Description of the Land Use Model, Transportation Model, Data Collection, and Socio-Economic Analysis efforts at the North Central Texas Council of Governments

THE NCTCOG REGION

The NCTCOG region includes the entire 16 counties of Collin, Dallas, Denton, Ellis, Erath, Hood, Hunt, Johnson, Kaufman, Navarro, Parker, Palo Pinto, Rockwall, Somervell, Tarrant, and Wise. Exhibit 1 illustrates the counties within the North Central Texas region. The region encompasses, 12,800 square miles, contains 225 cities and numerous districts and other political entities, and has a 2009 population of 6.6 million people. Exhibit 2 illustrates the counties within the North Central Texas metropolitan planning area (MPA).

Exhibit 1: Counties in the North Central Texas Region

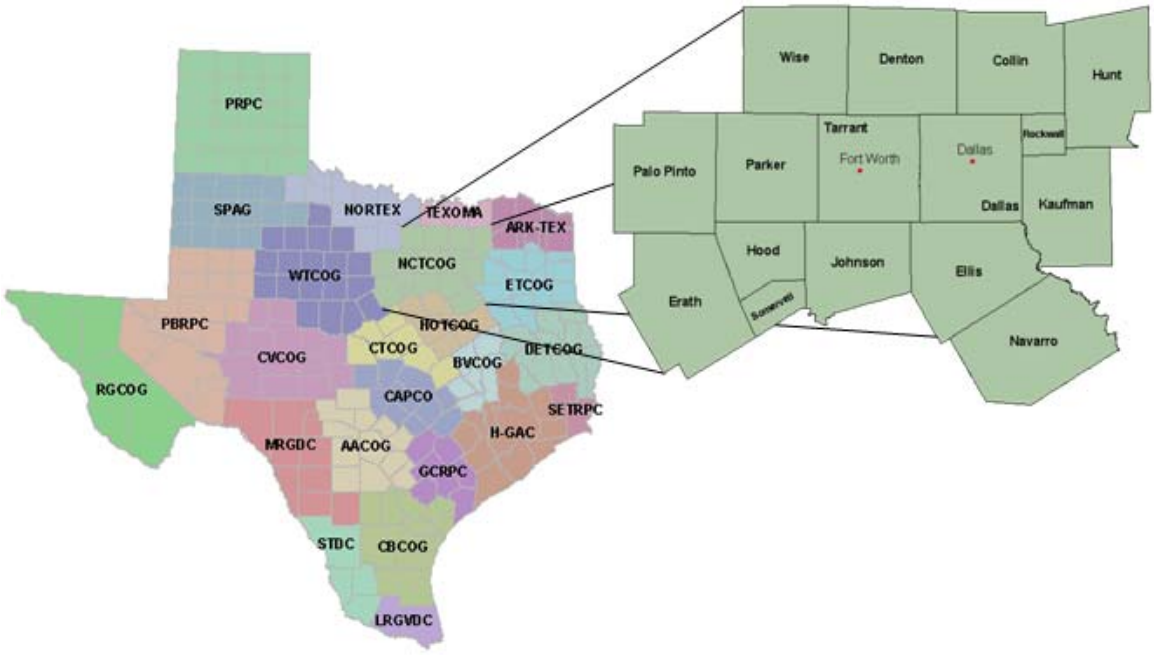
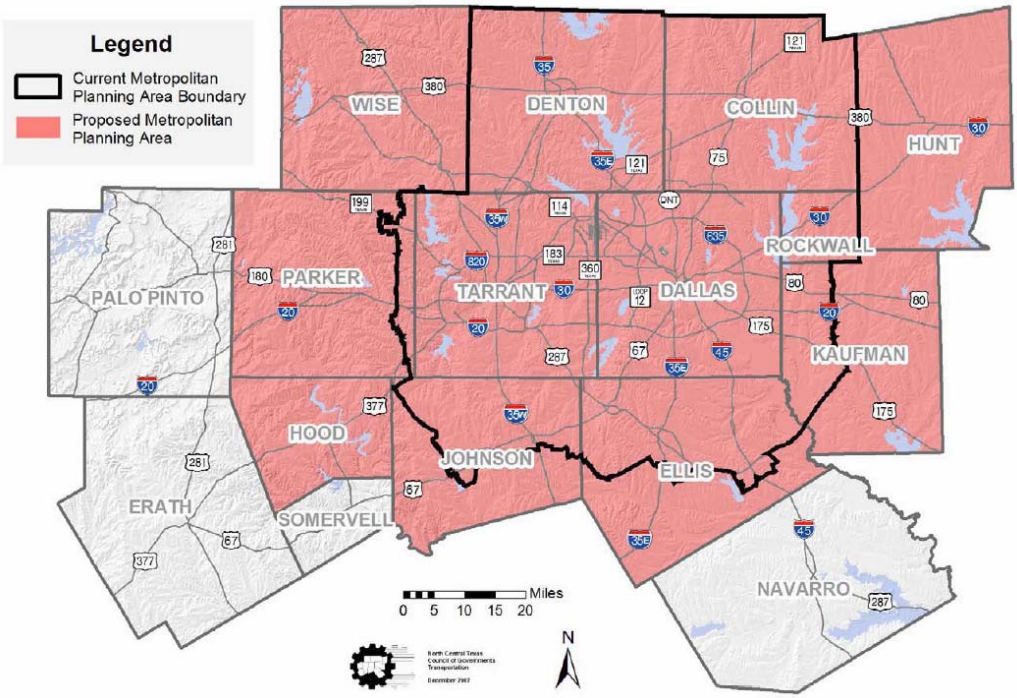


Exhibit 2: The North Central Texas Metropolitan Planning Area



REGIONAL TRANSPORTATION PLAN

The Metropolitan Transportation Plan program area prepares the long-range regional transportation plan, which identifies projects, policies, and programs to be implemented and carried out by the Metropolitan Planning Organization in conjunction with the transportation providers, local governments, and state and federal agencies. The Mobility Plan is approved by the Regional Transportation Council. The Regional Transportation Council is the independent transportation policy body of the Metropolitan Planning Organization. The RTC is comprised of 43 members: 36 local elected or appointed officials representing cities and counties, and seven transportation provider representatives. The RTC is responsible for overseeing the metropolitan transportation planning process. There are four primary transportation authorities in the North Central Texas region. Dallas Area Rapid Transit (DART), Fort Worth Transit Authority (The T), Denton County Transit Authority (DCTA), North Texas Tollway Authority (NTTA). Exhibit 3 illustrates the current funded roadway recommendations as part of the Mobility 2030: Metropolitan Transportation Plan. Exhibit 4 illustrates rail lines under consideration.

