# Transportation Modeling in Dallas-Fort Worth

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**North Central Texas Council Of Governments (NCTCOG)**

**for**

**INFORMS**

**Transportation Demands Forecasting Forum**

**October 21, 2010**

# Contents

- The Dallas-Fort Worth Region
- Planning Institutional Structure
- DFW Regional Travel Model

# The Dallas-Fort Worth Region

Some facts and some forecasts to describe the region

# Dallas-Fort Worth Metropolitan Area

## A Leading World Economy

| Urban Area[1] | Country | 2005 GDP Billion US$[2] | Rank |
|---|---|---|---|
| Tokyo | Japan | $1,191 | 1 |
| New York | USA | $1,133 | 2 |
| Los Angeles | USA | $ 639 | 3 |
| Chicago | USA | $ 460 | 4 |
| Paris | France | $ 460 | 5 |
| London | UK | $ 452 | 6 |
| Osaka/Kobe | Japan | $ 341 | 7 |
| Mexico City | Mexico | $ 315 | 8 |
| Philadelphia | USA | $ 312 | 9 |
| Washington DC | USA | $ 299 | 10 |
| Boston | USA | $ 290 | 11 |
| Dallas/Fort Worth | USA | $ 268 | 12 |
| Buenos Aires | Argentina | $ 245 | 13 |
| Hong Kong | China | $ 244 | 14 |
| San Francisco | USA | $ 242 | 15 |

Source: PriceWaterhouseCoopers, United Nations

*[1]Urban agglomerations as defined by the United Nations*
*[2]Exchange rates based on "purchasing power parity"*

# Regional Perspective

**Fourth Largest Metropolitan Area in the United States**

**Ranked 3rd in Population Growth Between 1990-2000 Adding Over 1 Million Persons**

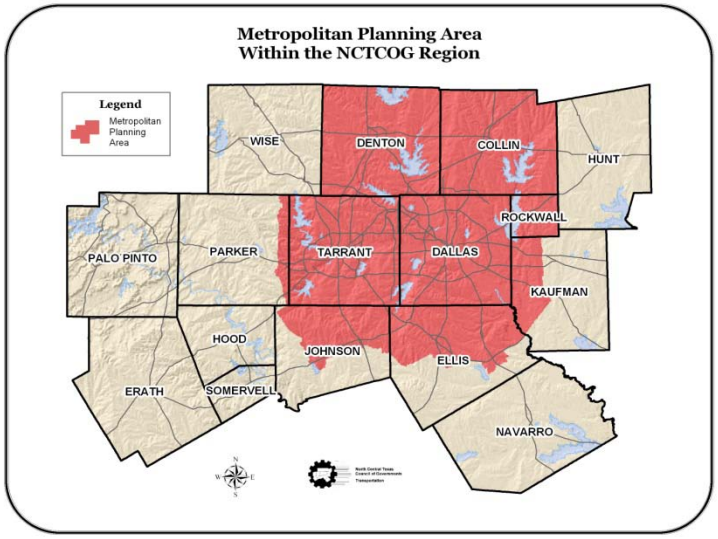
- **Current Growth Trend: Added nearly 850,000 Persons between 2000 and 2007 (Highest growth rate in at least last 50 years)**

**Larger than 34 States in Population**

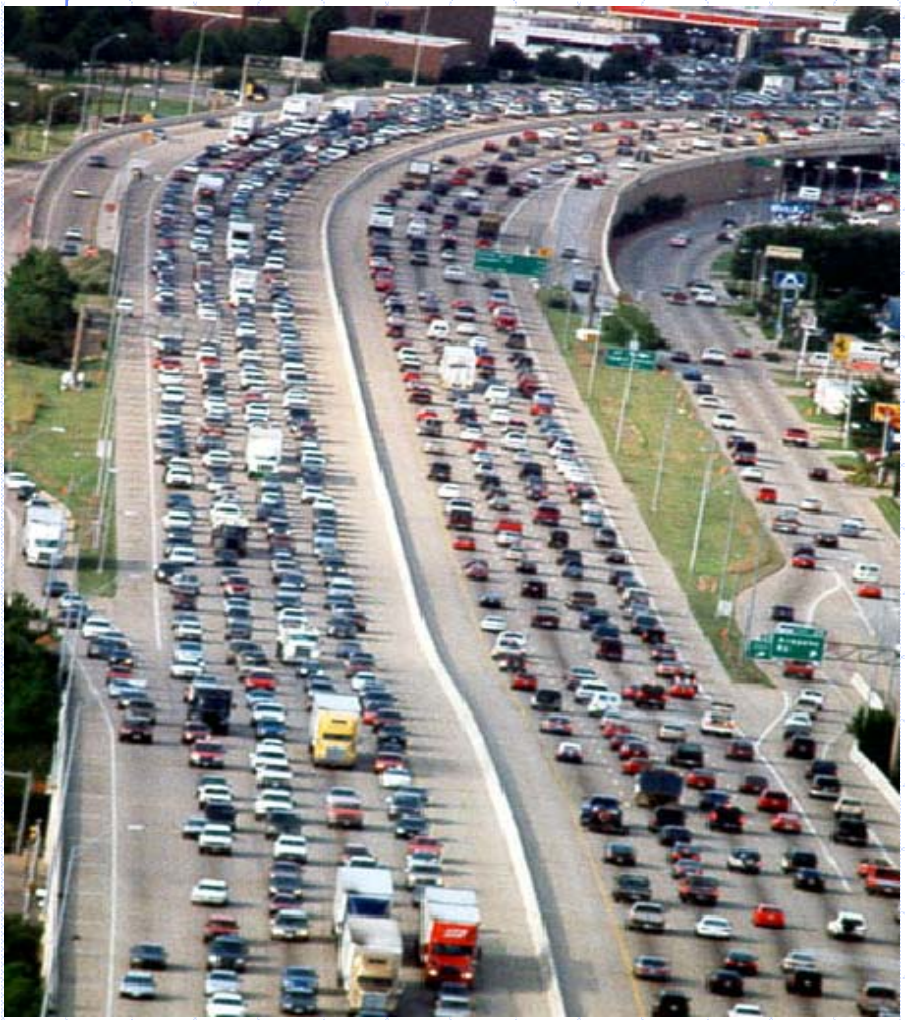
**Larger than 9 States in Land Area**

**Represent Over 34 Percent of the State's Economy**

**6 Million Persons in Year 2006 Growing to Nearly 9 Million Persons by the Year 2030**



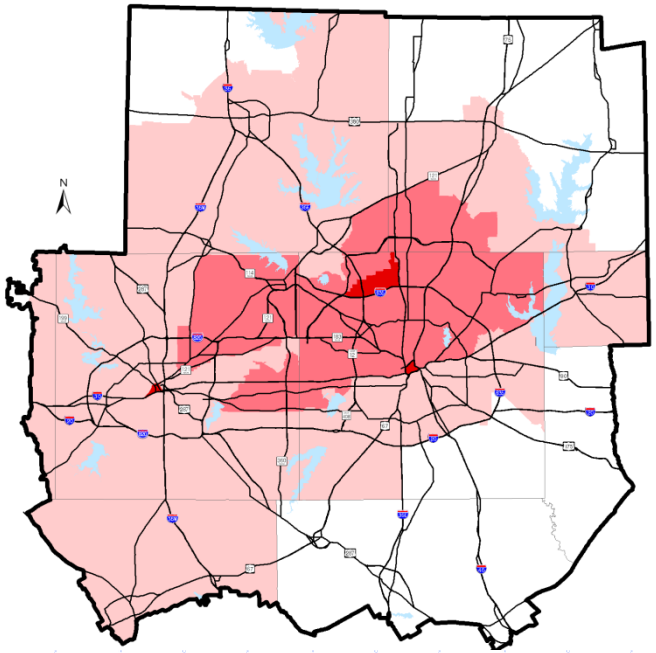
# DFW Region - Major Issues



- **Dramatic Growth in Single Occupant Vehicles (SOV)**
- **Increased Travel Time and Costs**
- **Non-attainment Area for the Pollutant Ozone**
- **No “Regional” Transit**
- **Suburban Sprawl**
- **Lack of Coordination in Land Use and Transportation Investments**

# 2030 Transportation Plan
# Regional Congestion Levels

**2007**

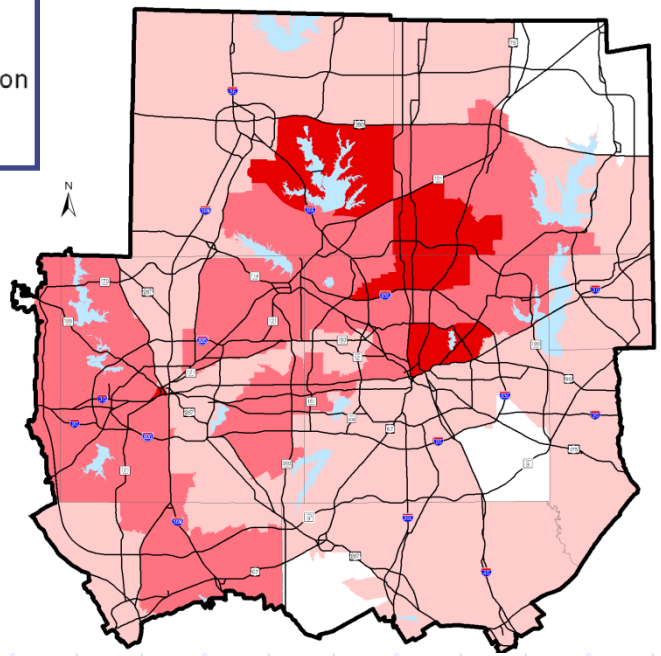


| | 2007 | 2030 | % Change |
|---|---|---|---|
| Population | 5.9 M | 8.5 M | 44.1% |
| Employment | 3.7 M | 5.3 M | 43.2% |
| VMT/Person | 25.6 | 28.4 | 10.9% |

- Areas with No Congestion
- Areas with Light Congestion
- Areas with Moderate Congestion
- Areas with Severe Congestion

| | 2007 | 2030 | % Change |
|---|---|---|---|
| Vehicle Miles Traveled | 151 M | 241 M | 59.6% |
| Roadway Capacity (Lane Miles) | 31,000 | 41,000 | 32.3% |
| Daily Total Delay (Vehicle Hours) | 1 M | 1.7 M | 70% |
| Annual Cost of Congestion | $4.2 B | $6.6 B | 57.1% |

**2030**



# Numerous complicated problems can emerge if growth is not managed well in our region.

To stay successful, proper planning is needed.

