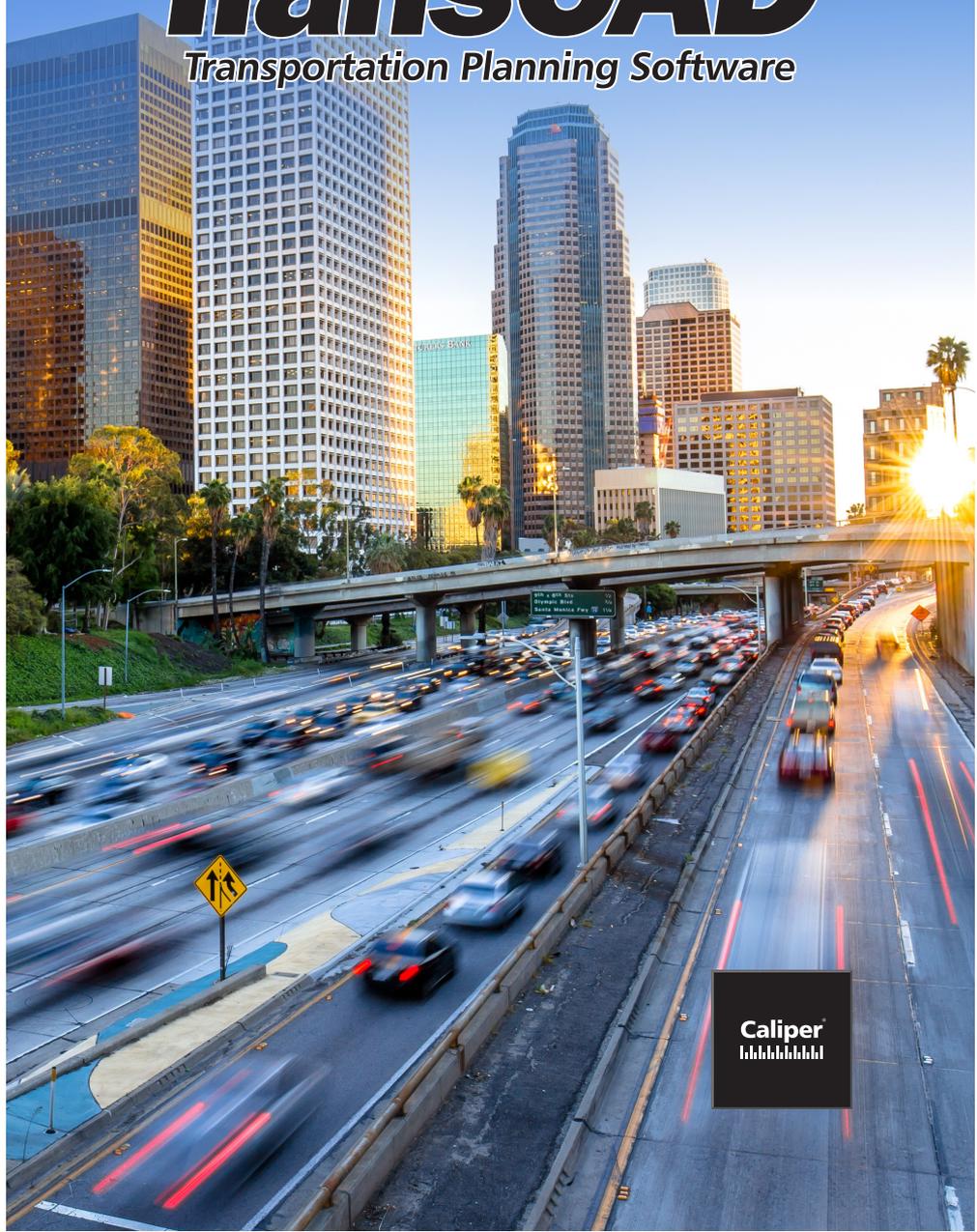


Travel Demand Modeling with

TransCAD[®]

Transportation Planning Software



The World's Most Powerful and Popular Travel Forecasting Software

TransCAD is the most comprehensive, flexible, and capable travel demand modeling software ever created. TransCAD supports all styles of travel demand modeling including sketch planning methods, four-step demand models, activity-based models, and other advanced disaggregate modeling techniques, and comes with the most extensive set of traffic assignment models ever assembled for use by planners and traffic engineers.

Many of the TransCAD enhancements and advantages come from improved algorithms and improved software engineering implementations of the best methods from the transportation science literature. Key procedures in TransCAD are multithreaded, resulting in enormous speed improvements on today's multi-core processors. There is also support for parallel processing for the largest models.

TransCAD is the only package designed to facilitate the implementation of best practices for travel forecasting and to provide a mechanism for advancing the state of the art in transportation modeling. Modeling with TransCAD is not limited to urban or regional demand forecasting, but is directly applicable for modeling passenger and freight flows at the state, national, and international level.

Demand Forecasting in a GIS Context

Travel forecasting models are used to predict changes in travel patterns and the utilization of the transportation system in response to changes in regional development, demographics, and transportation supply. Modeling travel demand is a challenging task, but one that is required for rational planning and evaluation of transportation systems.

TransCAD is the only modeling package that is GIS-based and fully integrates geographic information system (GIS) and demand modeling capabilities.