Exhibit 3: Funded Roadway Recommendations

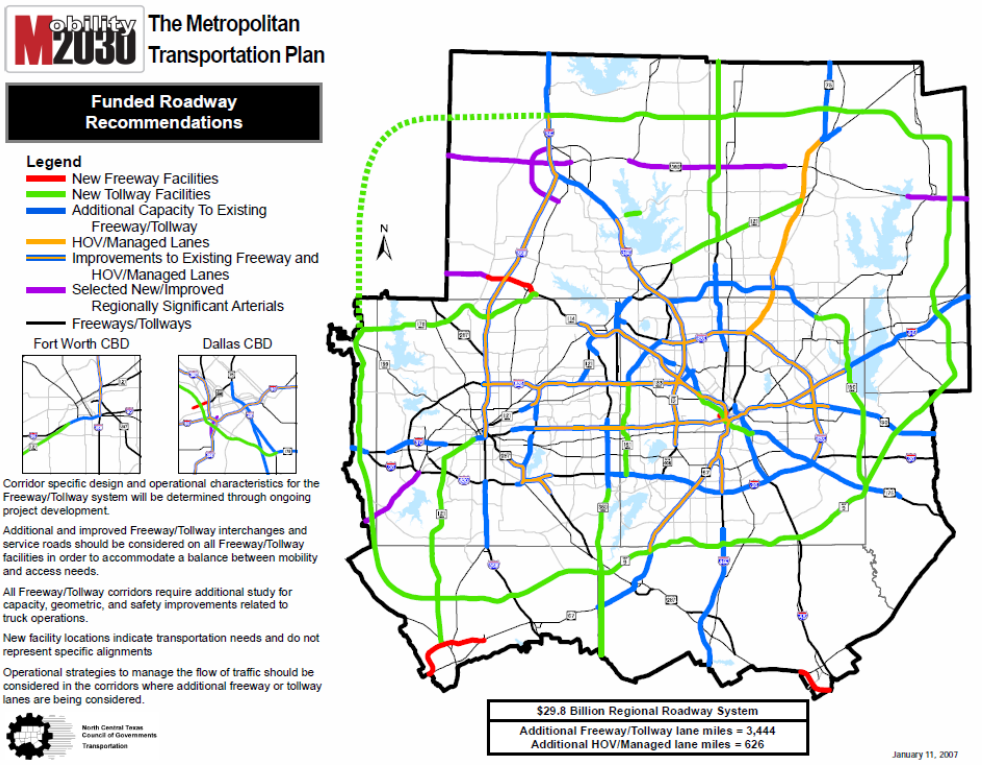
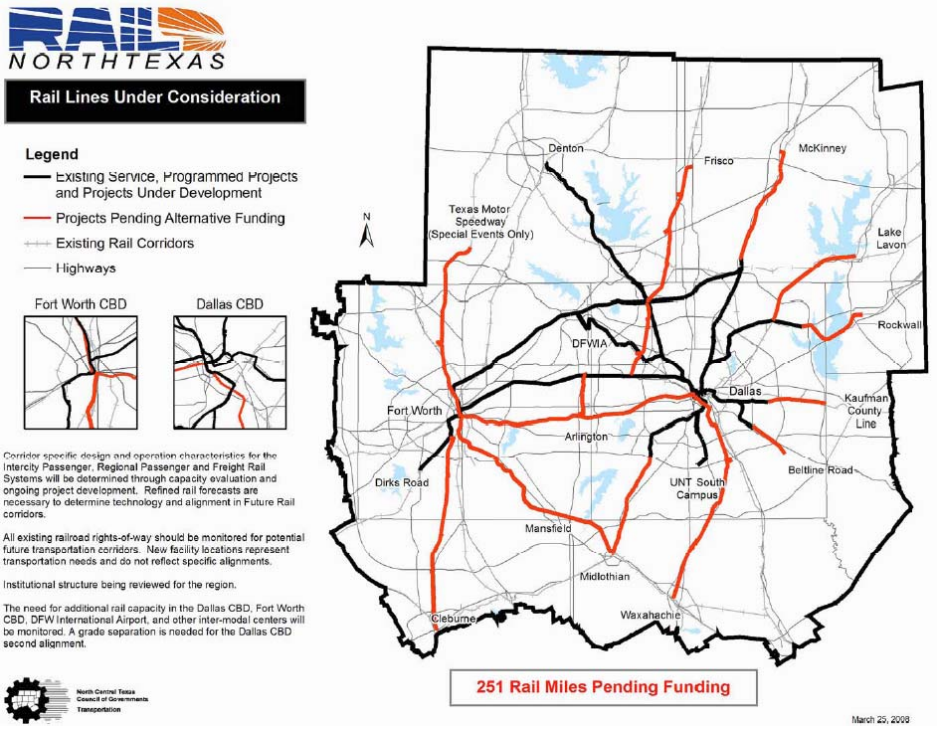


Exhibit 4: Rail North Texas



NCTCOG DEMOGRAPHIC FORECAST

The NCTCOG Demographic Forecast is created by the NCTCOG Research and Information Services department in coordination with the NCTCOG Transportation department. It is typically updated every 5 years. This forecast provides long-range, small area population, household and employment projections in five-year intervals. Forecast data are created for use in local and regional urban planning, economic development, homeland security, transportation planning, and various resource allocations.