How is the planning done in the region?

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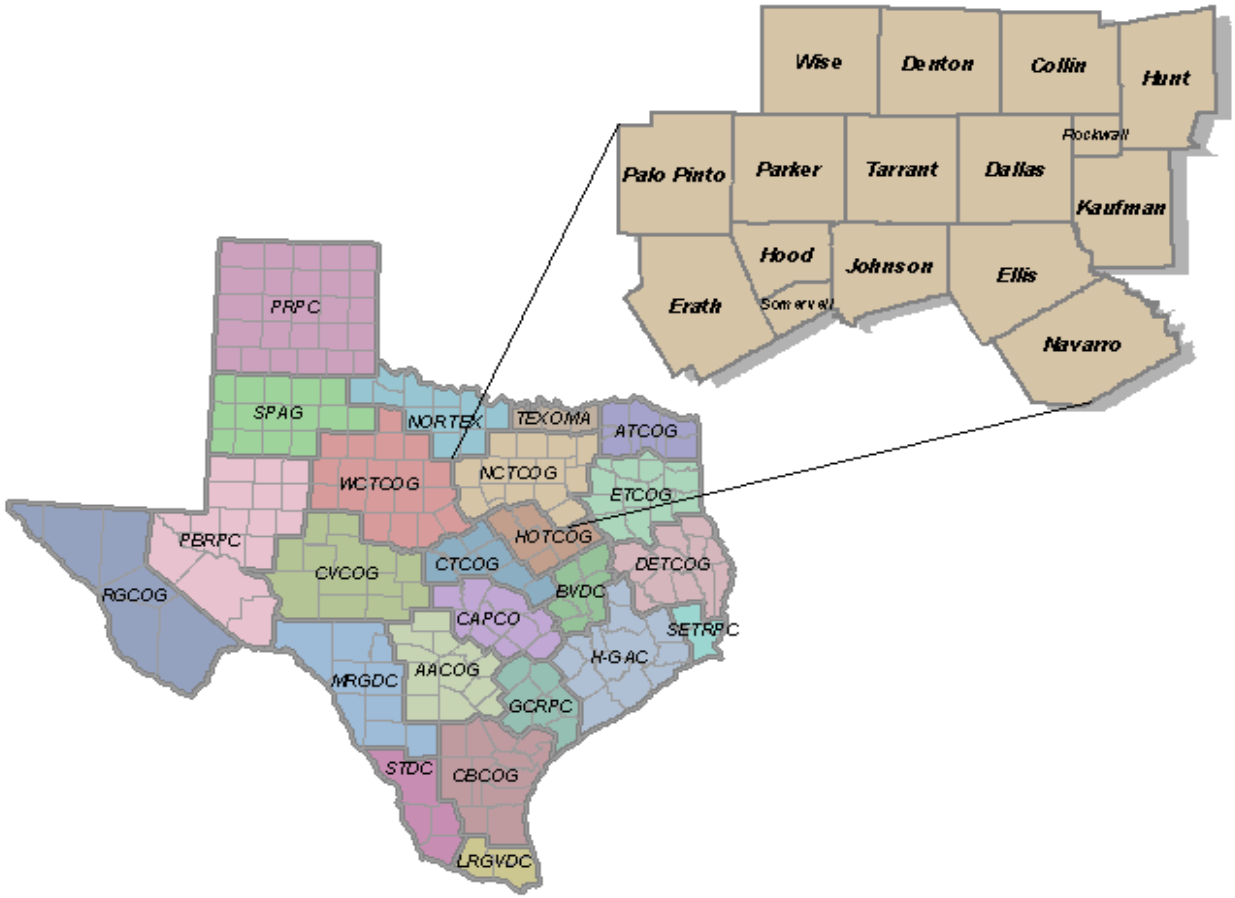
# Planning Institutional Structure

A quick review of NCTCOG and the concept of Metropolitan Planning Organization (MPO).

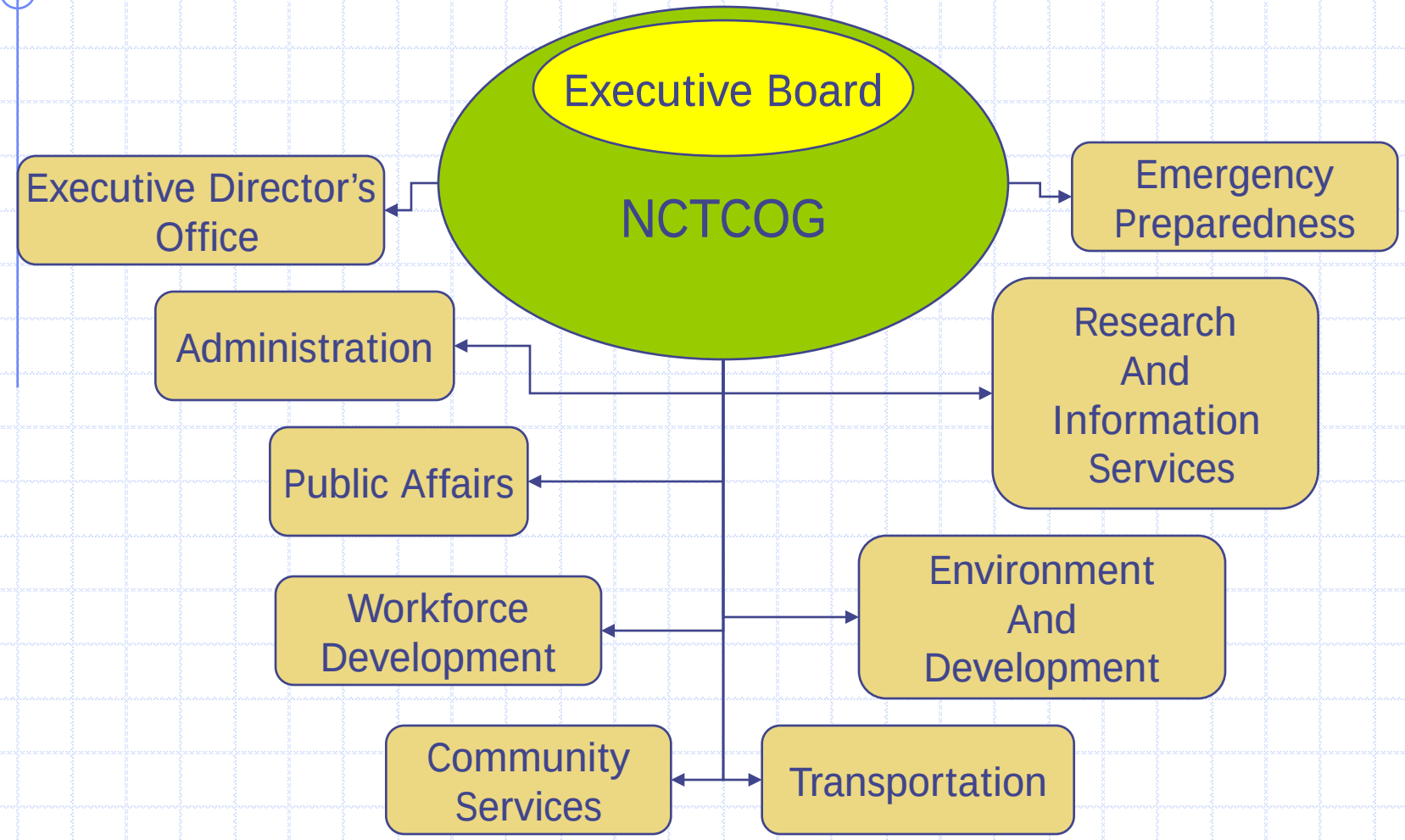
# What is NCTCOG?

The North Central Texas Council of Governments (NCTCOG) is a voluntary association of local governments, and was established to assist local governments in planning for common needs, cooperating for mutual benefit, and coordinating for sound regional development.