TransCAD is an extremely capable and robust GIS that includes many advanced features for transportation that are not available in other general purpose GIS software products.



There are many reasons to have a GIS as part of a travel demand forecasting package. First, GIS makes it possible for planning models to be much more accurate. For example, network distances are based on the actual shape of the road network and a correct representation of highway interchanges.

Second, the whole modeling process is more efficient. Data preparation is greatly facilitated and

the database and visualization capabilities catch errors before they cause modeling problems. With TransCAD, you and others will have an easier time understanding how the model components behave, thus requiring less staff time to implement and maintain travel models.

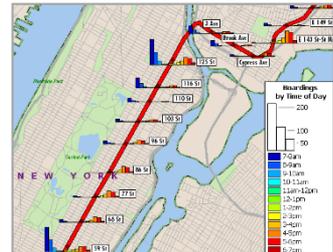
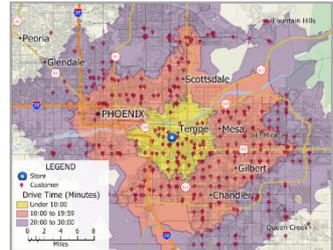
A third important advantage of a GIS-based modeling system is the use of the GIS itself and GIS-derived measurements directly in the modeling process. In TransCAD, different modeling equations can easily be derived and applied for different geographic subareas. Similarly, TransCAD brings new and much-needed capabilities for measuring geographic accessibility.

Because they have similar architectures, TransCAD is the planning package that integrates best with other institutional GIS software systems. TransCAD has native support for Esri Geodatabases, Access, Excel, Oracle, SQL Server, and Google Earth. TransCAD can exchange data with virtually all major GIS, CAD, and planning software packages.

TransCAD Software

TransCAD software is unique among travel demand forecasting packages in many respects:

- **Fully-Windows Compliant:** TransCAD supports Windows standards like .NET, COM, ADO, data exchange with Office, and the full complement of user interface conventions.
- **Powerful Built-in Relational Database:** TransCAD includes a powerful relational database and can work with external databases and ODBC clients.
- **Outstanding Graphics:** TransCAD provides high quality map output with dozens of thematic mapping styles and options, unlimited colors, fully-scalable line styles and symbols, a complete set of freehand drawing and annotation tools, labels that adjust to the map scale, and built-in highway shields. Support for image and web map layers makes it possible to overlay networks on top of aerial photographs and satellite imagery. TransCAD also has multimedia capabilities making it possible to integrate imagery, video, and web links associated with transportation facilities.

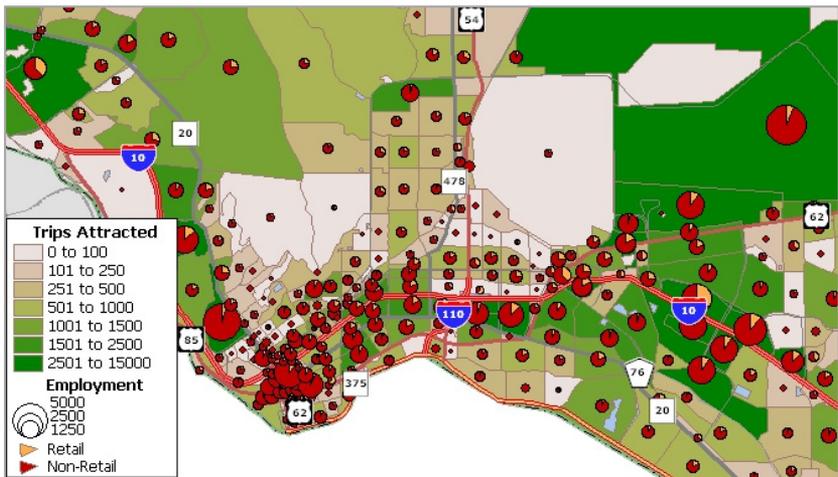


- **A Single, Unified Solution Without Costly Add-Ons:** TransCAD is the only unified package that performs all the desired functions. Other packages are limited to model application, leaving model estimation, database support, GIS, and often graphics and analytical postprocessing to other software. As a result, to do your work with other packages requires that you master four or five programs instead of one. Also, with TransCAD, you don't need to spend all of your time importing and exporting files.
- **Comprehensive Modeling Procedures:** TransCAD has the most comprehensive set of models. Because of its modern, unified design, TransCAD makes it easy to perform integrated modeling of all modes of transportation including car, HOV, truck, bus, rail, bicycle, and pedestrian movements.
- **The Most Powerful Matrix Engine and Virtually Unlimited Modeling Capacity:** There are no hard limits on the number of zones or the size of the networks to be modeled. There is efficient storage for matrix and network data without compromises that reduce processing speed. For these reasons, TransCAD is used in many large metropolitan areas including New York, Los Angeles, Denver, and Dallas-Fort Worth. TransCAD also has full support of Open Matrix Format (OMX).
- **Highest Quality Documentation:** The TransCAD help system includes a comprehensive travel demand modeling section that includes numerous examples and tutorials.
- **Unparalleled GIS Integration:** TransCAD embodies the highest level of GIS integration through its internal GIS that has many unique extensions for transportation. In addition, TransCAD integrates best with other GIS software because it has similar data structures and supports a vast array of popular data formats for vector databases and raster images. TransCAD works well with Esri and MapInfo data and is commonly used in conjunction with these other GIS software packages.