The forecast is developed using a federally recognized land-use model that allocates households and employment to sub-areas called forecast districts. This allocation is based on regional control totals and other regional inputs. Forecast districts are then disaggregated to smaller areas called Traffic Survey Zones. This disaggregation is based on proximity to transportation infrastructure, amount of vacant land, overall development capacity, historical trends, and NCTCOG development monitoring.

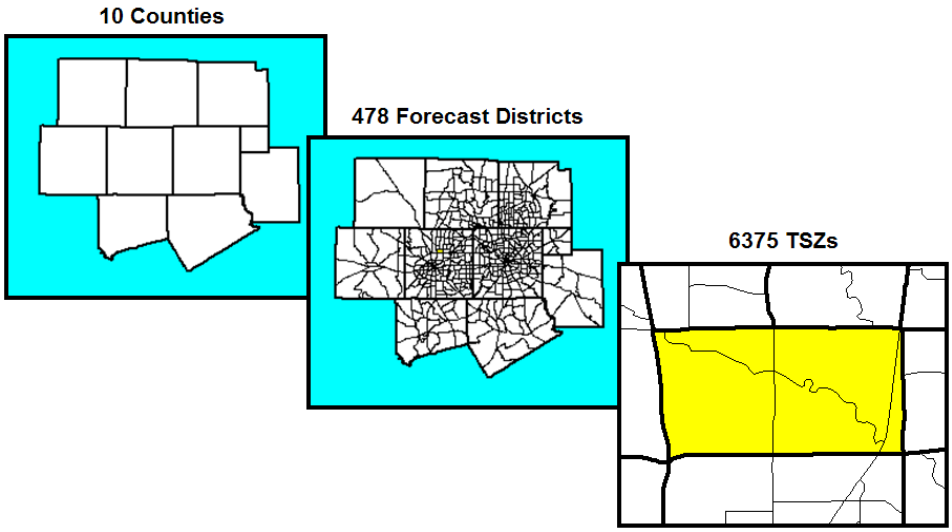
The methodologies used in the forecast process are typically reviewed by a Methodology Review Taskforce, comprised of a panel with expertise in research methodologies and knowledge of factors related to the growth of the region. Each city also has a representative in the Local Review Group which is responsible for approving their city's forecast totals.

2030 Demographic Forecast

The current official NCTCOG forecast is the 2030 Demographic Forecast. It was released in April 2003 and projected a population of 9.1 million people and 5.4 million jobs by 2030. It covered 10 of the 16 NCTCOG Counties. DRAM/EMPAL was the land use model used, while the transportation

model ran on a Texas A&M mainframe system. DRAM/EMPAL district totals were disaggregated to 6375 Traffic Survey Zones.

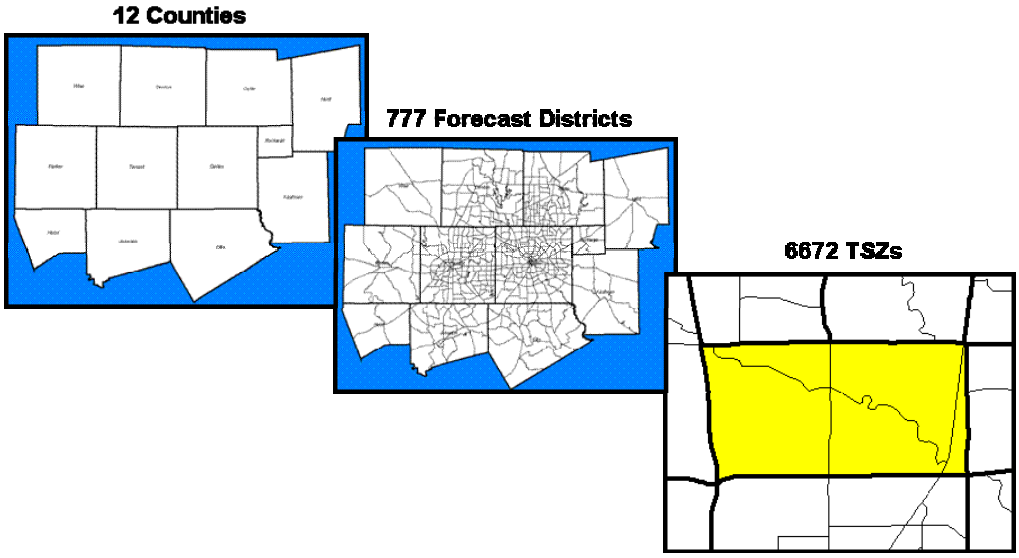
Exhibit 5: 2030 Demographic Forecast



2040 Demographic Forecast

Development is currently underway for the 2040 Demographic Forecast. It is expected to be released in October of 2009. It covers 12 of the 16 NCTCOG Counties. DRAM/EMPAL is the land use model used, while the transportation model is run using TransCAD (described later in this paper). DRAM/EMPAL district totals are disaggregated to 6672 Traffic Survey Zones.

Exhibit 6: 2040 Demographic Forecast



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NCTCOG DATA

NCTCOG Research and Information Services department continually collects data and information needed by Agency planning programs, including the Demographic Forecast. Below is a list of the data being collected that may be used in any land use model.

- Orthophotography – NCTCOG typically obtains 6 inch or 1 foot resolution aerial photography of the region every 2 years

- Parcels – NCTCOG currently has parcel boundaries and data for 10 of the 12 counties in the new MPA area. The two remaining should be available sometime this year. Quality varies across counties. NCTCOG began collecting GIS parcel data in 2002 for selected counties and continues to add new counties as it becomes available. Below is a table describing the current state of the information collected. This represents 2008 parcel data.