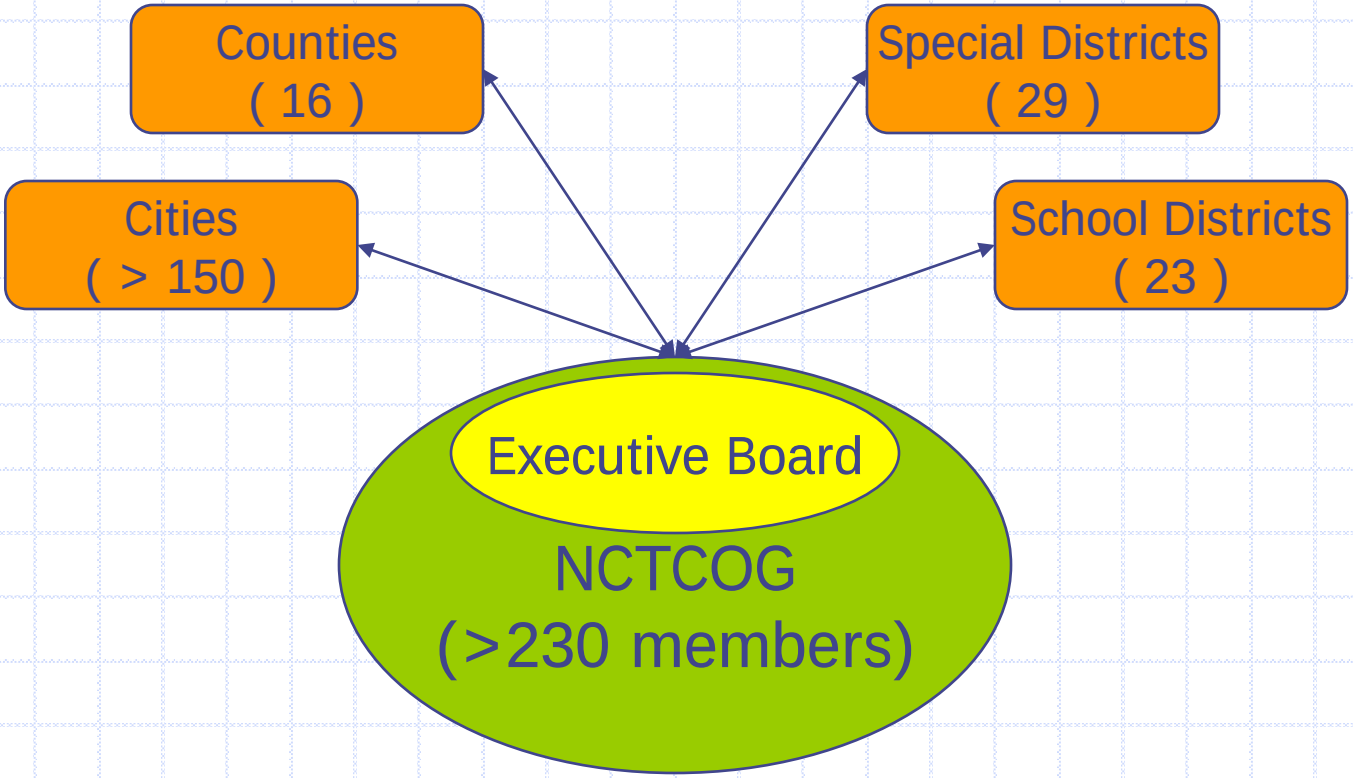
# NCTCOG Region



# NCTCOG-Internal



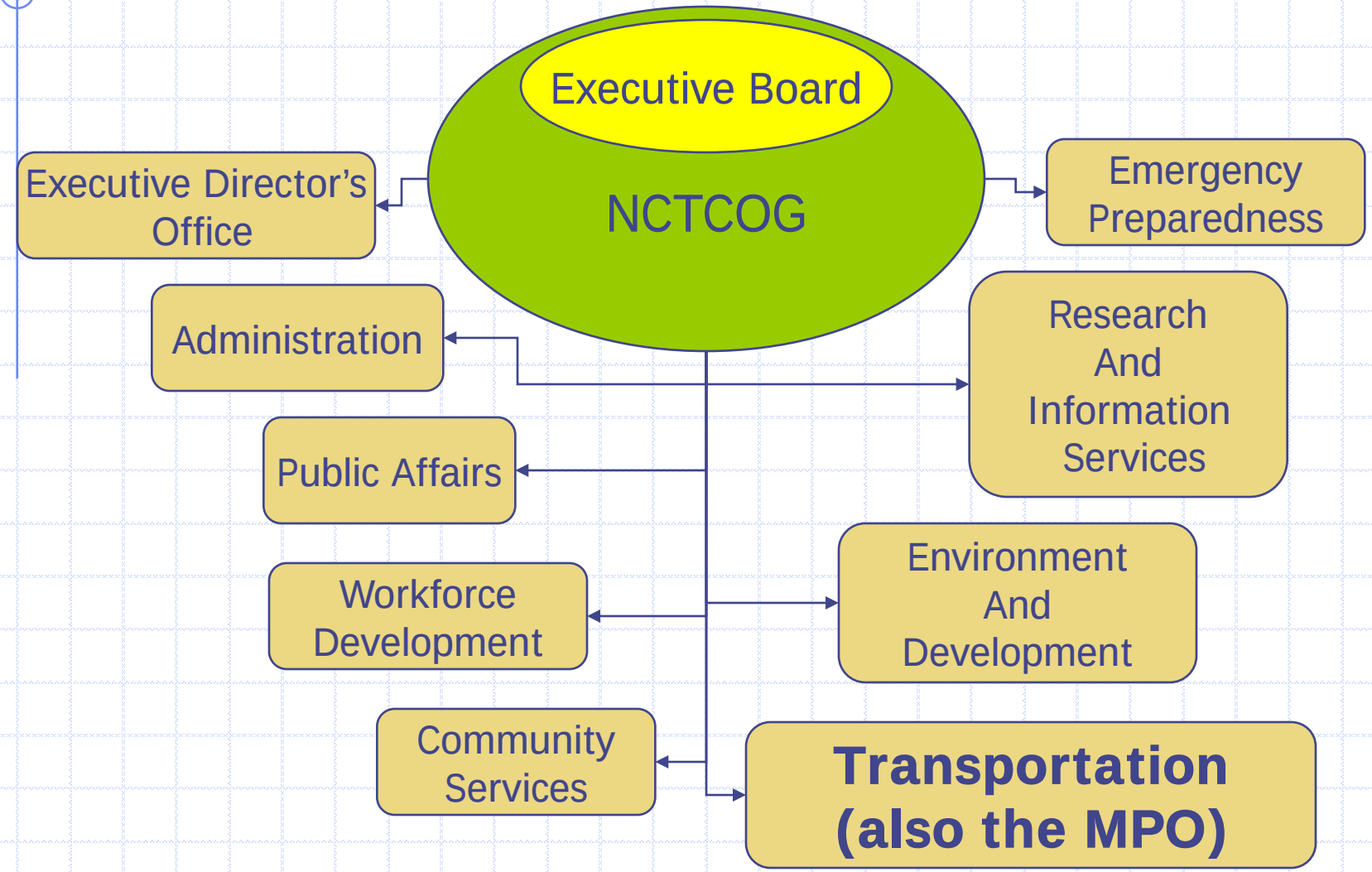
# NCTCOG-External



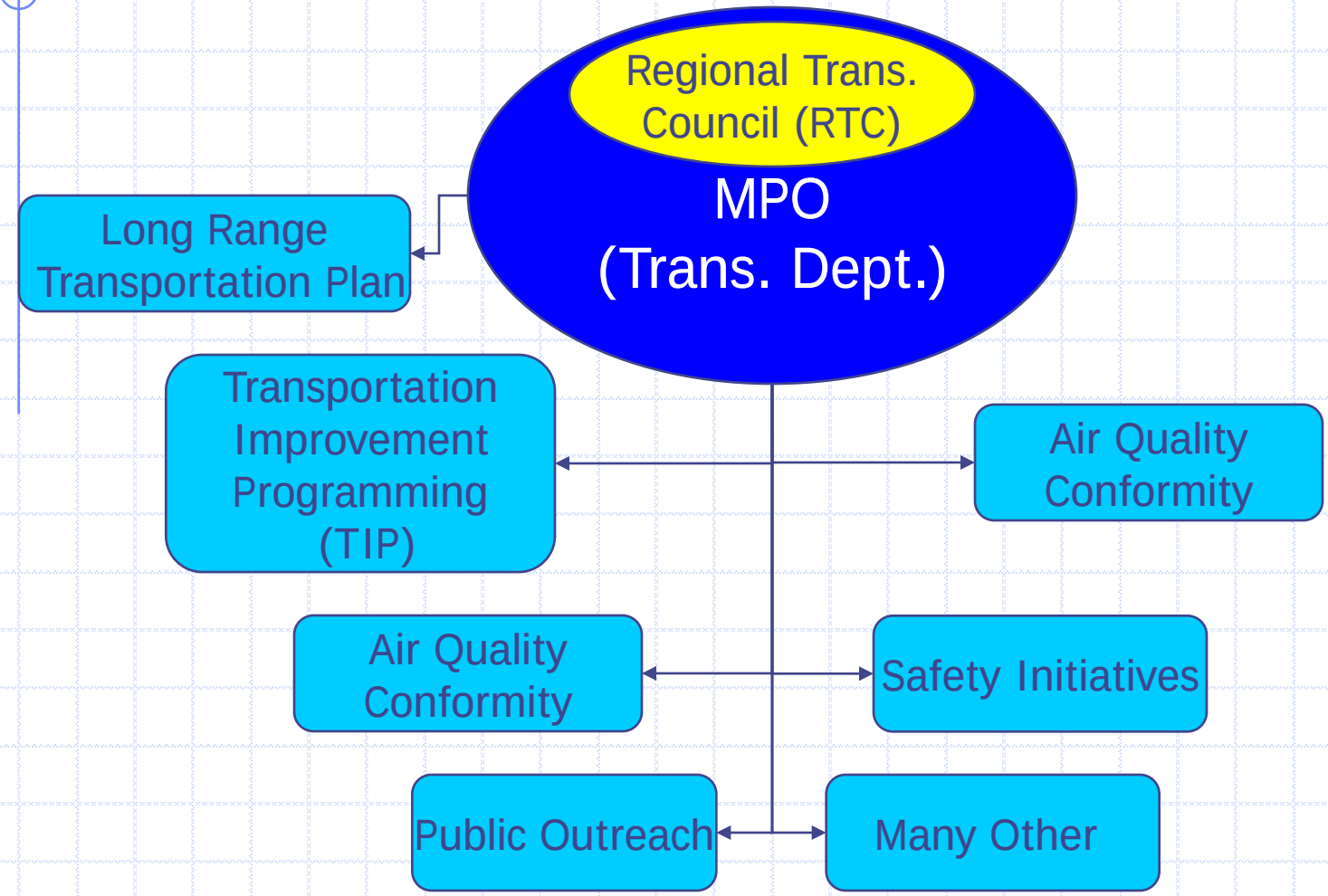
# What is a MPO?