TransCAD Modeling Capabilities

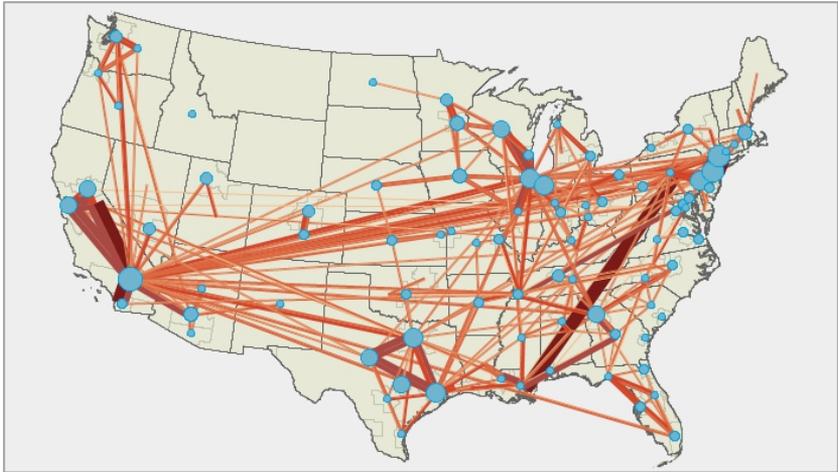
TransCAD includes comprehensive tools for trip generation, trip distribution, mode split modeling, traffic assignment, and all related matrix and network processes. TransCAD includes all of the traditional 4-step models and significant variants, quick response models with reduced data requirements, and advanced disaggregate demand models. Caliper continually enhances TransCAD to incorporate the most up-to-date methods for demand forecasting.

TRIP GENERATION



TransCAD includes a variety of trip generation models to forecast trip productions and attractions on any level of geographic aggregation. Among the methods are cross-classification, regression, and discrete choice models. TransCAD provides methods for the application and estimation of trip generation models. Also included is a powerful method to produce synthetic populations consistent with demographic distributions. The outputs of the population synthesis may be used as inputs to both traditional travel demand models as well as more advanced Activity-Based Models (ABM).

TRIP DISTRIBUTION



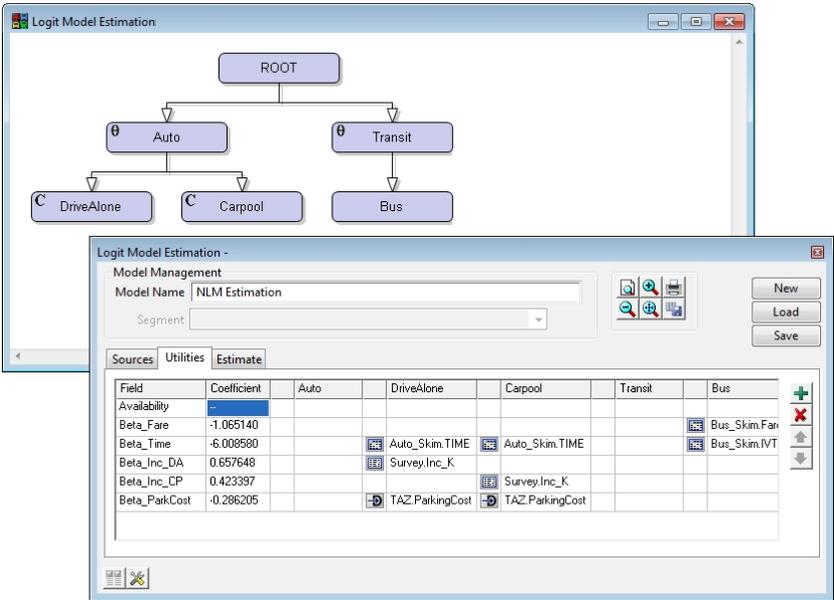
Trip distribution models are used to predict the spatial pattern of trips or other flows between origins and destinations. Models similar to those applied for trip distribution are often used to model commodity flows, retail trade, and store patronage.

TransCAD provides numerous tools with which to perform trip distribution, including procedures to implement growth factor methods, apply gravity models, generate friction factors, and calibrate new model parameters.

TransCAD includes tri-proportional models which allow for another dimension of constraints. In tri-proportional models, groups of cells in the P-A flow matrix are required to sum to specified values. TransCAD allows the additional dimension to be applied for both growth factor and gravity models.

In addition to traditional trip distribution methods, TransCAD supports modern distribution techniques based on discrete choice frameworks to apply destination choice models at both aggregate and disaggregate levels. Destination choice models include shadow pricing options to ensure consistency between productions and attractions.

MODE CHOICE ANALYSIS



Mode choice models are used to analyze and predict the choices that individuals or groups of individuals make in selecting the transportation modes that are used for particular types of trips. Typically, the goal is to predict the share or absolute number of trips made by mode.

