransCAD software has a nested logit routine; however, most of the Florida models have extensive pre- and post-processing which is time consuming to replicate in TransCAD. Thus, in the interim, FSUTMS-TransCAD will wrap around the Tranplan/Fortran nested logit mode choice model codes/scripts. Similarly, TransCAD will wrap around the existing EMIS program for air quality analysis. All other programs in other modeling steps will use native TransCAD procedures and routines. This includes using a doubly constrained gravity model and the TransCAD transit path building routine, both of which are different from current FSUTMS-Tranplan procedures. Users should note that results from the FSUTMS-TransCAD model will therefore differ from results obtained from the FSUTMS-Tranplan model. Users will need to re-calibrate and validate the FSUTMS-TransCAD model as part of the conversion process.

6. PARAMETERS

The *FSUTMS Interactive Users' Library CD* includes a complete listing of model parameters and coefficients by module. This electronic document also provides recommendations on sources of typical model parameters used in trip generation such as trip production rates, trip attraction rates, dwelling unit weights, and friction factors. While these recommendations should generally be considered reliable, more recent travel surveys and model validation studies might have resulted in new variations that are worth considering. As we have entered a new century, it is reasonable to recommend that MPOs abandon the use of default parameters originally recommended in Model Update Tasks B and C, as these were based on travel survey data from the 1960s and 1970s. A wealth of household travel surveys conducted in Florida during the late 1980s, 1990s, and more recently provide a more reliable source for such information. Census 2000 data should be encouraged as a source for dwelling unit weight calculations and journey-to-work comparisons.

In general, model parameters are not software specific. Therefore, as an interim measure, it is recommended that existing FSUTMS parameters be retained. Any changes that are necessitated due to the platform switch should be documented during the conversion process so that users may understand the implications of the parameter change. In the long term, it is recommended that all model parameters and coefficients be researched and updated to reflect the latest travel behavior trends and policy considerations.

7. INPUT AND OUTPUT FILES

Linked versions of the main databases (zone, network, and transit route) should be provided in the three subdirectories for a scenario (excluding REPORTS). For example, the zone database in the INPUT subdirectory would include all of the user-specified input zone data, such as:

- Households cross-classified by the appropriate categories for the trip production models (auto ownership by household size, single/multi-family, or lifestyle categories, etc.)
- Employment by type
- Hotel rooms
- Parking costs (although they might be modeled in some parts of the country, they generally are not modeled in Florida and are input data determined by the modeler)

It is recommended that the erstwhile ZDATA1 and ZDATA2 files be merged into a single ZONEDATA file in a database format. This will provide a single location for all residential and employment data. However, ZDATA3 and ZDATA4, that provide information on special

generators and external-internal productions respectively, should continue to remain in separate files due to their unique area-specific structure.

In the zone database in the TEMP subdirectory, calculated fields such as zone acreage or density measures could be stored. In addition, area types could be stored here to allow them to be computed based on density or other measures. In the zone database in the OUTPUT subdirectory, the final productions and attractions could be stored. On the other hand, productions and attractions before balancing could be stored in the database in the TEMP subdirectory.

For network data, the basic link attributes that are not changed or calculated by the model would be stored in the database in the INPUT subdirectory. These might include number of lanes, functional class, directionality, street names and other identifiers, tolls, screenline identifiers, and any values used to override calculated or lookup table values for link lengths, speeds, and capacities. The network database in the TEMP subdirectory could include calculated values such as the link lengths, lookup table speeds and capacities, free flow travel times (computed from the speeds), and area types. The network database in the OUTPUT subdirectory could include the assigned volumes, travel times, and speeds. It is to be noted that this setup is very different from the idea of maintaining a single network database for all alternatives. The issue of whether to store alternatives in a single database or multiple files should be addressed by the Model Task Force.

For transit route data, the basic route attributes that are not changed or calculated by the model would be stored in the database in the INPUT subdirectory. These might include route identifier and name, operator, mode, headway/frequency, fare, and speeds (for rail). The transit route database in the TEMP subdirectory could include calculated values for bus travel times. The transit route database in the OUTPUT subdirectory would include the assigned route volumes/boardings.