County	Availability	Quality of Data	Quality of Parcel Shapes	Notes
Collin	Y	Very good	Very good	
Dallas	Y	Very good	Very good	
Denton	Y	Good	Very good	Poor year built data
Ellis	Y	Fair/Good	Very good	Some missing values, including improved and land values.
Hood	Y	Poor/Fair		Missing some parcel shapes, missing year built field, and difficulties with improved and land values.
Hunt	N			In development
Johnson	Y	Good	Good	
Kaufman	Y	Good	Good	Poor year built data
Parker	Y	Good	Fair	Splits needed to match data to shape
Rockwall	Y	Fair	Good	Spatial data and year built information is poor. Troubles joining data to shape file.
Tarrant	Y	Very good	Very good	
Wise	N			In development

- Population Estimates by City and County – based on city submitted annual residential completions

- Multifamily data – Source: M/PF and ALN Apartment Data. These companies are recognized multifamily data providers are extremely familiar with the North Central Texas apartment market. M/PF data contains estimated occupancy rates by market area. A partnership between NCTCOG and ALN has been established to share data. ALN is providing NCTCOG with their database of apartment communities with 50 or more units and includes latitude/longitude and occupancy rate. ALN also tracks announced and under construction multi-family development.

- Residential occupancy rates – Source: Residential Strategies and MetroStudy. These companies are recognized single-family data providers are extremely familiar with the North Central Texas residential market. Third party data containing estimated occupancy rates by market area.

- Commercial occupancy rates – Source: CB Richard Ellis or other data provider. Third party data containing estimated occupancy rates by market area and type (office, industrial, retail).

- Additional building information – Source: Xceligent. Data has been used in the past, and could possible be obtained again. This database is of commercial structures with related information (including latitude and longitude) that are currently, or have been for sale or lease at one time. The last complete dataset contained 27,000 records.

- General regional features and Development Monitoring - NCTCOG's Development Monitoring database tracks over 8,000 major developments that are either existing, under construction, announced, or in the conceptual stages. Major developments are over 80,000 square feet and/or 80 employees and are classified in one of thirteen usage categories:

    - Education - Primary and secondary public schools, colleges and universities
    - Group Quarters - Jails, nursing homes, and dormitories with more than 80 rooms

- Hotel - Hotels and motels built since 1995 with at least 80 rooms or 80 employees
- Institution - Airports, airlines, and all major hospitals
- Cultural – Museums, etc…
- Industrial - Industrial buildings with at least 80,000 sq ft
- Mixed Use - Development with multiple uses, over 80,000 sq ft
- Multi-Family - Apartments, townhomes and condos with at least 80 units
- Office - Office buildings with at least 80,000 sq ft
- Recreation - Sites that attract high volumes of people, may be seasonal
- Retail - Malls, neighborhood centers and individual retail structures with at least 80,000 sq ft
- Service - Business services
- Single Family - Subdivisions built after 1998 with more than 80 homes

Main sources of information are the local newspapers, business journals, local governments, chambers of commerce, developers, and economic development corporations. Examples of development information NCTCOG staff look for are:

- New construction or expansion (size and location)
- Status updates (will start construction or complete). NCTCOG verifies with field work for publication
- Lease info (new stores moving into vacated big-box and strips, Target, Home Depot, etc.)
- Lease info (sizable square footage in office bldg is indication of major employer)

- Employer data – Source: NCTCOG and other partner surveys, Dunn and Bradstreet, InfoUSA, Texas Workforce Commission. NAICS codes is included with data. NCTCOG is now receiving regular updates of the Texas Workforce Commission business list

- Land Use – compiled from appraisal district data (using state land use codes), aerial interpretation and NCTCOG development monitoring data when needed.
  - Last regional coverage completed in 2006

- Comprehensive Plans, Future Land Use, Zoning collected from as many cities as possible

- Regional Control Totals – The Perryman Group (population and employment), Texas State Data Center (population), Water Development Board (population)

- Floodplain, parks, and other environmental data compiled from various sources

- Various Census data (Census 2000, ACS, PUMS)

NCTCOG GIS ENVIRONMENT

ArcGIS 9.3 – ArcMap, ArcGIS Server, ImageServer, SDE

NCTCOG DATABASE ENVIRONMENT

Microsoft SQL Server 2005 and 2008

NCTCOG PROGRAMMING ENVIRONMENT

Staff expertise with asp.NET, C#, Visual Basic, some Python

ORGANIZATIONAL STRUCTURE

Land Use Modeling / Demographic Analysis / Data Collection

- 5 Demographic Research Staff
    - Manager of Research
    - Senior Economic Planner
    - 2 Economic Planners
    - Research Intern

- Positions below are provide general support as needed
    - Application Development
        - Manager of Database Applications
        - Application Developer
    - 2 GIS Analysts (used for general GIS support and parcel data collection)
    - Internet Coordinator

Transportation Modeling

- 8 Transportation Modelers
    - Manager of Transportation System Modeling
    - 4 Senior Transportation System Modelers
    - 3 Transportation System Modeler I/II

ANNUAL BUDGET

Land Use Modeling / Demographic Analysis / Data Collection

- $320,000 – NCTCOG Transportation Department for development of NCTCOG Demographic Forecast, including data collection, modeling, analysis, support, and outreach

- $235,000 – Local Technical Assistance for development of Annual Population and Housing Estimates, Development Monitoring, Alternative Demographic Scenario Analysis, Visioning Exercises, Center for Development Excellence Support, fee for services projects, and general demographic support for local governments

- $150,000 – State Planning Assistance Grant for future land use modeling efforts. Will likely be used to fund the hiring of a Demographic Modeler

Transportation Modeling

- Approximately $1,000,000 – Support of all Transportation Modeling efforts at NCTCOG

NCTCOG LAND USE MODEL

NCTCOG has used Metropilus (DRAM/EMPAL) since the early 1980s. Dr. Stephen Putman, developer of Metropilus, has served as the primary consultant for each forecast process. NCTCOG has long been aware of alternatives to Metropilus but has continued to use the model because of its relatively few data requirements, ease of use (in terms of actually running the model), relationship with the developer, and FHWA approval.