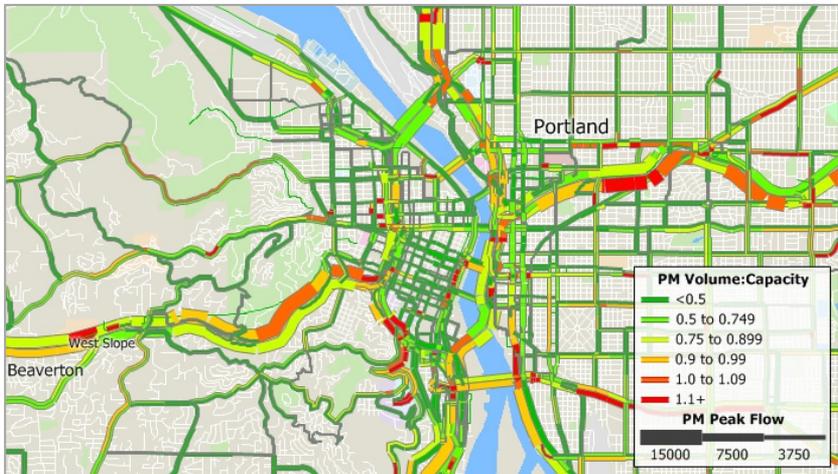
An important objective in mode choice modeling is to predict the share of trips attracted to public transportation. TransCAD provides procedures for calibrating and applying mode choice models based on multinomial and nested logit models, as well as legacy methods, and may be pursued at either a disaggregate or aggregate zonal level.

Estimation of the parameters in the nested logit and multinomial logit model is performed in TransCAD by the method of maximum likelihood, which calculates the set of parameters that are "most likely" to have resulted in the choices observed in the data. There is enormous convenience in estimating and applying nested logit models in the same software environment.

A special interface lets you draw the structure of your nested logit model graphically. A companion model management window helps setup the utility functions and data sources. With this interface, estimating nested logit models has never been easier.

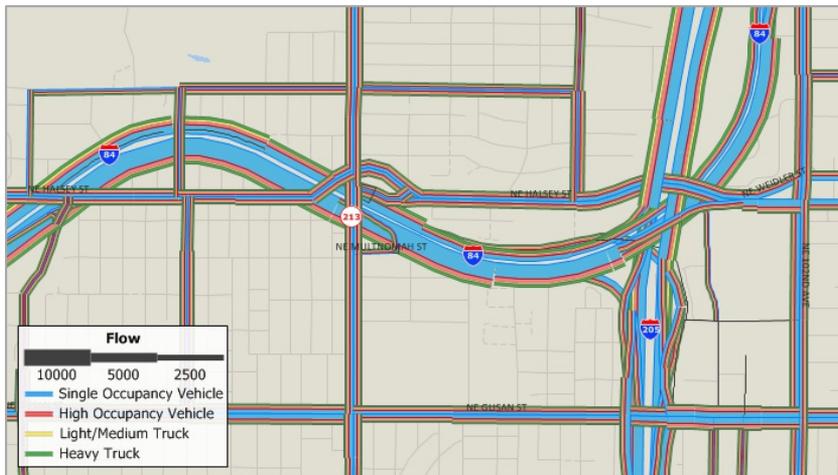
TransCAD supports choice set variation in both estimation and model application which is important for accurate model specification. TransCAD also provides support for coding user-defined mode choice procedures in FORTRAN, C, JAVA, and C++.

SUPER-FAST, HIGHLY-CONVERGENT TRAFFIC ASSIGNMENTS



TransCAD incorporates several breakthroughs in traffic assignment methodology that facilitate more accurate analyses of road traffic and the impacts of transportation improvements. All of the user equilibrium methods can achieve very high levels of convergence and do so with unprecedented fast computing times. Also, all of the methods take advantage of multi-threading to run much faster on multi-core and multi-CPU computers.

MULTI-MODAL, MULTI CLASS ASSIGNMENT



Among the advanced methods is a very flexible, master multi-modal, multi-class equilibrium or stochastic equilibrium assignment model that accommodates realistic multi-class entrance-to-exit tolls in addition to traditional link tolls. This is a generalized cost assignment that uses class specific values of time and network use restrictions. A wide array of volume-delay functions has been preprogrammed and there is provision for user written functions as well.

LEVEL OF SERVICE (LOS) CALCULATORS

TransCAD includes several modules for performing intersection LOS calculations and calculating related HCM measures. These are very convenient to use as no data transfer is required.

ASSIGNMENT UTILITIES

Screenline Analysis: Screenline analysis compares trip assignment results with the traffic counts on roads. More precisely, it is a process of comparing the directional sum of ground count traffic volumes across a screenline or a cordon line with the directional sum of the assigned traffic volumes across the same screenline or cordon line. Screenline analysis is a useful tool for the calibration

of trip assignment models, and it can also be used for more general purposes such as calculating flows that cross a screenline.

Subarea Focusing: While forecasting transportation demand for a region, you may be interested in performing a more detailed investigation of traffic patterns within a subarea, such as the downtown area. To facilitate subarea analysis, TransCAD provides a procedure that lets you create an O-D trip table for any subarea. The reduced O-D table may be used for performing a traffic assignment on a subarea network which may be more detailed than the regional network, or used in a traffic simulation for the subarea.