- Federal highway and transit statutes require, as a condition for spending federal highway or transit funds in urbanized areas, the designation of Metropolitan Planning Organizations (MPOs), which have responsibility for planning, programming and coordination of federal highway and transit investments
- SAFETEA-LU's requirement that a portion of Surface Transportation Program funds be made available for expenditure in metropolitan areas with populations over 200,000, along with project selection through the metropolitan planning process is one mechanism that has brought shared responsibility for highway and transit investment decisions in metropolitan regions

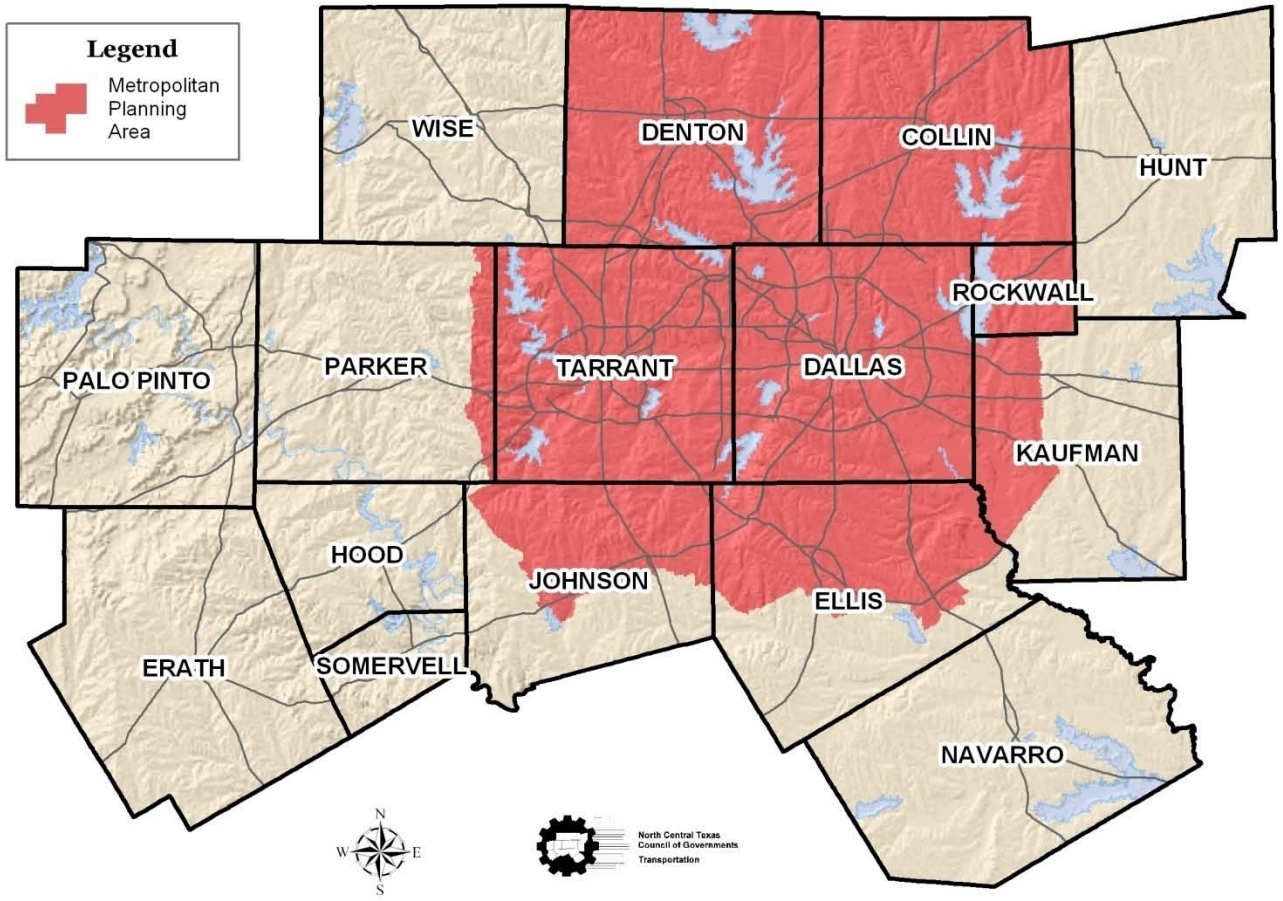
# MPO inside NCTCOG



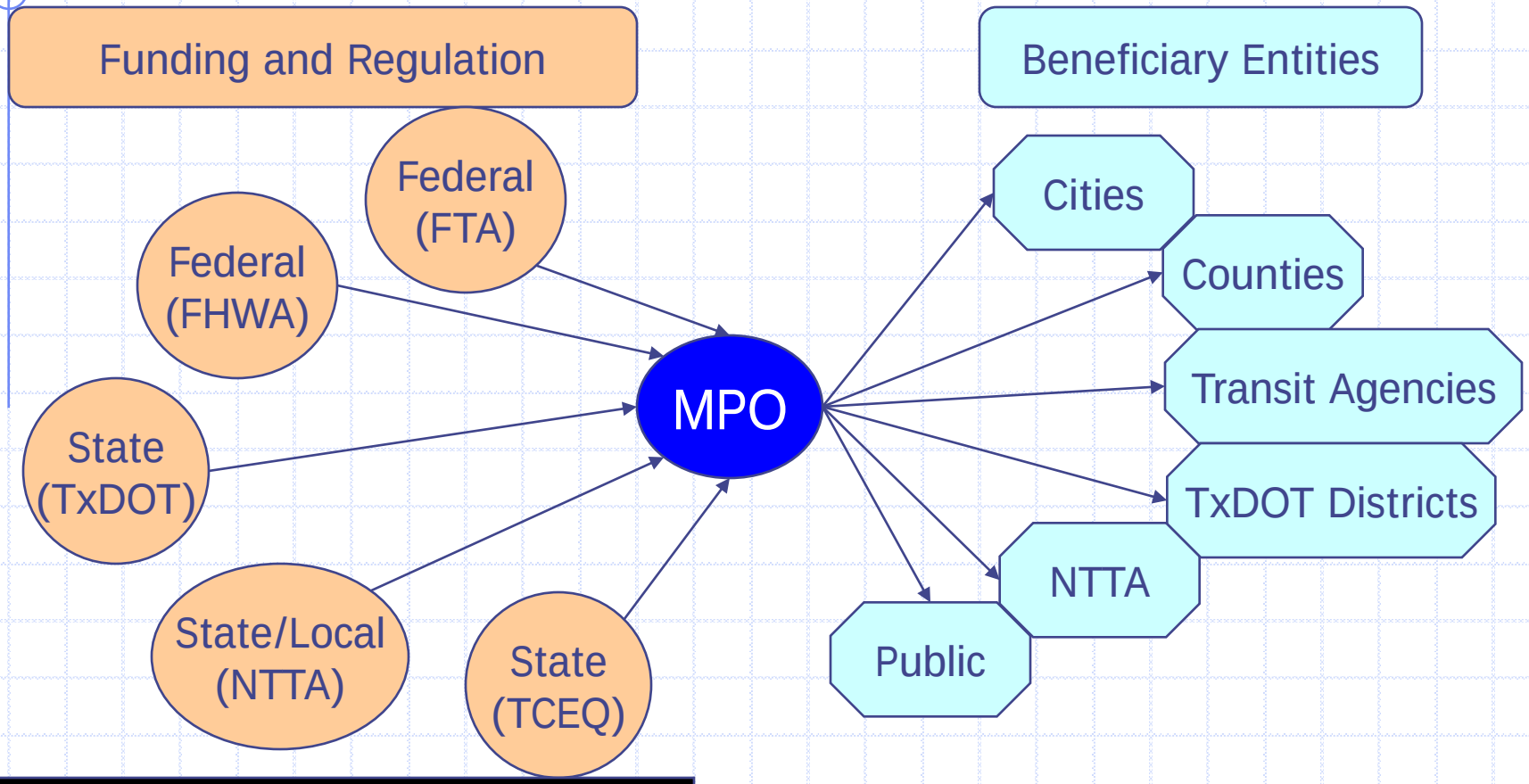
# MPO Functions



# Metropolitan Planning Area Within the NCTCOG Region



# Metropolitan Planning Organization Conceptual Role

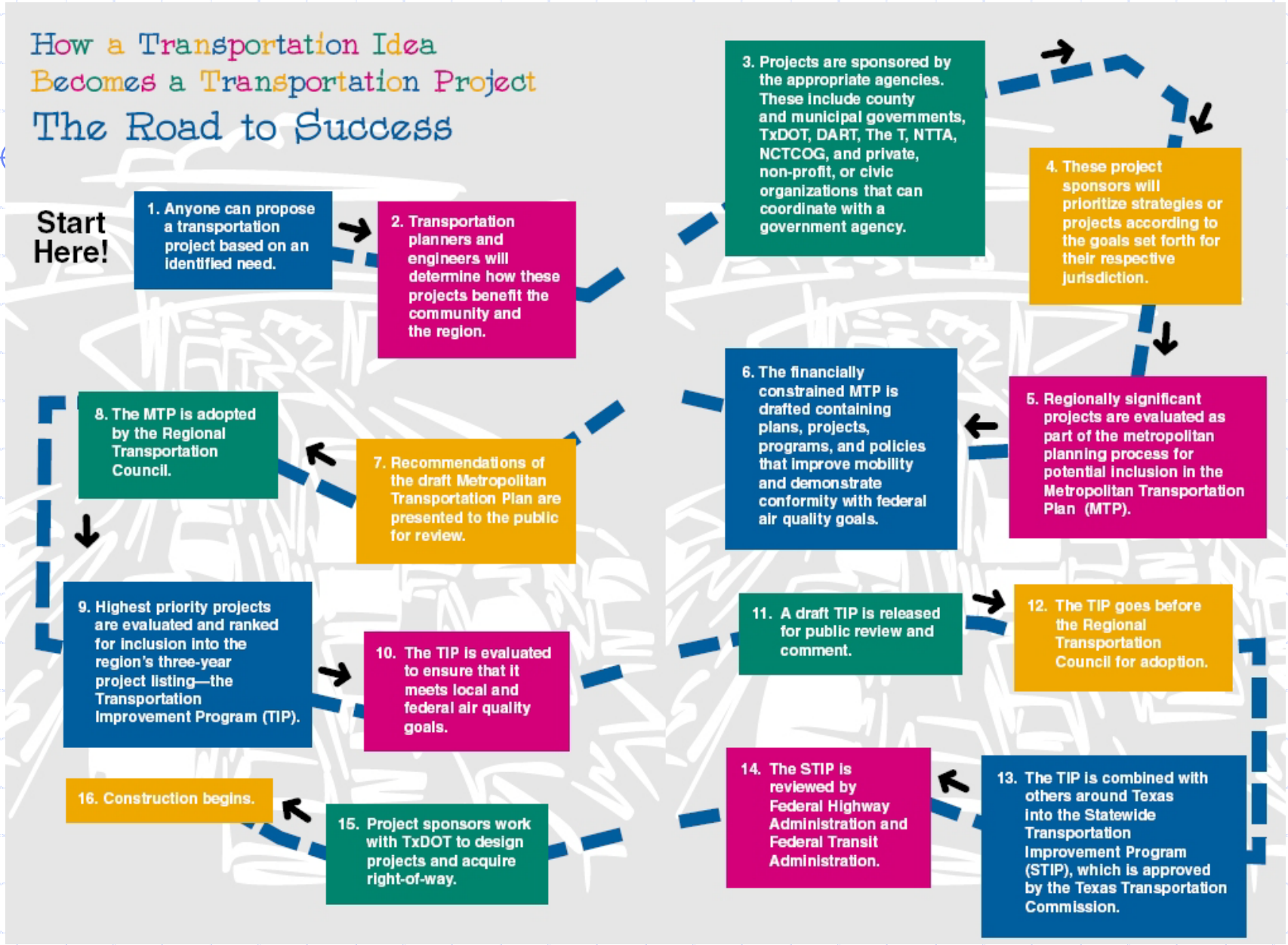



| | |
|---|---|
| FHWA | : Federal Highway Administration |