The NCTCOG Demographic Forecast has the support of local governments because of the detailed local review undertaken for each forecast period. In turn, NCTCOG has relied heavily on local input to overcome some of the model's weaknesses such as its inability to account for redevelopment and its inability to provide for detailed small area projections. The current NCTCOG forecast is being run using 777 districts. While Dr. Putman approved the use of this many districts, we believe the large number of zones is pushing the model's predictive abilities.

Metropilus offers little or no scope to introduce planning policies except by specifically assigning constraints or making adjustments to zonal attractiveness.

In working with the model, NCTCOG staff has learned how to set constraints to help mitigate some of the erratic or undesired outcomes. For example, using minimum constraints, analysts ensure that built-out zones will get some redevelopment. Conversely, maximum constraints are used to make sure that zones do not grow unreasonably fast or exceed reasonable capacities.

The need to set constraints and the inability to predict the outcomes resulting from changes in inputs are major issues for NCTCOG staff. It is NCTCOG's desire to have a model that produces results that are less erratic, more responsive to inputs, and better reflect possible changes in land use. As it is now, NCTCOG staff must run many iterations of the model with different combinations of constraints in order to have confidence in the results. NCTCOG strives to keep the model and inputs as free of bias as possible and this need to constrain the model is discomforting.

NCTCOG REGIONAL TRAVEL MODEL

(This is an excerpt of the first chapter of larger regional travel model document that can be found at http://www.nctcog.org/trans/modeling/documentation/DFWRTMModelDescription.pdf)

The following describes the internal setting and assumptions of the Dallas-Fort Worth regional travel model (DFX) updated in June 2009. The DFX is the North Central Texas Council of Governments' (NCTCOG) official travel demand model. The DFX is a four-step trip-based travel demand model which models a 10,000 square mile area in North Central Texas.

The software application is a collection of components that implements a four-step trip-based travel demand model on the TransCAD 5.0 R2 platform. The software is developed and maintained by the Model Development Group in the Transportation Department at NCTCOG. The parameters, coefficients, and models in this application are calibrated based on the following data sources:

- 1994 workplace survey;
- 1996 Dallas-Fort Worth household survey;

- 1999 automatic traffic count stations;
- 2001 Dallas/Fort Worth International Airport survey.
- 2003 SkyComp freeway density, speed and volume study;
- 2004 Texas Department of Transportation (TxDOT) traffic saturation counts;
- 2004-2006 various sources of traffic counts and travel time studies
- 2005 external stations survey;
- 2007 Dallas Area Rapid Transit (DART) transit onboard survey;
- 2008 Fort Worth Transportation Authority (FWTA) transit onboard survey, and;
- 2008 Denton County Transportation Authority (DCTA) transit onboard survey;

The DFX accepts the following input files: demographic data, roadway network including toll roads and HOV, transit supply system including rail and park-and-ride, and airport and external stations forecasts. It produces traffic volumes and speeds on roadways and transit usage data on the transit system. In addition to flexible coding tools, a smooth menu system for performing model runs, and extensive reports, the software provides a comprehensive file management system for the organization of input and output data.

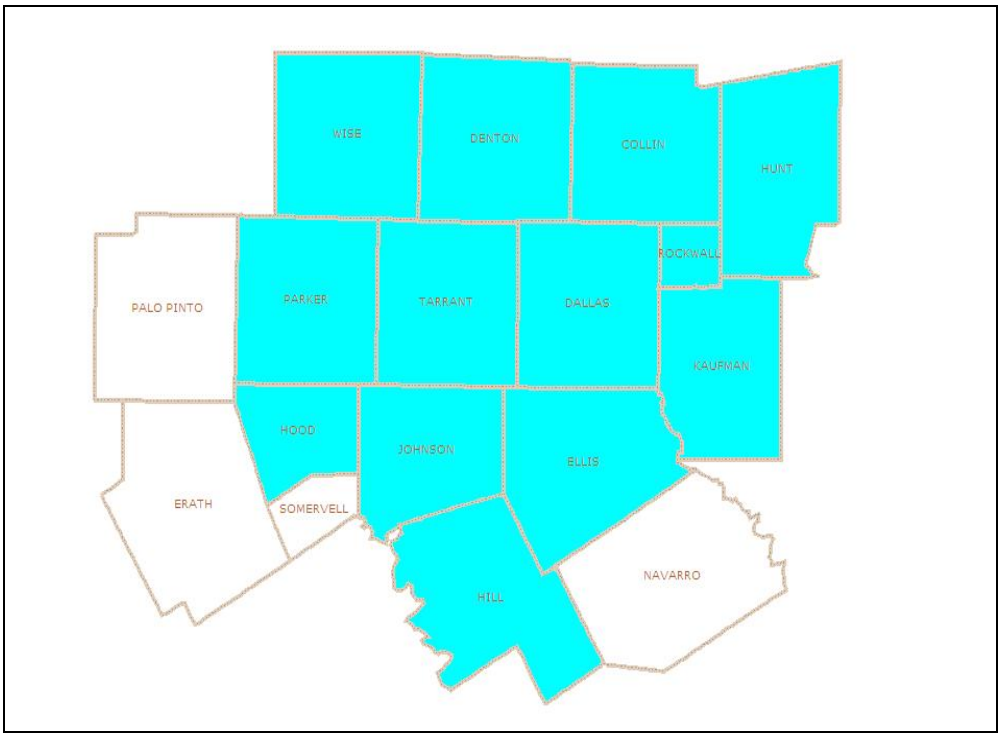
Below is a brief summary of each of the four major steps and other intermediate steps of the model. They are presented in the following order:

1. Zone Structure
2. Roadway Network Coding and Preparation
3. Trip Generation (Step 1)
4. Roadway Skim and Trip Distribution (Step 2)
5. Transit Network Coding and Transit Skims
6. Mode Choice (Step 3)
7. Transit and Traffic Assignment (Step 4)

Zone Structure

The modeling area of DFX includes the entire 13 counties of Collin, Dallas, Denton, Ellis, Hill, Hood, Hunt, Johnson, Kaufman, Parker, Rockwall, Tarrant, and Wise. Exhibit 7 illustrates the modeling areas within the North Central Texas region.