Assignment Differences: You can compare two flow tables to find assignment differences. The assignment differences utility creates a theme that graphically illustrates the locations and magnitudes of differences. This tool is particularly useful for analyzing the effects of changing network attributes, such as capacity or VDF parameters, or employing different assignment techniques.

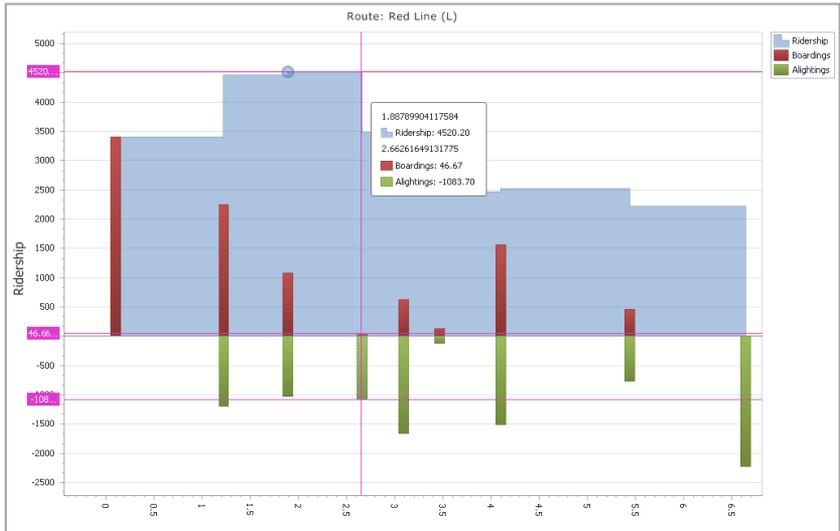
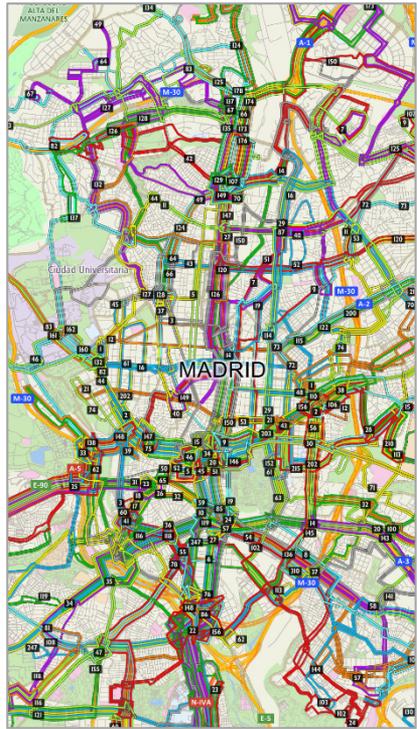
Select Link/Zone Analysis: You can create an origin-destination matrix file that indicates the number of trips that pass through a specified set of links or zones, sometimes referred to as critical links or critical zones. You can also create an assignment table that contains the component of flow on links that pass through a specified set of links or zones.

Public Transit

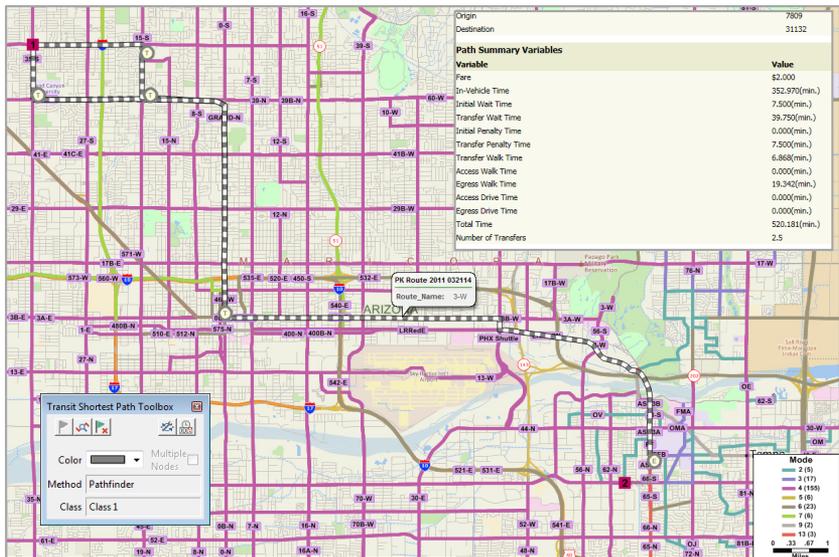
Public transit is a specialty of TransCAD, with capabilities that greatly exceed those of other planning packages. TransCAD is the only software that has a realistic GIS-based representation of transit systems. TransCAD has special data structures for handling transit



routes in all their natural complexity. Routes may be stored, displayed, edited, and analyzed. An important feature is that transit routes can be directly placed on the streets so that interactions between autos and transit can be treated explicitly. Moreover, stops need not be located at street intersections, but instead can be located where they really are and on the correct side of the street. Special visualization capabilities for transit make it easy to display and label overlapping routes. TransCAD has the broadest set of transit pathfinding routines of any package and includes headway-based and schedule-based methods.