In addition to the zone, network, and transit route databases, there would be other data files that would be specific to each of the subdirectories. Some examples would include:

INPUT subdirectory

- Any parameters that are currently stored in PROFILE.MAS that are still needed in FSUTMS-TransCAD
- Trip rate parameters
- Friction factors
- K-factors
- Mode choice model coefficients
- Volume/delay curve parameters

- External-external trips that are not calculated by the model
- Terminal times (if not calculated)
- Other files needed by TransCAD

TEMP subdirectory

- Skim matrices (highway time, HOV time, transit in-vehicle time, transit fare, etc)
- Any trip tables by mode/purpose/time of day that would not be kept permanently

OUTPUT subdirectory

- Boardings at transit stops

REPORTS subdirectory

- Generally, these will be defined under item 12, but they could include intersection turning movement summaries, results of select link analyses, screenline summaries, VMT summaries, transit assignment summaries, etc.

It is suggested that the number of variables computed and kept in the output file be increased somewhat so that reviews and summaries of individual runs can be made after the fact if needed. Examples might include a review of some zonal variables such as areas and densities. More important would be transit computed running times which are important FTA submissions. Also, once user benefits can be computed, it is suggested that user benefit values be placed in the output directly, at least as a default; they can be deleted later if an alternative is deemed no longer relevant.

8. DATABASE FIELD NAMES

The Department's GIS-TM effort, which developed a set of ArcView applications for editing and displaying FSUTMS-Tranplan modeling data, specified a set of field names. Most of these names would be suitable for the FSUTMS-TransCAD model conversion process. The list of database field names specified as part of the GIS-TM development effort is furnished in Appendix B. This list of database field names will be used as an interim standard for FSUTMS-TransCAD. Those field names that are not needed will not be used in the FSUTMS-TransCAD conversion process. Any missing fields that are not covered in this specification will need to have field names specified during the conversion process. All such field names should be identified and documented so that they can be incorporated into future versions of FSUTMS-TransCAD.

One noteworthy consideration in this regard is that the field names should be no more than 10 characters to be dBase (DBF) compatible. While many of the GIS-TM field names do conform to this, a few field names do not. The use of field names greater than 10 characters may be

limiting in that it would be difficult to create and modify databases outside the TransCAD environment. A 10-character standard would not necessarily be a poor legacy; in the past, database field names were limited to six characters. Therefore, a 10-character standard is likely to be quite sufficient while also minimizing the burden of typing and displaying long names. Also, the following standards should be applied in all field naming exercises:

- The first character of the field name must be a letter.
- Punctuation marks, blank spaces, and other special characters should not be used (as specified in Section 2 for file names).

9. NETWORK CODING STANDARDS

Existing FSUTMS network coding standards are applicable in the interim for the first wave of model conversions. All existing network coding standards are being maintained at this time. In the long term, however, the network coding standards should be substantially enhanced and updated. It is recommended that an enhanced base map be used for the highway network layer, and that this single layer be used as the basis for all highway and transit networks in the future. The following observations are worth noting in this regard:

- Transit network structure – The Gainesville model conversion process created two transit networks that are independent from each other and from the auto trip highway network. This would seem to create an undue burden in creating and maintaining networks as there would be three distinct networks. Instead, all transit route systems should be based on the same line layer as the highway network. It appears that this will require the transit networks to be recoded instead of "converted."

- Highway line layer construct – Either all highway networks for a given study could be kept in a single line layer or each alternative could be kept in its own layer. The concept of relational databases and the ease of maintenance would suggest that all networks should be kept in a single layer, or in tables linked to the base network layer. Adoption of this concept creates great importance for backing up the network line layer files, as losing one database would mean that all are lost. Version control also would be very important in this concept. As part of this recommendation, it is suggested that a high-quality and complete database be used for the network line layer. At this time, Caliper's Florida statewide network will be used as the base for the network line layer. A major concern with using a commercial database like GDT Dynamap or ETAK is the consistency of link IDs from one update to another.

It is important to strengthen the tie between the transit and highway networks by using a common base map for these networks. This would facilitate an integrated multimodal analysis using a process equivalent to that in Tranplan for highway/transit speed calculations.

10. GIS THEMES AND TEMPLATES

The TransCAD software package offers an extensive list of map templates from which the user can choose a display or theme. In addition, TransCAD allows the user to create a custom map or theme for display purposes. There should be a standard set of themes or templates that are generated with each step or run in FSUTMS-TransCAD. The user would then be able to choose a set of maps and themes that should be displayed/saved with each model step and run.

As part of the model conversion process, Caliper has created a standard set of maps for users. This standard set of maps and themes will be used as an interim standard and point of departure pending additional input from the Model Task Force. The standard set of maps includes those for displaying zonal geography (by selected socio-economic variables such as household size and car ownership) and networks by facility type, area type, and so on.