| FTA | : Federal Transit Administration |
| TxDOT | : Texas Department of Transportation |
| TCEQ | : Texas Commission on Environmental Quality |
| NTTA | : North Texas Tollway Authority |

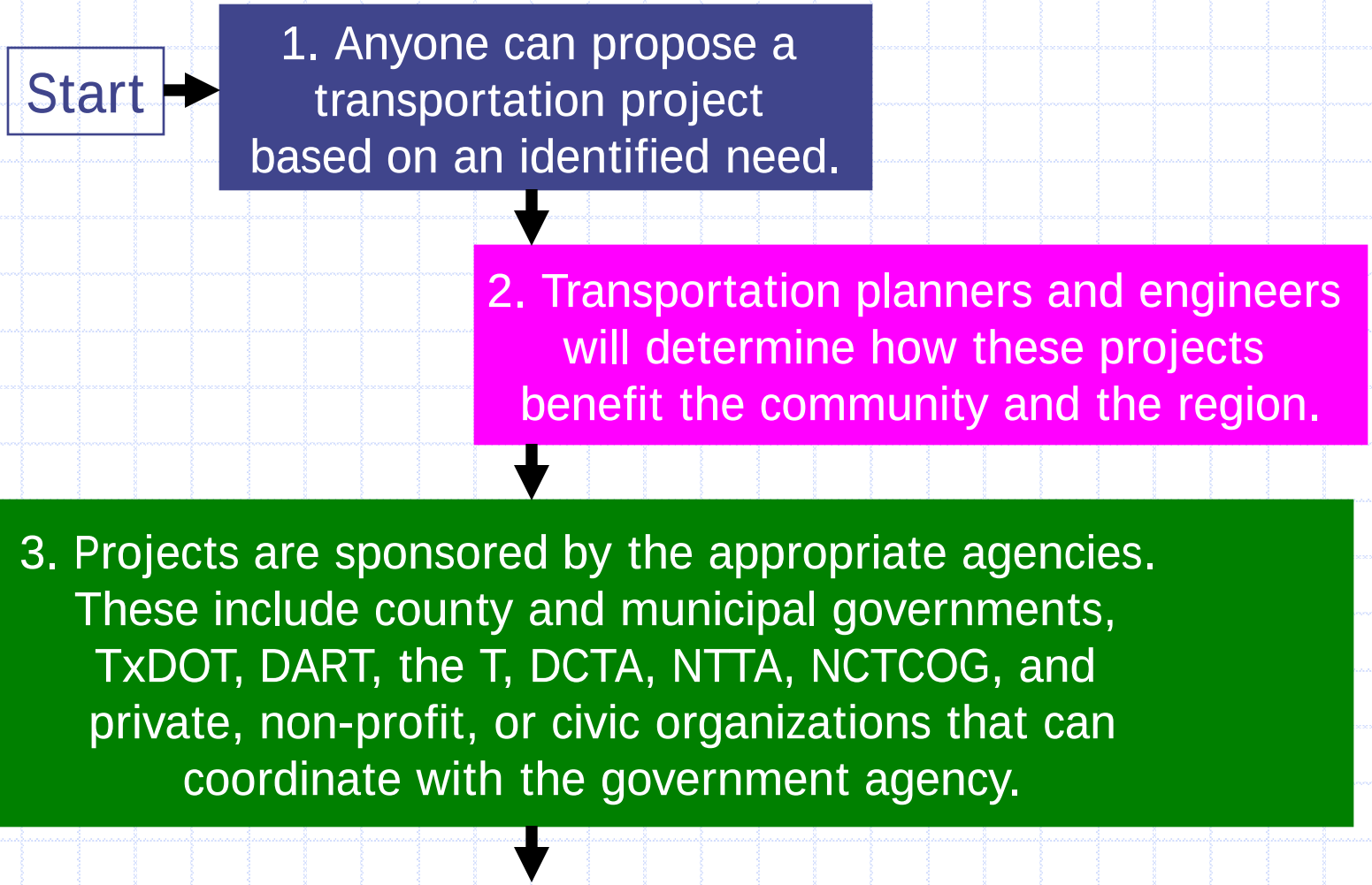
# How a Transportation Idea Becomes a Transportation Project in 16 Steps

# How a Transportation Idea Becomes a Transportation Project

## The Road to Success



# The Road to Success (1-3)



# The Road to Success (4-6)

4. These project sponsors will prioritize strategies or projects according to the goals set for their respective jurisdiction.

5. Regionally significant projects are evaluated as part of the metropolitan planning process for the potential inclusion in the Metropolitan Transportation Plan (MTP).

6. The financially constrained MTP is drafted containing plans, projects, programs, and policies that improve mobility and demonstrate conformity with federal air quality goals.

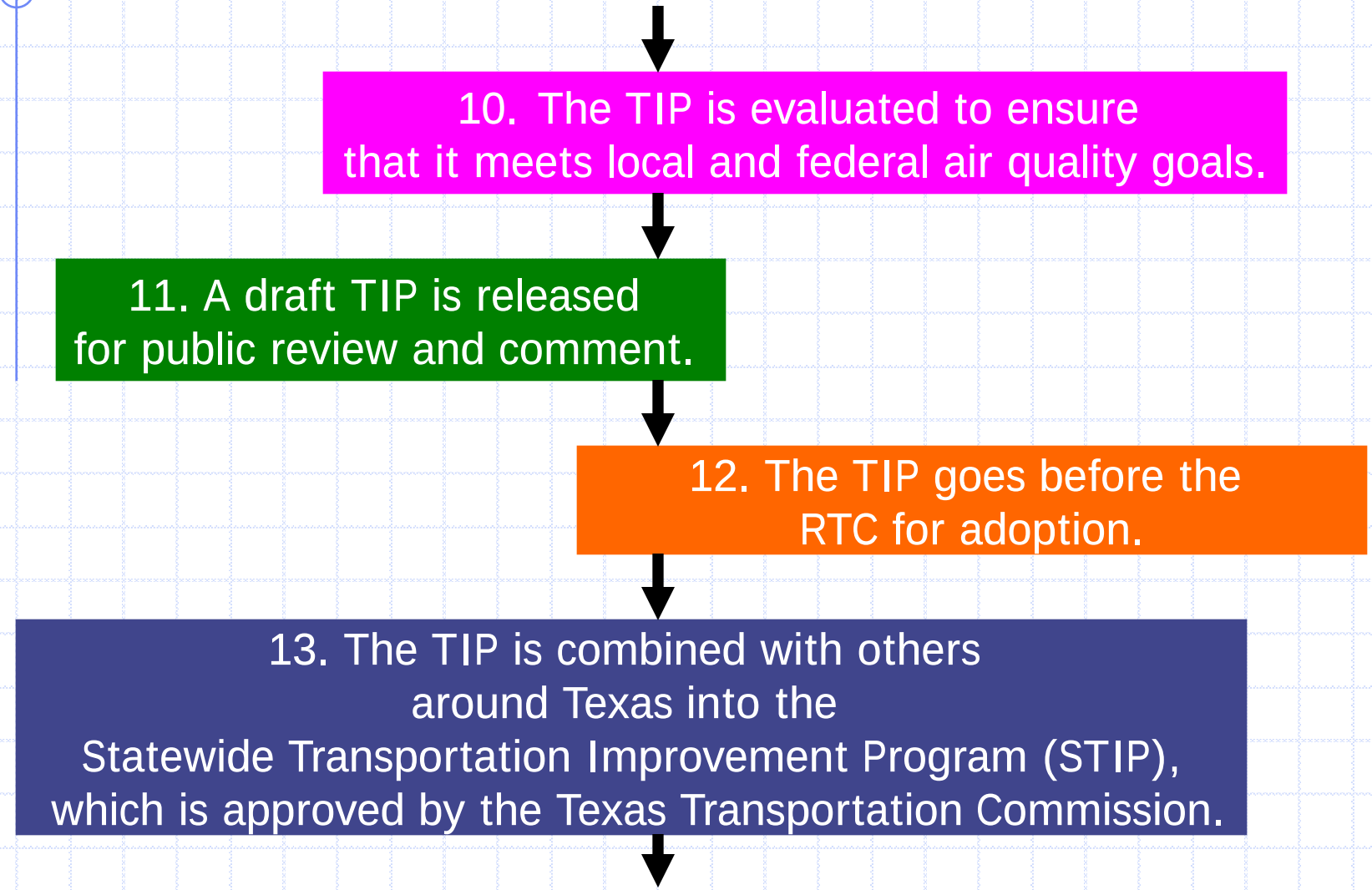
# The Road to Success (7-10)