SCHEDULE-BASED TRANSIT NETWORKS AND PATHS



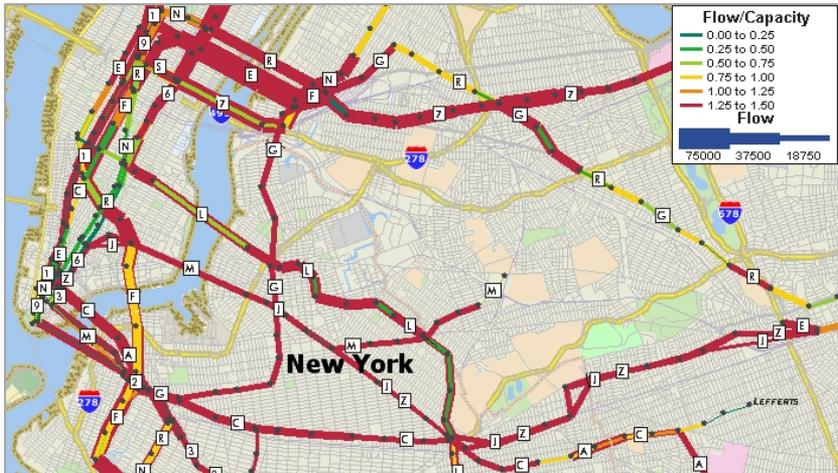
TransCAD has special tools and procedures for creating and working with transit networks. Transit fares can be specified as flat, zonal, or mixed. Using transit networks and fare structures, you can solve shortest path problems, calculate transit path attributes (i.e., skims), and perform transit assignment.

TransCAD can process schedules and assist in developing network attributes such as route headways.

TransCAD can perform transit analysis based on schedules including interactive schedule-based origin-to-destination paths, schedule-based transit skimming, and schedule-based transit assignment. Transit networks imported from GTFS will also import schedule data.

TransCAD includes the most realistic and flexible transit pathfinding and skimming methods. The key methods provide the multiple paths that travelers will use and give the analyst fine control over access, egress, and transfer properties.

TRANSIT ASSIGNMENT



Transit assignment models are used to estimate the number of passengers that utilize segments in a transit network as a function of transit level of service. These models take as input a matrix of passenger flows between origins and destinations and a transit network, and produce link level and aggregate ridership statistics. TransCAD includes an array of sophisticated transit network assignment procedures.

These procedures include multi-class methods that are sensitive to fares, access station choice, and park and ride access, as well as equilibrium assignments, which take account of the capacity of transit service and the effect of ridership on crowding, comfort, and, optionally through dwell time effects, on the travel time on the route. These methods distribute the flow between a particular origin and destination to multiple paths, based on their relative attractiveness.

The transit assignment procedures produce a table of ridership at every stop along each route in the transit network. Optional outputs include critical link analysis, boarding and alighting counts, stop-to-stop flows, route-to-route transfers, and aggregate ridership counts. You can also save the paths utilized and visualize them directly.

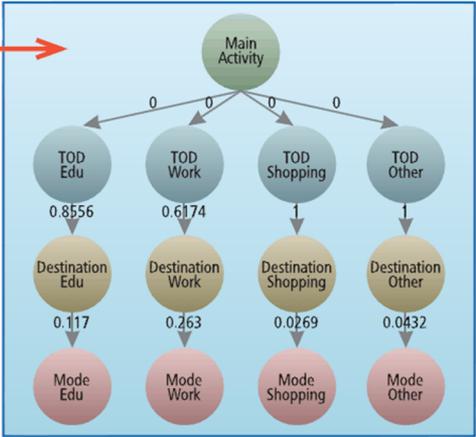
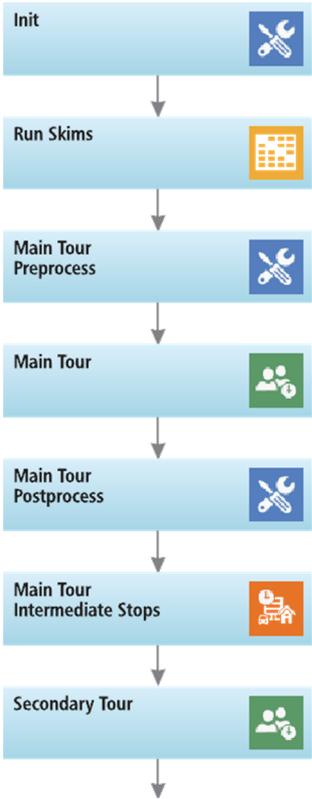
GTFS CAPABILITY

With TransCAD, public transportation routes can easily be mapped using General Transit Specification Feed (GTFS) data. The data can be imported as TransCAD Routes System files directly or conflated to lie on top of a routable street file that can also be used for calculating walk, drive, and bicycle access and egress. These routes can then be used for advanced public transportation modelling and public transportation accessibility.