11. ROADWAY GEOGRAPHY

The ultimate objective under this item is to incorporate roadway geography and shapes into model networks, thus moving away from the stick-network formats used in FSUTMS-Tranplan. As an interim standard, models with up-to-date networks and base maps should be converted to TransCAD line layers. The line layers would be maintained in a geographic latitude and longitude coordinate system. Thus, areas that are using stick networks at this time will have the stick networks converted to TransCAD without any enhancement (other than correction of easy-to-find obvious errors).

Eventually these systems should be changed to use an enhanced base map with shapes for the highway network layer, with this single layer as the basis for all transit networks. Several base map options were discussed as a source file for adding the shapes into the stick networks. These included the Caliper statewide map (constantly updated), the Census Tiger files, GDT Dynamap, and the converted FSUTMS model networks themselves.

Within FDOT, the ITS office has decided to use the GDT Dynamap system for its base network. The advantage of using the Caliper statewide network is that the roadway characteristics have already been added thus providing the attribute fields needed for modeling. Sufficient review of the Caliper statewide network and associated databases must be done to ensure that fields

needed for modeling purposes are incorporated in the database. The Caliper statewide network includes every state road as well as all local roads in the urban models in those areas where models have been converted. It could be used in conjunction with the GDT Dynamap system as well as the Tiger files so that supplemental street level information can be obtained and merged into the modeling network. Caliper has used aerial photography to make the network as accurate as possible. The issues associated with a commercial product such as GDT Dynamap include copyright and license mechanisms, updates and maintenance, and the retention of arc identification numbers during updates.

At this time, as an interim standard, the Caliper statewide network will be used as the base map. Caliper will incorporate this geographic layer into the highway-only models that they are converting. The adopted standard for the base network may be periodically reviewed over time to ensure that the modeling needs of the state are being met.

12. STANDARD REPORTS

Standard FSUTMS reports should be defaults in FSUTMS-TransCAD and should include the following at a minimum (listed by module). Note: It may be possible to combine some of these into single reports.

Trip Generation

- Total number and percent of trips by purpose
- Aggregate trips by purpose per person, per household, and per employee
- Socioeconomic ratios such as persons per household, employees per population, etc.
- Socioeconomic totals and other ratios presently found in the LUCHECK program
- Environmental justice statistics such as the percentage of zero auto households

Trip Distribution

- Average (mean) trip lengths by purpose, compared to observed values
- Trip length frequency distributions (tabular and graphed) by purpose, compared to observed distributions
- Difference between input and output attractions by zone
- Number and percentage of intrazonal trips by purpose, compared to observed values

Mode Choice

- Formatted listing of model coefficients and constants
- Diagram of nesting structure
- Number and percent of trips by mode, sub-mode, and purpose
- Estimated auto occupancy factors by purpose

Highway Assignment

- Vehicle-miles traveled (VMT)
- Vehicle-hours traveled (VHT)
- Number of trips loaded and counted
- Volume/count ratios by VMT, VHT, and PSWADT:
    - By screenline, cutline, and cordon line
    - By area type, facility type, and number of lanes
    - By volume group
- Root Mean Squared Error (RMSE) by volume group
- Input and congested speeds (and percent differences)

Transit Assignment

- Estimated and observed ridership by mode and route
- Boardings and alightings by stop and direction
- Ratio of estimated over observed ridership by mode and route
- Estimated number of transfers by mode and route
- Peak vehicle requirements (based on some TLOS measure?)
- Transit station loading graphical report

Although TransCAD provides the ability to generate any report or thematic map as per the user's desires, a set of standard reports is needed to serve as study documentation. Pending the receipt of additional input from the Model Task Force, the following is a list of reports that ought to be part of the modeling process:

- Trip generation report summarizing productions and attractions by trip purpose, input Zdata, special generators, input trip rates, and other data reported by GEN and LUCHECK.
- A trip distribution report list with average trip length and percent intrazonal trips, as well as displaying the trip length frequency distribution for each trip purpose.
- A mode choice report that provides information on auto occupancy by purpose, transit mode of arrival data, and transit station access data. However, station usage data may fit better in the transit assignment/evaluation step. As such it is recommended that the mode choice report be limited to trip table related efforts reflecting linked trips, while station activity would be an assignment and unlinked trip display.
- Transit assignment reports on boardings by route and mode, transfers, load factors, line volumes and operating statistics like vehicle hours, vehicle miles, and peak vehicle requirements.
- A report like the FSUTMS HEVAL report is needed. HEVAL probably should be examined and perhaps modified to produce reports that can be inserted directly into documentation. Seldom used reports should be eliminated. But reports of VHT and VMT

and volume/count ratios by area type and facility type are needed, as are screenline summaries for model validation purposes.