7. Recommendations of the draft Metropolitan Transportation Plan are presented to the public for review.

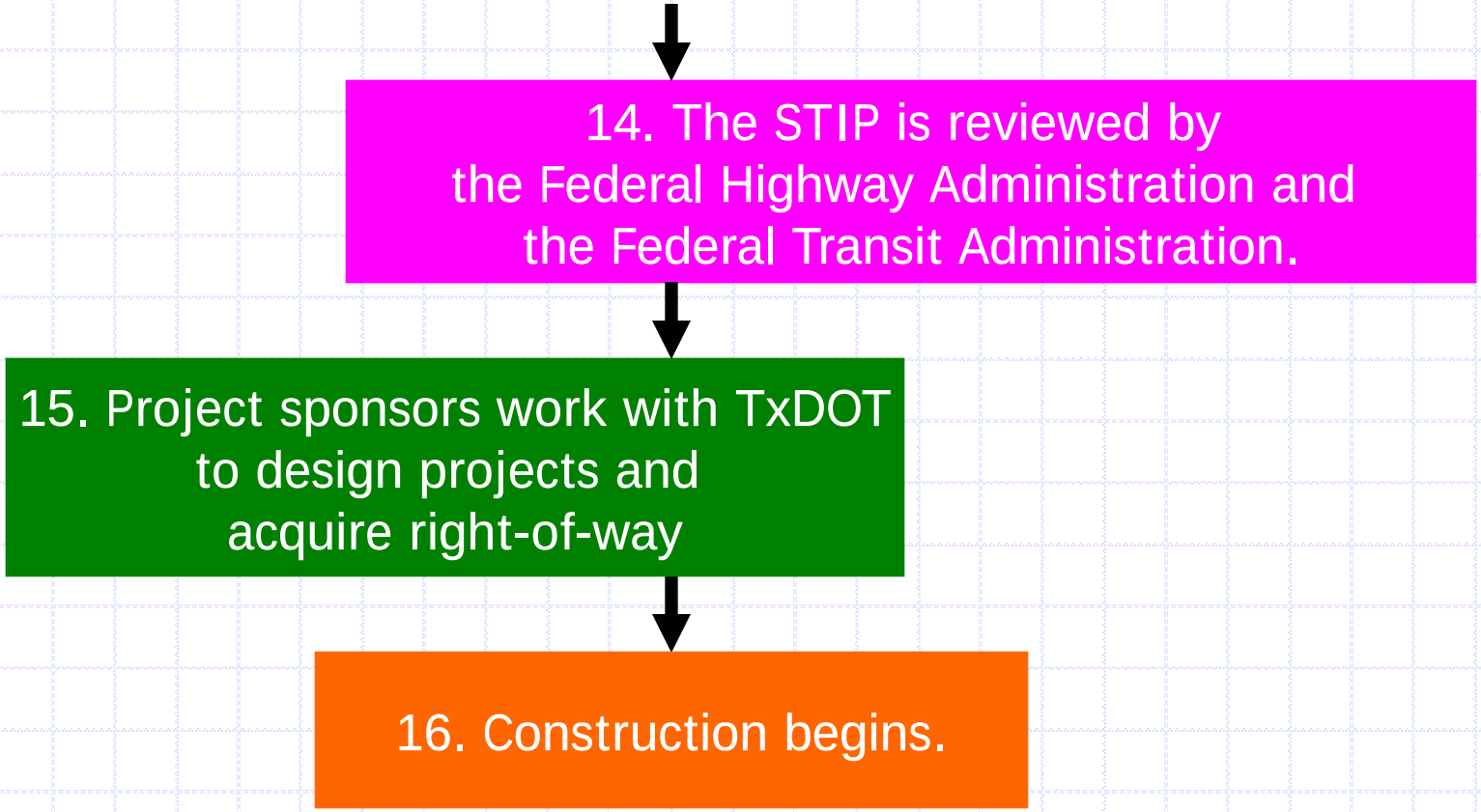
8. The MTP is adopted by the Regional Transportation Council (RTC).

9. Highest priority projects are evaluated and ranked for inclusion into the region's three-year project listing—the Transportation Improvement Program (TIP).

# The Road to Success (10-13)



# The Road to Success (14-16)



# Contents

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# DFW Regional Travel Model

A mathematical tool to assist planning and decision making

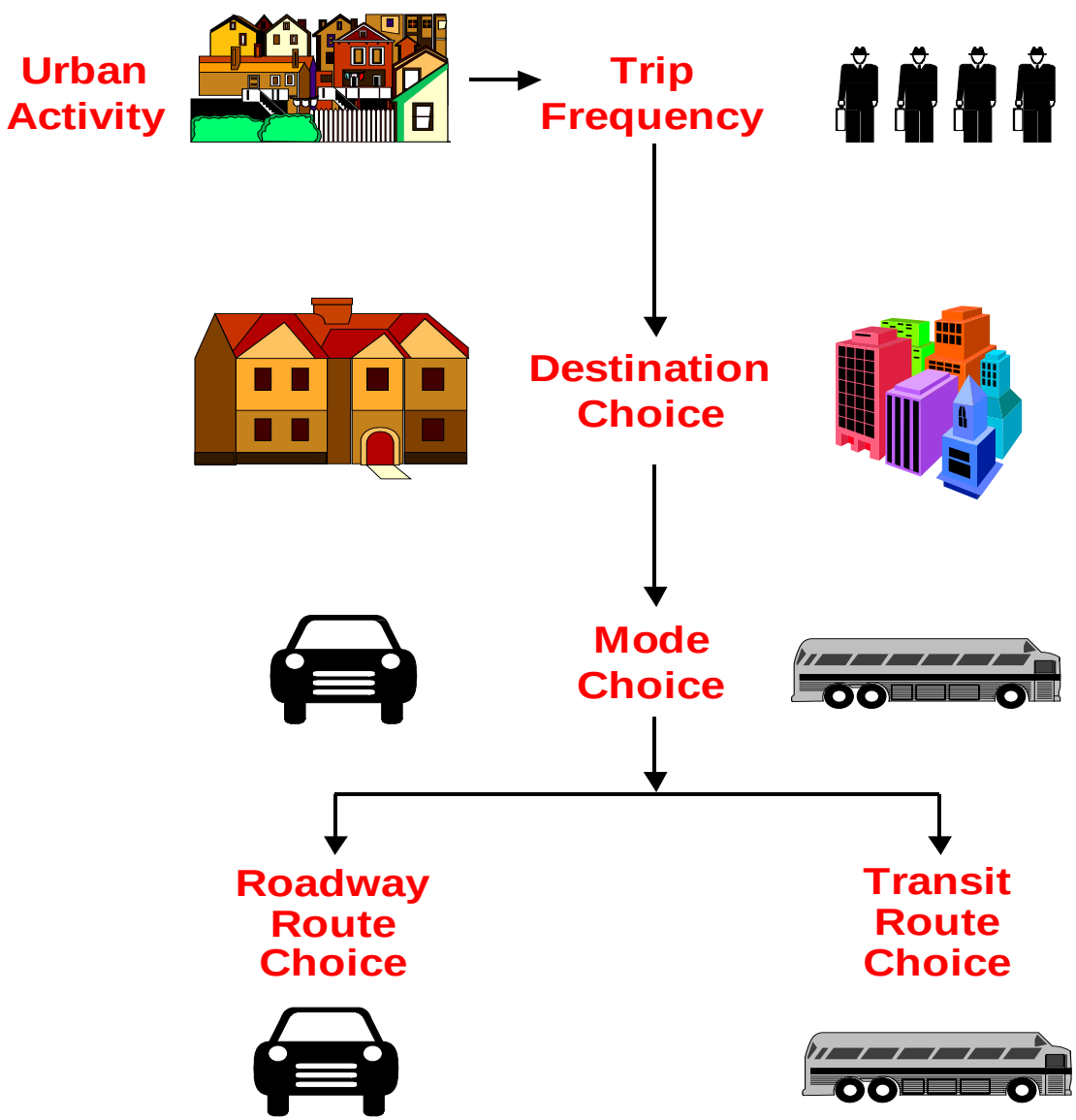
# Modeling Paradigm
# The Ideal Solution

- Ideally, we should build a detail model to replicate every person's daily travel decisions:
  - travel or not?
  - if yes, where to?
  - at what time?
  - using what mode (car drive alone, car shared-ride, transit, bicycle, walk)?
  - path?
- Then, we should model long term decisions of a person to predict future
- Finally, we can aggregate everyone's decisions and observe the effect on a project.
- This approach is currently impractical. Why?