Activity-Based Models

TransCAD offers native support for custom-built Activity-Based Models (ABM). It features a highly efficient computational platform synthesizing the advantages of multithreading and parallel processing to tackle the large popula-

tions and heavy numerical calculations associated with the most sophisticated ABMs in practice. Both traditional and state-of-the-art econometric modeling frameworks are available to the modeler, including linear regression, multinomial and nested Logit, destination choice, hazard duration and Multiple Discrete-Continuous



Extreme Value (MDCEV) procedures. An easy-to-use flowchart interface allows model components to be organized and interconnected to represent the desired behavioral processes. A flexible parameter editor facilitates specification and editing of model structures, utility equations and data sources, also allowing the user to define expressions to create new variables on the fly from existing matrices and tables. All of the ABM features are integrated with the other TransCAD procedures and tools including multi-modal traffic assignment, GIS-based data visualization, and reporting. The outputs from TransCAD ABMs can also be used directly as inputs to simulation-based Dynamic Traffic Assignment (DTA) in TransModeler.

Road and Transit O-D Estimation

Accurate and up-to-date trip tables are critical inputs for transportation planning models. Traditionally, the principal method of collecting information on the spatial pattern of trips within urban areas has been the large scale home interview survey. Unfortunately, home interview surveys of the necessary sample size are prohibitively expensive and difficult to implement, and are therefore rarely done. In contrast, traffic counts on highway links are inexpensive to perform and are routinely collected in many areas. It is thus extremely attractive to have a method to create or update trip tables based upon traffic counts.

TransCAD provides very flexible and effective procedures for estimating and/or updating an origin-destination matrix based upon a sample of network link traffic counts and an initial or base trip table.

Non-Motorized Travel Analysis

With TransCAD you can have separate and fully integrated networks for bicycles and pedestrians. Pedestrian links can be full street networks. Walk links can be included in transit networks.

Freight Applications



TransCAD has been designed to facilitate freight demand modeling as well as passenger models. TransCAD can manage all of your freight data no matter how many origins, destinations, shipments, or commodities are involved. TransCAD offers a complete solution for modeling commodity flows and truck movements. Freight traffic can be easily assigned to the transportation network and there are also specialized assignment procedures available for rail waybill assignment.

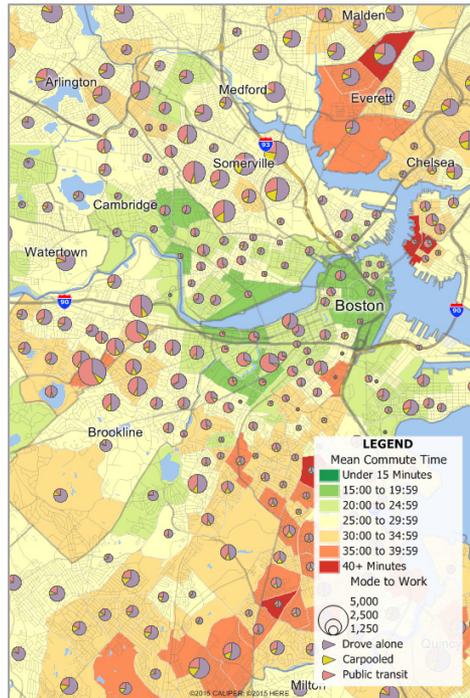
Data Access

TransCAD includes utilities that model developers will find indispensable for data preparation.

Geocoding: Virtually all forms of survey data can be analyzed in TransCAD. For most modeling purposes, each survey will be geocoded to the respondent's primary location. For traveler surveys, each survey will most commonly be geocoded to their residence.

Access Census Data Directly:

Census data are very valuable in urban transportation analysis. TransCAD comes with extensive Census data. TransCAD also provides procedures for importing specialized Census data. There are procedures for importing data from the Census Transportation Planning Package (CTPP). The CTPP data are among the most valuable datasets available for transportation planners. TransCAD also comes with up-to-date American Community Survey (ACS) data. Support for accessing LEHD data is also available.



A World of Data: Increasingly there are many other data sets available for use with TransCAD for many other countries and regions. Caliper can help you identify these data sets.

Import Networks and Trip Tables: TransCAD provides tools for importing networks and network data from a variety of stand-alone transportation planning packages. These networks are converted into GIS databases that can be used for all types of planning, modeling, and mapping applications. TransCAD provides a seamless import capability for transportation planning network files in TP+, EMME, TRIPS, QRSII, TMODEL and TRANPLAN Cube formats, usually with no preprocessing necessary. Other data can be imported from ASCII and many other formats.

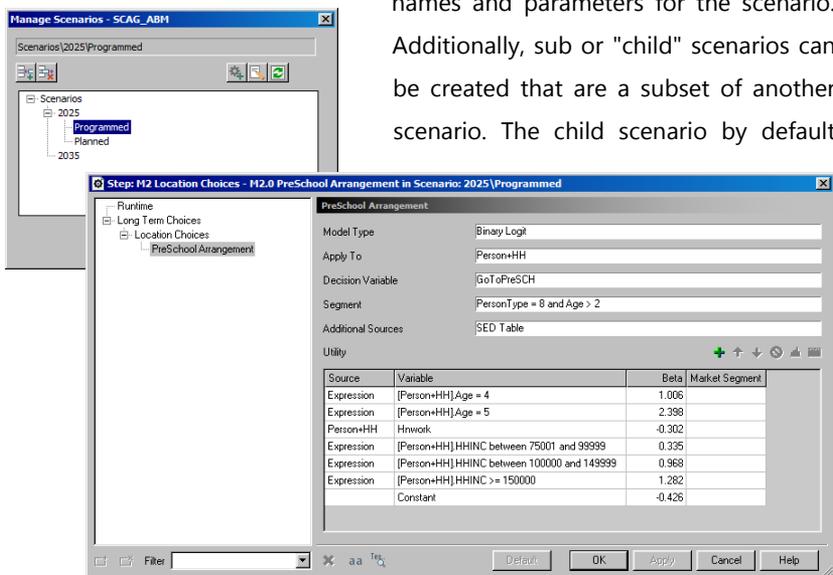
With the model manager, you can interactively specify the order of the modeling steps to be performed, select all of the input and output files, and edit the model procedure parameters. The easy-to-use interface also documents the model and its components, and makes it simple to set up parallel processing.