APPENDIX A
FSUTMS-TransCAD SAMPLE FILE NAMES

Gainesville Name	Full FSUTMS Name	Comment
Highway Input		
hnet.dbd	hwylinks-gvl-01-A4HOV-u.dbd	Highway network database
spdcap.bin	spdcap-gvl-01-A4HOV-u.bin	Speed capacity table
tcards.bin	turnpen-gvl-01-A4HOV-u.bin	Turn prohibitors/penalties
termtime.bin	termtime-gvl-01-A4HOV-u.bin	Terminal times
Highway Output		
hnet.net	hwypaths-gvl-01-A4HOV-p.net	Binary network
fhskims.mtx	freeskim-gvl-01-A4HOV-p.mtx	Skims
rhskims.mtx	congskim-gvl-01-A4HOV-p.mtx	..
Transit Network and Data		
amtnet.rts	amtnet-gvl-01-A4HOV-u.rts	AM Routes
mdtnet.rts	mdtnet-gvl-01-A4HOV-u.rts	MD Routes
fare.mtx	fare-gvl-01-A4HOV-u.mtx	Fares
modeamad.bin	parmamad-gvl-01-A4HOV-u.bin	Mode-specific parameters
modeamlh.bin	parmamlh-gvl-01-A4HOV-u.bin	..
modeamwl.bin	parmamwl-gvl-01-A4HOV-u.bin	..
modemd.bin	parmmd-gvl-01-A4HOV-u.bin	..
mode-max-wait.mtx	maxwait-gvl-01-A4HOV-u.mtx	..
tnetam.dbd	--	AM Transit links -- should be eliminated
tnetmd.dbd	--	MD Transit links -- should be eliminated
Trip Generation and TAZ System		
Zone.dbd	tazbndy-gvl-01-A4HOV-u.dbd	Zonal boundary GIS database
duweight.bin	duweight-gvl-01-A4HOV-u.bin	Dwelling unit stratification curves
grates.bin	genrates-gvl-01-A4HOV-u.bin	Generation rates
zdata1.bin	zonedata-gvl-01-A4HOV-u.bin	Zonal socio-economic data
zdata2.bin	--	Combine zdata1 and zdata2
zdata3.bin	specgen-gvl-01-A4HOV-u.bin	..
zdata4.bin	eiprods-gvl-01-A4HOV-u.bin	..
eetrips.bin	eetrips-gvl-01-A4HOV-u.bin	External-external trips
Trip Generation Output		
prods.bin	prods-gvl-01-A4HOV-p.bin	Productions
attrs.bin	attrs-gvl-01-A4HOV-p.bin	Attractions
prod-attr.bin	prodattr-gvl-01-A4HOV-p.bin	
p-hh-hm.bin	hhsizehm-gvl-01-A4HOV-p.bin	Cross-class: percent HM units by size
p-hh-mf.bin	hhsizemf-gvl-01-A4HOV-p.bin	Cross-class: percent MF units by size
p-hh-sf.bin	hhsizesf-gvl-01-A4HOV-p.bin	Cross-class: percent SF units by size
p-v-hh-hm.bin	hhxvehhm-gvl-01-A4HOV-p.bin	Cross-class: number HM units by size & vehicles
p-v-hh-mf.bin	hhxvehmf-gvl-01-A4HOV-p.bin	Cross-class: number MF units by size & vehicles
p-v-hh-sf.bin	hhxvehsf-gvl-01-A4HOV-p.bin	Cross-class: number SF units by size & vehicles
eetab.mtx	eetab-gvl-01-A4HOV-p.mtx	External-external trip table
Trip Distribution		
ff.bin	friction-gvl-01-A4HOV-u.bin	Friction factors