Exhibit 7: Modeling Area Within the North Central Texas Region

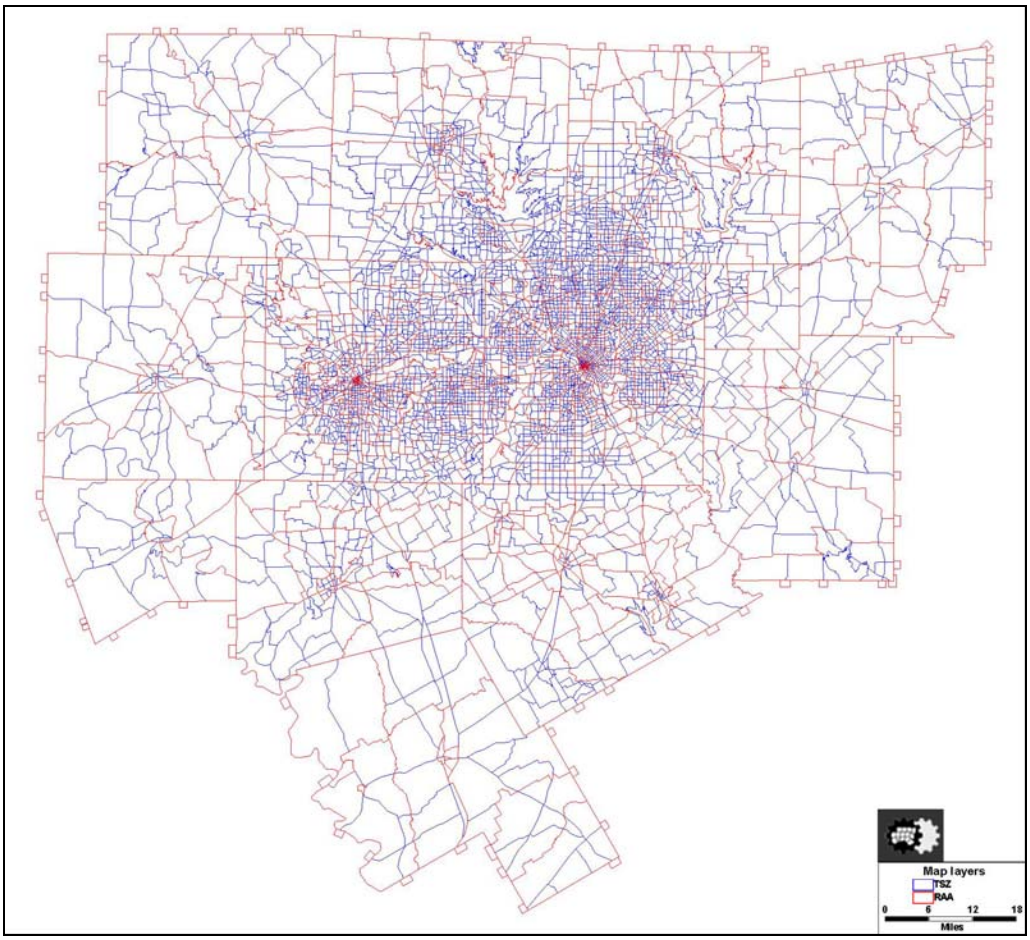


The modeling area has been divided into 5,386 travel survey zones (TSZ) of which 4,303 are internal zones, and 83 are external zones. TSZs are created through aggregation of census blocks.

The purpose of having a large number of zones in the area is to avoid splitting the zones for sub-area and corridor analyses. A stable zone structure creates convenience in model runs and consistency in the comparison of different projects.

The TSZ structure remains unchanged during the process of future projections and model analysis. Communication with the model users for zonal data input and output is based on the TSZ structure. Most of the internal model components directly use the TSZ zone structure with the exception of the income and household size distribution component in the trip generation module. The distribution of households among income groups and household sizes are based on the aggregation of the TSZs into 821 regional area analysis (RAA) zones. Exhibit 8 shows the TSZs and RAA zones in the modeling area.

Exhibit 8: TSZs and RAA Zones in the Modeling Area



Roadway Network Coding and Preparation

The transportation network of DFX is a GIS database that represents the actual roadway and rail links for the year of analysis. The network is the underlying database for all other steps in the DFX. The transportation network file is a series of links that are connected through nodes representing railroad tracks, roads, and intersections.

Generally, the roadway network is coordinated with the TSZ layer, so that the number of links inside the TSZ area is minimized. As mentioned in the zone structure description, the zone structure is designed to stay unchanged for different analyses. This makes roadway-coding rules for inclusion of links in the modeling network clear and consistent among roadway networks.

The Roadway Network Coding step includes checks on the integrity of the network and interdependence of the fields; the addition of the roadway network database fields for use later within DFX; creation of centroid connections to link the TSZ layer to the coded roadway network; and the calculation of loaded speeds, loaded travel times, operating costs, walk time, toll values, and cost of link travel. At the end of the roadway coding and preparation, the network is ready for providing initial travel time skim tables to be used in trip distribution.