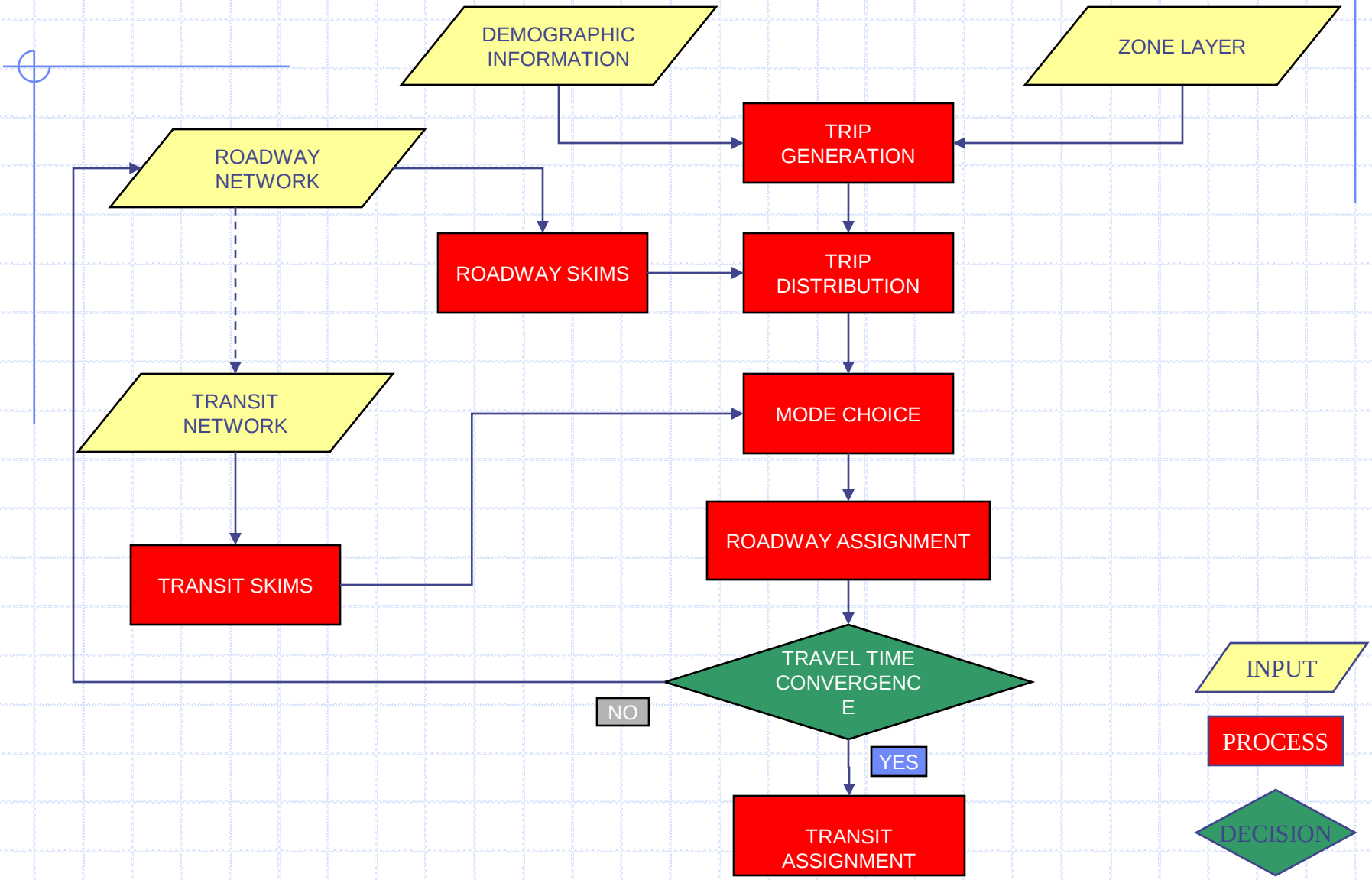
# Modeling Paradigm
# The Practical Solution

- Practically, we model collective trip patterns for groups of people in a travel survey zone (TSZ). We estimate:
  - number of motorized trips produced and attracted
  - how trips are distributed among TSZs
  - mode share of distributed trips(car drive alone, car shared-ride, and transit)?
  - assign trips to roadway or transit paths.
- Then, we model long term growth of population and employment for each zone.
- Finally, we aggregate collective decisions and observe the effect on a project.
- This approach is less than ideal but generally works for big decisions.

# Travel Demand Forecasting Process



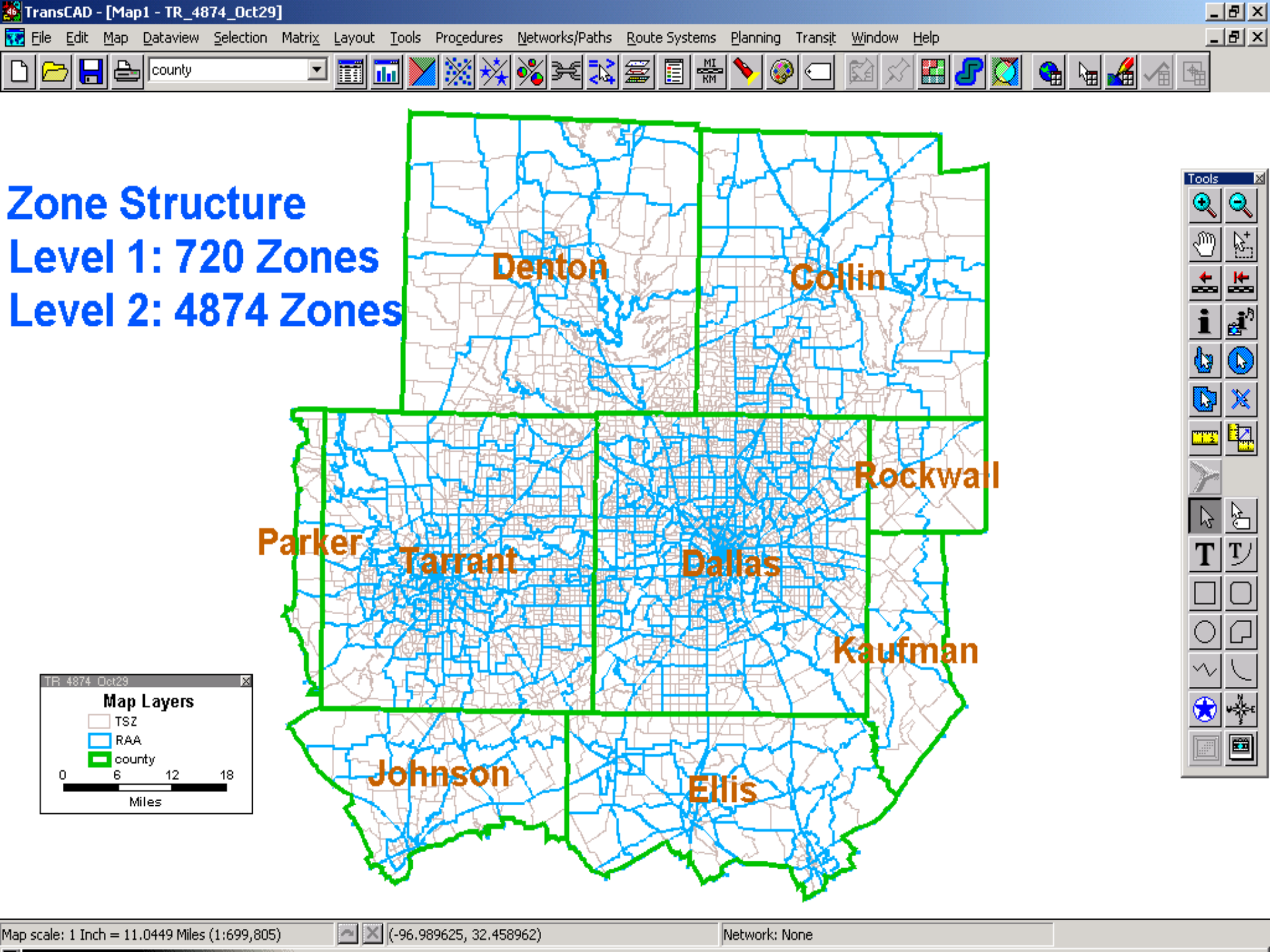
# Four-Step Modeling Process



# The “Practicality” Of Real-World Modeling

- Actual Scope Of Human Behavior → **Model Scope**
  - All Person Trips → **Motorized Person Trips**
  - All Travel Purposes → **HBW, HNW, NHB, And Truck Purpose Categories**
  - All Occupations → **Basic, Retail, And Service Jobs**
  - All Households → **Income And Household Size Categories (Plus Auto Ownership Breakdowns)**
  - All Streets → **Non-Local Streets**

- Individual Data → **Aggregate Data (Zones)**


TransCAD - [Map1 - TR_4874_Oct29]
File Edit Map Dataview Selection Matrix Layout Tools Procedures Networks/Paths Route Systems Planning Transit Window Help
county
Zone Structure
Level 1: 720 Zones
Level 2: 4874 Zones
Denton
Collin
Rockwall
Parker
Tarrant
Dallas
Kaufman
Johnson
Ellis
Tools
TR_4874_Oct29
Map Layers
TSZ
RAA
county
0 6 12 18
Miles
Map scale: 1 Inch = 11.0449 Miles (1:699,805)
(-96.989625, 32.458962)
Network: None