Trip Distribution Output		
ptrips.mtx	pertrips-gvl-01-A4HOV-p.mtx	Person trip tables
tld.mtx	tlength-gvl-01-A4HOV-p.mtx	Output for report
Mode Choice		
hbw.nlm	nloghbw-gvl-01-A4HOV-u.nlm	These files replace NLOGIT.SYN
hbnw.nlm	nloghbnw-gvl-01-A4HOV-u.nlm	..
nhb.nlm	nlognhb-gvl-01-A4HOV-u.nlm	..
modechoiceparams.bin	nlogparm-gvl-01-A4HOV-u.bin	..
Mode Choice Output		These files are different from Tranplan
hhtab.mtx	htriptab-gvl-01-A4HOV-p.mtx	Output highway trip tables
intrazonal.mtx	intrazon-gvl-01-A4HOV-p.mtx	No Tranplan equivalent (need to check)
mchoice-sum1.bin	modesum1-gvl-01-A4HOV-p.bin	Report file
mchoice-sum2.bin	modesum2-gvl-01-A4HOV-p.bin	Report file
modein.mtx	modein-gvl-01-A4HOV-p.mtx	Input trip tables
modeout-hbw.mtx	mtabhbw-gvl-01-A4HOV-p.mtx	Output trip tables
modeout-hbo.mtx	mtabhbnw-gvl-01-A4HOV-p.mtx	..
modeout-nhb.mtx	mtabnhb-gvl-01-A4HOV-p.mtx	..
termtime.mtx	termtab-gvl-01-A4HOV-p.mtx	Auto access terminal time (need to check)
Highway Assignment Output		
hrldxy.bin	hwyloads-gvl-01-A4HOV-p.bin	Drop the XY reference
hrldxy-pre.bin	preloads-gvl-01-A4HOV-p.bin	
Transit Network and Assignment Output		Files much different than Tranplan
amlkflow1.bin	amlkflow1-gvl-01-A4HOV-p.bin	Flows on links
amlkflow2.bin	amlkflow2-gvl-01-A4HOV-p.bin	..
amlkflow3.bin	amlkflow3-gvl-01-A4HOV-p.bin	..
amrtflow1.bin	amrtflow1-gvl-01-A4HOV-p.bin	Flows on routes
amrtflow2.bin	amrtflow2-gvl-01-A4HOV-p.bin	..
amrtflow3.bin	amrtflow3-gvl-01-A4HOV-p.bin	..
am-onoff1.bin	amonoff1-gvl-01-A4HOV-p.bin	On-off at stops
am-onoff2.bin	amonoff2-gvl-01-A4HOV-p.bin	..
am-onoff3.bin	amonoff3-gvl-01-A4HOV-p.bin	..
mdlkflow.bin	mdlkflow-gvl-01-A4HOV-p.bin	..
mdrtflow.bin	mdrtflow-gvl-01-A4HOV-p.bin	..
md-onoff.bin	mdonoff-gvl-01-A4HOV-p.bin	..
tskimam1.mtx	tskimam1-gvl-01-A4HOV-p.mtx	Various skims
tskimam1.tnw	tskimam1-gvl-01-A4HOV-p.tnw	..
tskimam2.mtx	tskimam2-gvl-01-A4HOV-p.mtx	..
tskimam2.tnw	tskimam2-gvl-01-A4HOV-p.tnw	..
tskimam3.mtx	tskimam3-gvl-01-A4HOV-p.mtx	..
tskimam3.tnw	tskimam3-gvl-01-A4HOV-p.tnw	..
tskimmd.mtx	tskimmd-gvl-01-A4HOV-p.mtx	..
tskimmd.tnw	tskimmd-gvl-01-A4HOV-p.tnw	..

APPENDIX B
CANDIDATE FIELD NAMES

ZONEDATA.bin
- NodeID
- Sector
- SFDU
- SFPctVNP
- SFPctVac
- SFPop
- SFPct0Veh
- SFPct1Veh
- SFPct2Veh
- MFDU
- MFPctVNP
- MFPctVac
- MFPop
- MFPct0Veh
- MFPct1Veh
- MFPct2Veh
- HotelRms
- HotelPctOc
- HotelPop
- TotalPop
- EmpInd
- EmpCom
- EmpServ
- EmpTot
- EnrSchool
- STParkCost
- LTParkCost
- UserNotes

SPECGEN.bin
- NodeID
- GenType
- FuncCode
- Trips
- PctHBW
- PctHBS
- PctHBSR
- PctHBO
- PctNHB
- EmpTot2
- EmpCom2
- EmpServ2
- EnrSchool2
- TotDU