Trip Generation

The first step in the 4-Step Model is Trip Generation. The function of the Trip Generation module is to convert demographic data into person trips productions and attractions for different purposes. Inputs to the trip generation module have to be predictable and geographically tied to the zone structure. The prediction of the inputs to the trip generation module is the function of the land use model.

The demographic data for the trip generation module includes population, the number of households, median household income, the number of basic, retail and service employments and special generator employments, the household income distribution and the household size distribution for each TSZ.

The outputs of the trip generation program are balanced production and attraction person trips from and to each TSZ for four trip purposes: Home-Based Work (HBW), Home-Based Non-Work (HNW), Non-Home-Based (NHB) and internal truck trips (OTH) to and from each TSZ. In the output, the HBW trip productions and attractions are separated into the four income groups defined in the model. The outputs are used in the trip distribution step along with roadway skims.

Roadway Skim and Trip Distribution

The second step in the 4-Step Model is Roadway Skim and Trip Distribution.

Roadway Skim

The Roadway Skim module is designed to find the shortest paths, minimizing travel time, from origin centroids to destination centroids for auto modes. The number and types of the travel time skims needed are determined by the number of trip purposes, the number of peak periods, and the traffic assignment vehicle classes, which are dependent on mode choice module. There are a total of four roadway skim matrices produced which represent different time periods of interest (a.m. peak and off-peak) and whether or not HOV facilities are utilized for skimming; the matrices are named Peak HOV, Peak No HOV, Off-Peak HOV, and Off-Peak No HOV.

The output of the roadway skim module consists of four matrices that are built based on the a.m. peak or off-peak loaded travel time with HOV facilities included and excluded from the roadway network. The matrices also include the travel distance along the shortest travel time path for use in the mode choice module.

Trip Distribution

The Trip Distribution module determines the number of trips between each origin and destination zone for which trip production, trip attraction, and skims are known. For internal trips, the DFX adopts a form of the gravity model for trip distribution. Each set of parameters is calibrated for each trip purpose, so there are a total of seven gravity models (four for HBW in each income quartile, HNW, NHB, and OTH trips). There are three types of inputs to feed into the gravity models: a friction factor table, production/attraction totals, and an impedance matrix. The gravity model outputs are trip matrices indicating where trips are generating from and to for each trip purpose. The airport trip sub-module estimates the number of HNW and NHB trips to and from the airports based on the number of enplanements at each airport.

The TSZ productions and attractions are outputs of the trip generation module.

Transit Network Coding and Transit Skims

The Transit Network represents existing transit service in the year of analysis. It is a GIS database built on the roadway network. Actual transit service is the integration of several routes with different vehicle technologies, boarding and alighting stations, fare structure, transfer policies, and service times.

Transit Network Coding

The DFX models the transit service for the a.m. peak period of 6:30 a.m. to 8:59 a.m. and the off-peak period of 9:00 a.m. to 2:59 p.m. to represent transit service and transit use in a 24-hour weekday.

Transit lines are grouped into several modes. The modes are created generally based on technology used, fare system, or operating characteristics of the routes. Commonly used modes are local bus, express bus, commuter rail, and light rail.

Transit Skims

Transit skim tables provide shortest path times through the transit network using specific assumptions described in the larger travel model document. The determination of transit paths and travel times is based on the TransCAD Pathfinder algorithm.

The output of the Transit Skims are twelve matrices derived from the transit networks for bus only, rail only, and bus-and-rail transit trips during the a.m. peak and off-peak service periods with walk (no park-and-ride) and drive accesses (park-and-ride only). Each matrix has tables describing costs and times for travel. These tables are used in the mode choice module, along with other inputs, to calculate the mode shares.

Mode Choice

The third step in the 4-Step Model is Mode Choice. The mode choice modules determine the portion of trips that use different modes. The mode choice modules are applied to the trip table outputs of the trip distribution process. The modes considered in the DFX are drive alone, shared-ride with 2 occupants (SR 2), shared-ride with 3 or more occupants (SR 3+), transit rail only, bus only, and bus-and-rail with walk access and drive access. The 6 transit modes are in the same level under a transit nest. The 3 Auto modes are in the same level with the transit root.

Trips are segmented based on trip purposes and market segments within home-based purposes. Models were developed for HBW, HNW, and NHB trips. Same structure of nested logit model is used for all trip purposes. The outputs of the mode choice module are sets of person trip tables for each of the 9 modes for each trip purpose and market segments.

Roadway Traffic Assignment and Transit Assignment

The final step in the 4-Step Model is Traffic and Transit Assignment. Traffic assignment is run for the morning peak period and the off-peak period in the initial iteration and the first feedback iteration. For the last iteration, the roadway traffic is assigned for the a.m. peak period, p.m. peak period, and off-peak period, and the transit traffic in the peak and off-peak periods.

Roadway Traffic Assignment

The inputs for roadway traffic assignment are vehicle trip tables by time-of-day. There are three time-of-day periods: the a.m. peak period from 6:30 a.m. to 8:59 a.m. (AM); the p.m. peak period from 3:00 p.m. to 6:29 p.m. (PM); and the off-peak period (9:00 a.m. to 2:59 p.m. and 6:30 p.m. to 6:29 a.m.). The DFX considers four vehicle classes: drive-alone vehicles (DA), shared-ride vehicles with access to HOV facilities (SRHOV), shared-ride vehicles with no access to HOV facilities (SRNOHOV), and trucks (TRUCK). The DFWRTM adopts a generalized cost method for multi-modal multi-class roadway assignment. Different vehicle classes have different sets of roadway networks to access and different parameters for value-of-time.

The output of the roadway traffic assignment are total traffic volumes and times stored in the roadway network file, and estimated volumes for each class stored in separate output files.