SCENARIO MANAGEMENT

The model manager includes a powerful scenario management facility. Once you have a working model, you use the Scenario Toolbox to organize the parameters for different runs of the model and to run the scenario. The Scenario Toolbox is the control panel for creating new scenarios, for editing and reviewing their parameters (input and output data files), and for running the model under different scenarios.

Object-oriented methods are used to maintain the relationships among sets of interrelated scenarios. Each scenario allows users to define the base directory that the model files use and, optionally, all the relevant input and output file

names and parameters for the scenario. Additionally, sub or "child" scenarios can be created that are a subset of another scenario. The child scenario by default



inherits all parameter values from its parent. Whenever the parent scenario's parameters change, the child's values change automatically, greatly streamlining the model process.

INNOVATIVE INTERACTIVE BATCH CAPTURE

There is an innovative batch processing system that is built in to TransCAD. TransCAD lets you create scripts interactively by clicking menu items, choosing parameters in dialog boxes, and saving the corresponding script.

Support Services and Requirements

TransCAD is easy to learn and use. The documentation teaches travel forecasting and contains numerous tutorial exercises so that you can explore planning methods on your own. Caliper also offers frequent training courses in Boston and at customer locations. Many universities use TransCAD in teaching transportation planning.

Caliper training is widely acknowledged as the best in the industry. Caliper has trained more than 5,000 professionals from around the world in the use of TransCAD. The TransCAD training course was recognized in a U.S. nationwide survey by the Urban Transportation Monitor as one of the best training classes offered.

Technical Support and Maintenance

Use of TransCAD is backed by the largest planning software support staff in North America. Technical support is provided by telephone and email, and Caliper is known for the high quality and timeliness of our support services.

TransCAD Versions

TransCAD comes in two versions. Standard TransCAD contains all of the travel demand forecasting procedures described in this brochure; these procedures are not included in Base TransCAD.

System Requirements

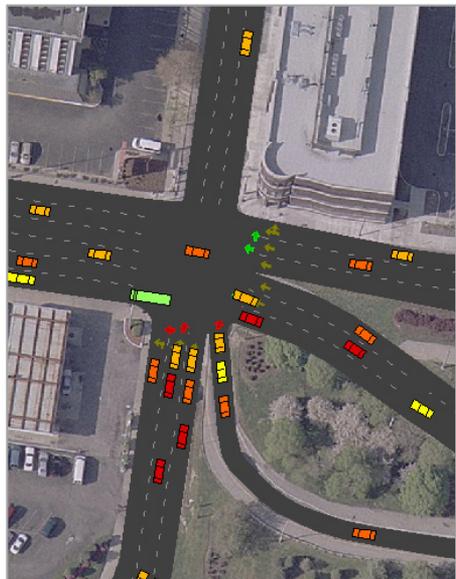
TransCAD will perform well on any 64-bit computer than runs Windows 7 or above. Recommended hardware includes at least 8GB of RAM, 20GB of hard disk space, and an available USB port. For especially large numbers of zones, additional memory and disk space may be required. More detailed hardware recommendations are available upon request from Caliper.

Also Available from Caliper

TRANSMODELER TRAFFIC SIMULATION SOFTWARE

TransModeler is a powerful and versatile traffic simulation package applicable to a wide array of traffic planning and modeling tasks. TransModeler can simulate all types of road networks, from freeways to downtown areas, and can analyze wide area multimodal networks in great detail and with high fidelity. You can model the behavior of complex traffic systems in a 2-dimensional or 3-dimensional GIS environment to illustrate traffic flow, signal operation, and overall network performance.

Based upon the latest research, TransModeler employs advanced methodological techniques and software technology to bring traffic simulation into a new era. TransModeler incorporates dynamic routing of trips based upon historical or simulated time dependent travel times, and also models trips based on origin-destination trip tables or turning movement volumes at intersections. It simulates public transportation as well as car and truck



traffic, and handles a wide variety of ITS features such as electronic toll collection, route guidance, and traffic detection and surveillance.

TransModeler can work with TransCAD to provide an integrated capability to perform operational analysis of transportation projects and plans. Traffic simulation results can also be used to facilitate more accurate travel demand forecasting.



About Caliper

Founded in 1983, Caliper is recognized worldwide as a leader in the development of transportation and GIS software. Caliper provides a broad range of consulting services in support of TransCAD planning applications. These include model development and calibration, model conversion from other systems, software customization, and web application development. For more information, please visit our web site, WWW.CALIPER.COM, e-mail INFO@CALIPER.COM, or call us at 617-527-4700.



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