EIPRODS.bin
- NodeID
- Sector
- ProdExtInt
- NewZone
- PctNewZone
- UserNotes

District 4 ZDATA1
- NodeID
- RefZone
- HHoldWOCld
- HHoldWCld
- VehWOCld
- VehWCld
- WrkerWOCld
- PrsonWOCld
- PrsonWCld
- Hotel
- CBDExUrb

District 4 ZDATA4
- NodeID
- IDCode
- TotPTrip
- PerPHWB
- PerHBShp
- PerPHBSR
- PerPHBSch
- PerPHBO
- PerPNHB
- PerPTruck
- TotaTrip
- PerAHBW
- PerAHBShp
- PerAHBSR
- PerAHBSch
- PerAHBO
- PerANHB
- PerATruck
- XtravTime
- PerHBW0Veh
- PerHBW1Veh
- PerHBW2Veh
- PerOth0Veh
- PerOth1Veh
- PerOth2Veh

District 7 ZDATA1
- NodeID
- CardTyp
- CntCode
- PlanDist
- TAZ
- TotDU
- PerVacNP
- PerVac
- TotPop
- Per0VehRet
- Per0VehWOC
- Per0VehWCh
- Per1VehRet
- Per1VehWOC
- Per1VehWCh
- Per2VehRet
- Per2VehWOC
- Per2VehWCh
- Per3VehRet
- Per3VehWOC
- Per3VehWCh
- BusHotel
- EcoHotel
- RstHotel
- GroupQuts
- PerOccHote
- TotHotelOc

District 7 ZDATA 2
- NodeID
- CardTyp
- CntCode
- PlanDist
- TAZ
- EmpInd
- EmpComReg
- EmpComLoc
- EmpServReg
- EmpServLoc
- EmpTot
- EnrK12
- EnrHigher
- LightTruck
- HeavyTruck
- StParkCost
- LtParkCost
- ActCode
- ActDesc

District 7 ZDATA3
- NodeID
- CardType
- TAZ
- TAZDesc
- TripEndTyp
- TripPurpos
- ModifFunc
- ModifVal

District 7 ZDATA4
- NodeID
- CardType
- TAZ
- TAZDesc
- TotVTrip
- PerEtoE

Turn Penalties
- ID
- fromNode
- thruNode
- toNode
- PENALTY
- PROHIBITOR

Alternative Descriptions
- ScenID
- ScenName
- ScenYear
- ScenAlt
- ScenDesc

Traffic Count Data
- LinkID
- TrafCounID
- CountYear
- AADT

Transit STops
- NodeID
- StopType

VFACTORS
- FacType
- URoadFactr
- ConFac
- BPRCoef
- BPRExponen

Speed/Capacity Tables
- Lanes
- FacType
- AreaType

School Data
- NodeID
- ElemTAZ
- MidTAZ
- HighTAZ
- ELEMENROLL
- MIDENROLL
- HIGHENROLL
- PRIVENROLL
- EleTrpRate

- MidTrpRate
- HigTrpRate
- PrvTripRate
- RegionlTAZ

Highway Link Attributes

- LinkID
- ATyp1Dgt
- FTyp1Dgt
- ATyp2Dgt
- FTyp2Dgt
- ABLanes
- BALanes
- ACODE
- FCODE
- TOLLC
- CCODE
- LUCODE
- ZON
- GEOLOC
- USECODE
- ABTSFLG
- ABTS
- ABOBTS
- ABCAP
- ABCOUNT
- ABLINKG
- BATSFLG
- BATS
- BAOBTS
- BACAP
- BACOUNT
- BALINKG

Toll Link Attributes

- LinkID
- CTOLLVALUE
- TOLLC
- TOLLTYPE
- PLA_RAM_ID
- LANES
- MAXLANES
- TOLLAMOUNT
- SRVCTIME
- DECELCODE
- ACCESCODE
- EXCHLANES
- AVILANES
- RATIO_HEAW

Highway Load Data

- LinkID
- UNCONGTIME
- CONGTIME
- VOLUME
- CAPACITY
- VCRATIO
- LINKDIR
- VOL1
- VOL2
- VOL3
- VOL4
- VOL5
- VOL6
- VOL7
- VOL8
- VOL9
- VOL10
- VOL11
- VOL12
- VOL13
- VOL14
- VOL15
- VOL16
- VOL17
- VOL18
- VOL19
- VOL20
- VOL21
- VOL22
- VOL23
- VOL24
- VOL25