Transit Assignment

The Transit Assignment step uses the TransCAD PathFinder algorithm. Transit assignment is only run after the last feedback is completed in the model run.

Transit assignment includes twelve separate assignment sub–modules. Six assignment sub–modules assign HBW transit trips. Bus only, rail only, and bus-and-rail transit tables are assigned by two modes of access of walk and drive separately. Six assignment sub–modules assign the total of HNW and NHB transit trips. Bus only, rail only, and bus-and-rail transit tables are assigned by two modes of access of walk and drive separately. Transit trip tables are assigned in a 24–hour production–attraction format to the networks.

Needs Summary

NCTCOG has successfully implemented it current land use model, DRAM/EMPAL, for several forecast cycles while recognizing some potential shortcomings such as over-emphasis on the role of transportation in location choices and the lack of behavioral content such as a representation of real estate markets (housing supply, demand and prices are not considered, only household and job locations in zones).

Newer models may use a micro-simulation approach to modeling household choices of residential location, business location choices, and real estate development and prices. They may also use dynamic, annual simulation of the evolution of cities over time. All of these important features are absent in the current model.

The importance and influence of local and regional policies in our existing forecasting tool is limited and vague. Therefore, the consequences of implementing different policies are not conveniently shown in forecasts. If we consider the function of the planning agency to shape a desired future in a region, there is a need for deriving the policies that would lead us to a desired land use and demographics (reverse modeling).

Restriction in transportation funding limits the expansion of roadway facilities compared to the last fifty years. It is conceivable that maintenance and management would capture most of the infrastructure funding. This trend will lead us toward more operational functions in the short term as opposed to planning decisions in long term. The future land use model may have to be sensitive to finer changes and be integrated with other models to be effective.

Because of the time it takes to implement a new land use model, it is imperative that NCTCOG begins moving toward the next generation model now. Staff is looking to define a strategy for the future of NCTCOG's integrated transportation and land use modeling. Specific questions are listed below:

- How do we create a more robust tool for land use, population & employment forecasts than we are currently using?
  Current Practice: Households and employment are output by the model as is a broad description of change in land use. Population is calculated using a separate process.
  Desired Practice: Model forecasts detailed socio-economic characteristics and outputs anticipated land use patterns based on numerous key agents.

- How do we better integrate our transportation and land use modeling efforts?
  Current Practice: Separate modeling systems operating in different environments using different sets of assumptions and requiring multiple iterations.
  Desired Practice: System considers demographics, land use, market behaviors (production, consumption & trade, including labor & land provision and pricing, shopping), travel costs, and transport networks within the same framework.

- How do we model alternative land use scenarios based on policy changes or structural changes?
  Current Practice: No system for predicting effects resulting from changes in policy (e.g. adoption of higher density zoning) or changes in structure (e.g. more single-person households).
  Desired Practice: System allows for relatively easy modeling of various scenarios.

- How do we model output at a small-area level?
  Current Practice: Modeling is performed on large geographies and then disaggregated to smaller geographies using an independent process.
  Desired Practice: System provides reliable results at relatively small geographic levels (TSZ, grid, parcel).

- How do we increase confidence in the model results?
  Current Practice: Model outputs require extensive review and analysis. With one exception (the target forecast), output has to be adjusted because it does not match reality.
  Desired Practice: Model provides reasonable results that stand up to scrutiny by local reviewers.

- How can the model help us reach regional goals such as: meeting minimum air quality standards, encouraging development that preserves natural assets, and ensuring that water supplies are adequate to accommodate anticipated growth?
  Current Practice: No system for describing the necessary patterns to achieve stated goals.
  Desired Practice: System provides indications of potential pathways to move toward regional goals.

In addition, these are some of the key items needing to be addressed:

- How do the other models really perform? How many bugs, headaches, and assumptions?
- What are the budget issues that would be expected?
- How much time is needed to get to a production system?

- What are the data needs in each case?
- What type of staff expertise, structure, and training are needed?
- What are the other items of cost?

Examples of NCTCOG Land Use Model Projects

NCTCOG has numerous projects in which a more robust land use / transportation model is needed. Examples of these projects are listed below.

- **NCTCOG demographic forecasts** – for long-term regional planning (mobility plan), small area forecasts for other local and regional urban plans including economic development projects, water resources, comprehensive plans, etc. The demographic forecast is directly tied to future land use modeling.
- **Short term modeling** – Development of modeling tools for short term analysis, including impact analysis of economic conditions, infrastructure improvements, etc. This is especially important to local governments.
- **Alternative regional forecasts modeling** – Development of scenarios based on policy changes for regional visioning exercises or smaller county and sub-county analysis. In addition, RIS currently only models for the 12 core counties. Additional modeling efforts will be needed for the remaining four counties.
- **Develop socio-economic modeling –** The region is expected to undergo significant socio-economic changes over the next 20-40 years. A rising Hispanic population, changes in household sizes, and income distribution shifts are among the items that need to be modeled in more detail. This data can be synthesized, and third-party software is available that can help this process, but we feel some additional effort and modeling will be needed to produce results at the small area.
- **Land cover modeling** – Used in analyzing impervious surface affects on water runoff characteristics
- **Affordable housing modeling** – Potential for broadening the reach of NCTCOG Demographic Forecast by predicting housing prices and disaggregating households by income as well as other characteristics, and capturing the affordability impacts of alternative scenarios.
- **Preservation of land in green space** – Used to earmark specified parcels for green space preservation, which would influence the supply of land, and could be tested as an attractor for residential or business location. This has a direct connection to E&D Greenprinting initiatives.
- **Urban design issues** – Used to explore parcel-level capacity and the land's ability to incorporate a flexible set of terms in the location choice equations for businesses and households.
- **Understanding of special land use features** – Need to examine the relationship between special land use features of interest (e.g., pedestrian-friendly environments, mixed land use and transit oriented development), and neighborhood attractiveness;