Transit Route Attributes

- LinkID
- IDNum
- Mode
- Line
- LineID
- Code
- Headway
- Region
- Oneway
- AStop
- BStop
- ET
- NH
- MH
- S
- RL
- Period
- RouteNo
- SequencNum
- LinkDir
- RouteClass

Transit Optional Link Attributes

- ACODE
- TMODE0
- TMODE1
- TMODE2
- TMODE3
- TMODE4
- AB_DIST
- AB_XITA
- AB_TIME
- BA_DIST
- BA_XITA
- BA_TIME
- OptClass

District 5 External Productions

- NodeID
- TripPurpos
- ExtSta
- OIA
- OCCC
- UNIV
- SEAW
- DIS1
- DIS2
- DIS3
- DIS4
- DIS5
- DIS6
- DIS7

District 5 Special Attractions

- NodeID
- TripType
- TAZ
- Desc_
- PersonTrip
- pctTourist
- pctResdent
- pctEI
- Descriptio

ZDATA5

- NodeID
- CardType
- TAZ
- AvgAutoOcc
- TripEndTyp
- TripPurpos
- PctAllocat

ZDATA1B

- NodeID
- TAZ
- RefTAZ
- HHNoChldPk
- AutoHHNoCh
- AutoHHChld
- PrsnHHNoCh
- PrsnHHChld
- OccHMRooms
- CBDExUrb
- DUs
- PctOccDUPk
- PctOccDUAn
- PctSFDUsPk
- PctSFDUsAn
- PctMFDUsPk
- PctMFDUsAn
- HMRooms
- PcOcHMRmPk
- PcOcHMRmAn
- OccHMRmBus
- OccHMRmPls
- OccHMRmMix

ZDATA3B

- NodeID
- CardType
- SectorNum
- TAZ
- ProdAtt
- FuncCode
- TotPrsTrip
- PctHBW
- PctHBShop
- PctHBSR
- PctHBSch
- PctHBO
- PctNHBW
- PctNHBO
- PctAirport
- Pct4TieTrk
- pctSnglTrk
- PctCombTrk
- TotalEmp
- CommEmp
- SvcEmp
- SchoolEnr
- HH
- HMUnitsOcc
- SGDes

ZDATA4B

- NodeID
- CardNum

- ExtTAZ
- TotPTrip
- PctPHBW
- PctPHBShp
- PctPHBSR
- PctPHBSch
- PctPHBO
- PctPNHBW
- PctPNHBO
- PctPAirpor
- PctP4TTrk
- PctPSngTrk
- PctPCpmTrk
- TotATrip
- PctAHBW
- PctAHBShp
- PctAHBSR
- PctAHBSch
- PctAHBO
- PctANHBW
- PctANHBO
- PctAAirpor
- PctA4TTrk
- PctASngTrk
- PctAComTrk
- XTravTime
- PctHBW0Veh
- PctHBW1Veh
- PctHBW2Veh
- PctOth0Veh
- PctOth1Veh
- PctOth2Veh
- RdwayName

APPENDIX C
THREE-LETTER ABBREVIATIONS FOR FLORIDA'S MODEL AREAS

MPOs		
Brevard	BRE	
Broward	BRO	
Charlotte	CHA	
Collier	COL	
Fort Walton Beach	FWB	
Gainesville	GVL	
Indian River	IND	
Jacksonville	JAX	
Lee	LEE	
Marion	OCA	(not MAR, which would be confused with Martin)
Martin	MRT	
Miami-Dade	MIA	
Orlando	ORL	
Palm Beach	PBC	
Panama City	PAN	
Pensacola	PEN	
Polk	PLK	
Sarasota/Manatee	SMA	
St. Lucie	STL	
Tallahassee	TLH	
Volusia	VOL	or DAB (depending on MPO's preference)
Regional Models		
D5 Central Florida	CFR	
D7 Tampa Bay (TBRPM)	TBY	
Florida Freight Model	FRE	
Florida Statewide Model	SWM	
Lee/Collier	LCL	
NERPM	NER	
SERPM	SER	
SMATS/Charlotte	SMC	
Treasure Coast	TRE	

APPENDIX D
FUTURE ENHANCEMENTS TO FSUTMS-TransCAD
Summary of Group Discussions at Model Task Force Meeting, May 4-5, 2004

Roadway Geography

- Needed GIS layers include a TAZ database, a separate TAZ boundary coverage, model roadway/network geography, and a local street network to develop the transit access network (eliminate spider network).

- Information that should be included in these database layers include socioeconomic data, roadway facility type, number of lanes, area type and traffic counts, railroad alignment, intersection control, turn penalties and prohibitions, ITS components, pavement information, bridge attributes, truck restrictions, bus stop coding, station coding, fixed guideway, and barriers.

- The roadway geography should be compatible with statewide, FDOT, city and county geography, GDL (Geographic Data Library) and ETDM procedures, and should provide the ability to overlay aerial photos.

- There is a need to develop a procedure to maintain the databases over time, including the Caliper-provided base maps.

- The map projection system needs to be established for each network in the state.

- FSUTMS should automatically update the transit network when changes are made to the highway network.

Generation of Standard Reports and Output

- There needs to be a checkbox list so that the user can select the specific reports that should be generated in a particular run, with defaults already checked.

- Better diagnostic messages should be provided when an error occurs.

- Users should be able to change the format of the report.

- There should be an interface that will allow for the production of summary reports by district, county, market segment, screen line, and cut line.

- Reports should be provided to display off peak vehicle use, emissions, ons and offs by transit route, percent trucks, highway and transit level of service by corridor, environmental justice, transit capacity, trip length frequency data, unbalanced attractions by district or county, transit station activity, VMT and VHT, and other useful HEVAL information.

- There needs to be a better identification of trip purpose instead of the previous numeric coding scheme of 1, 2 etc.

- The input and output files need to be time and date stamped.

- The system should allow for the creation of reports by drawing a corridor on a map and obtaining reports for a specified area.

- There is a need to develop a reporting system for land use checks and network checks, i.e., there should be a utility for checking data inputs.

- There is a need to develop reports for quality control purposes and user-friendly debugging procedures.

- The reports should include a comparison between the model outputs and observed patterns in travel survey data.

GIS Themes

- The GIS Committee should be involved in the development and specification of GIS Themes.

- Several themes of interest include:
    - barriers to be used in transit
    - link attributes by color
    - volume/capacity
    - volume/count
    - population density
    - level of service with GIS-TM standard imports
    - environmental justice (selected based on population groups)
    - bridges
    - maintenance schedules
    - transit routes
    - land use checks
    - facility constraints (environmental, historical, etc.)
    - desire line maps
    - mapping to examine origins and destinations
    - transfer matrices
    - bar charts showing various shares and trends
    - auto ownership by TAZ
    - zero-automobile households
    - mode split by purpose by zone
    - linkage to census data

- FSUTMS should include defaults for colors and patterns, a default library for GIS layers, and a central repository to share themes.

- A general list of thematic maps should be set up with a pull down menu where the user can select the desired theme.

- Care should be taken to ensure that the colors can be easily discerned by those who may be colorblind or color-challenged.

User Interface

- The proposed user interface is good.

- The map-based model selection interface is quite good, but there should also be an option to go directly to the model of choice.

- The version number of the model should be clearly identified.

- All current FSUTMS steps should be a part of the standard interface.

- There is a need to be able to run more than one scenario at a time or stack runs sequentially in a batch job.

- There should be an initial setup report and an automatic check for the required files.

- There should be a checkbox list for the users to specify the files that should be kept at the end of the run, with defaults already checked.

- There is a need for model version control.

- There should be a scenario management interface.

- There should be buttons to edit, finalize, delete, etc.

- There should be a way to save a run, delete or save temporary files, compress files, and archive.

- There should be an option to name and password-protect a model run, perhaps in an archive library.

- There should be an option to run Summit (for Transit New Starts Projects) and air quality emissions programs.

- Before executing a command there should be an “are you sure?” question.

Miscellaneous

- The output file should be protected so that it cannot be modified (e.g., current binary format in TRANPLAN).

- There is a need to run multiple sessions with one key.

- The line layers need to be compatible across modal networks.

- There should be
    - unlimited undo and redo capabilities
    - save and save as capabilities
    - an audit trail of user actions
    - a formal archiving ability
    - auto save option
    - an option to update multiple scenarios at the same time
    - an option to map landmarks and make them polygons

- There should be a method to analyze version certifications between networks.

- The error and debugging messages should be improved.

- A method should be developed to check the speed-cap table.

- There should be an option to compress files.

- It should be easy to convert TransCAD output to a format compatible for input to ArcGIS, ETDM, etc.

- The TransCAD training should be more focused on FSUTMS (travel demand modeling) and less on GIS functionality.