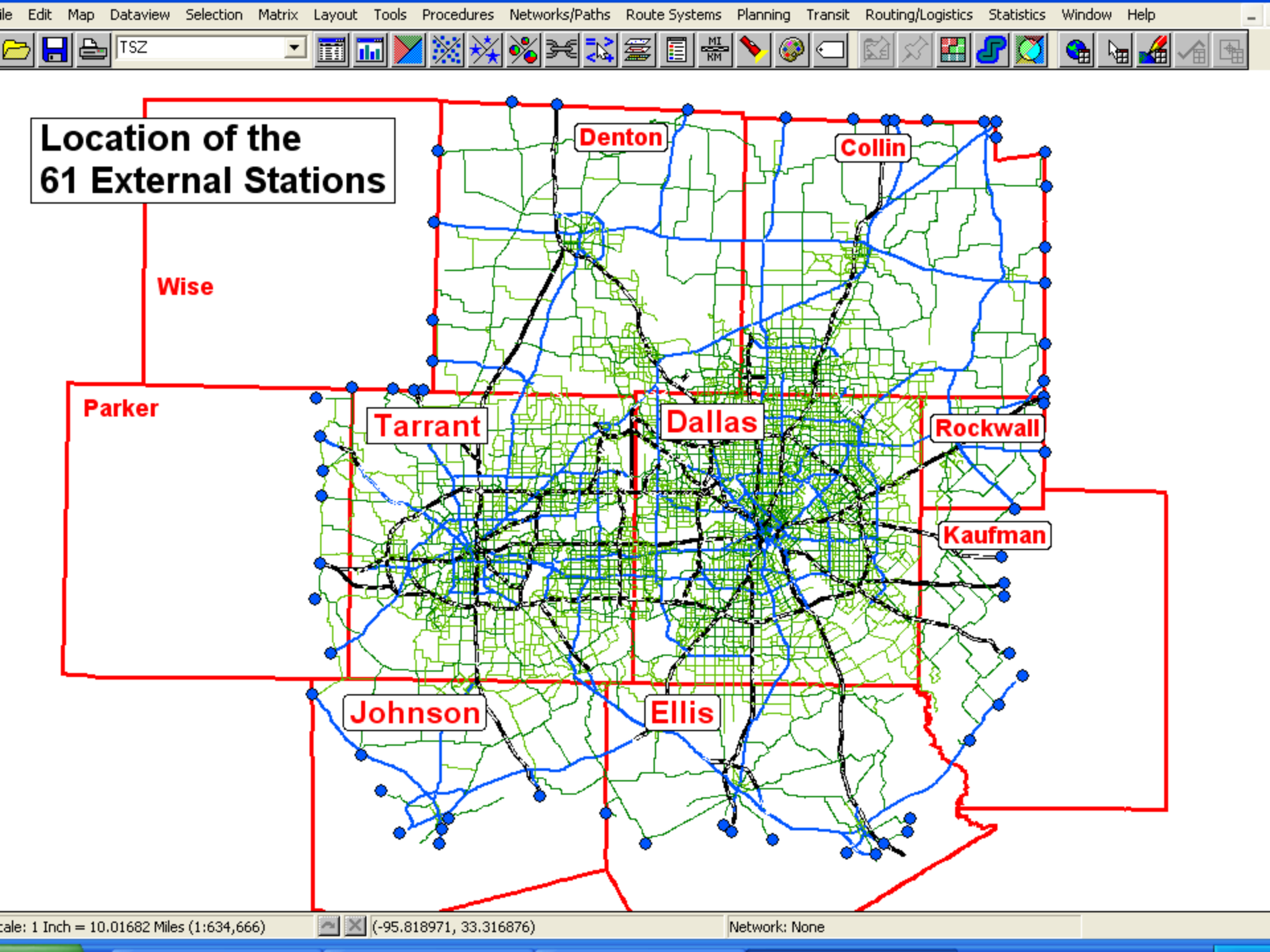
# Creation Of 4,874-Zone Structure

**Start With Year 2000 Census Block Layer**

- **Ground Truth Rectification**
- **Some Block Splits (e.g., DFW And Love Field Airport)**
- **76,336 Blocks Aggregated to 6,399 zones**
- **Add 61 External Station "Tiny Circle" Zones = 6,460 Total Zones**

**Aggregate The 6,460-Zone Layer**

- **= 4,813 Internal Zones + 61 External Station Zones**
- **= 4,874 TransCAD Model Zones**

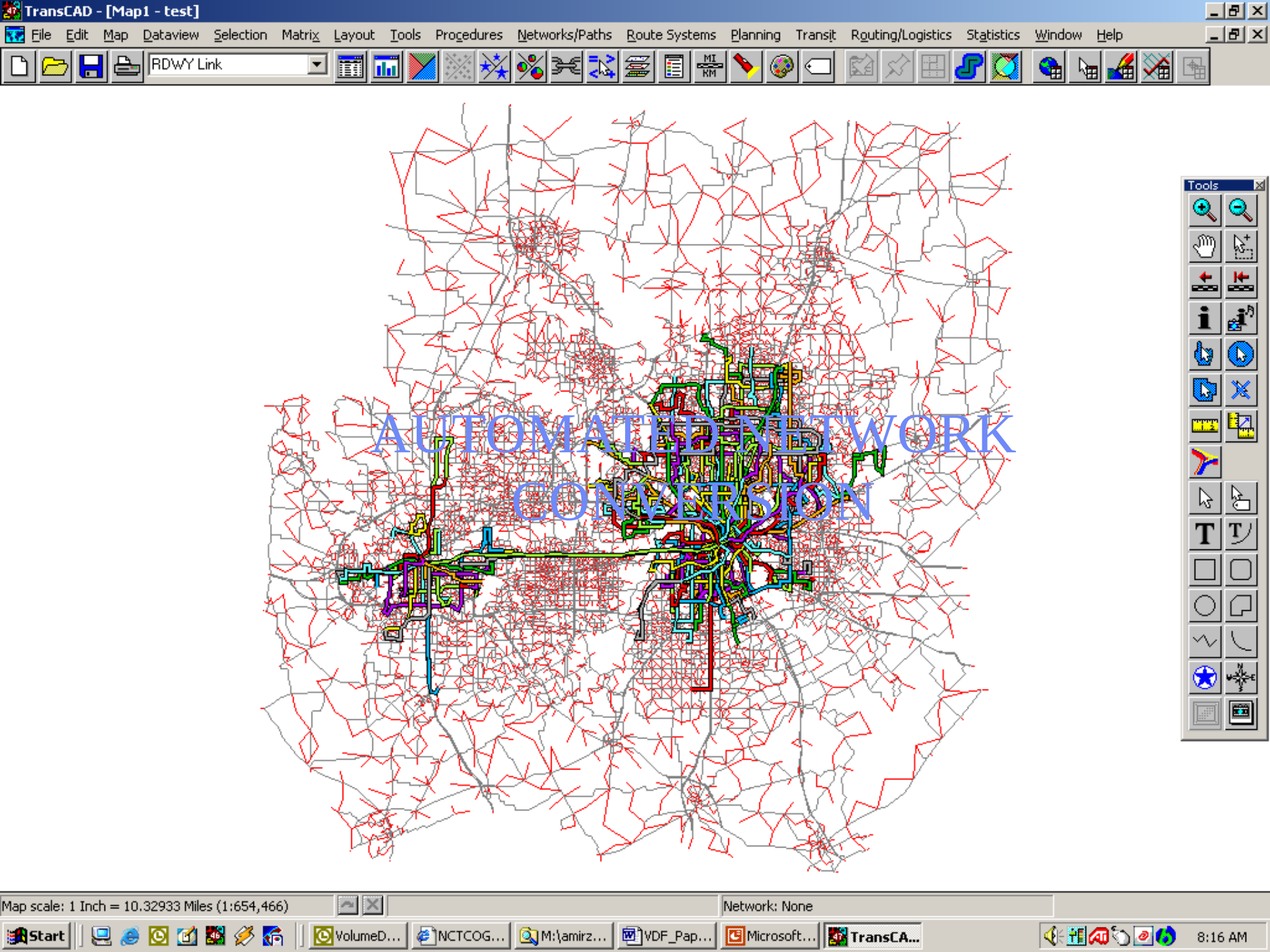

Location of the
61 External Stations
Denton
Collin
Wise
Parker
Tarrant
Dallas
Rockwall
Kaufman
Johnson
Ellis
TSZ
Edit
Map
Dataview
Selection
Matrix
Layout
Tools
Procedures
Networks/Paths
Route Systems
Planning
Transit
Routing/Logistics
Statistics
Window
Help
MI
KM
cale: 1 Inch = 10.01682 Miles (1:634,666)
(-95.818971, 33.316876)
Network: None

# TransCAD Model Size

**4874 Zones Retained For ALL Modeling Steps**
- **From Trip Generation To Traffic/Transit Assignment**
- **4813 Internal + 61 External**
- **Number Of Zone-To-Zone Pairs = 23.8 Million**

**Year 2025: 27,000 Roadway Links**
**+ 9,600 Zone Connectors**
- **Over 36,600 Coded Links**
- **22,000 Network Nodes**

**2025 Transit**
- **410 Coded One-Way Bus Lines And 36 Rail Lines**
- **14,500 Bus Stops And 171 Rail Stations**


TransCAD - [Map1 - test]
File Edit Map Dataview Selection Matrix Layout Tools Procedures Networks/Paths Route Systems Planning Transit Routing/Logistics Statistics Window Help
RDWY Link
Tools
AUTOMATED NETWORK CONVERSION
Map scale: 1 Inch = 10.32933 Miles (1:654,466)
Network: None
Start
VolumeD...
NCTCOG...
M:\amirz...
VDF_Pap...
Microsoft...
TransCA...
8:16 AM

# Roadway Preparation

- Link Free Speed

  Based On Speed Limit, Distance, Area Type, Functional Class, And Intersection Control

- Directional Hourly Capacity

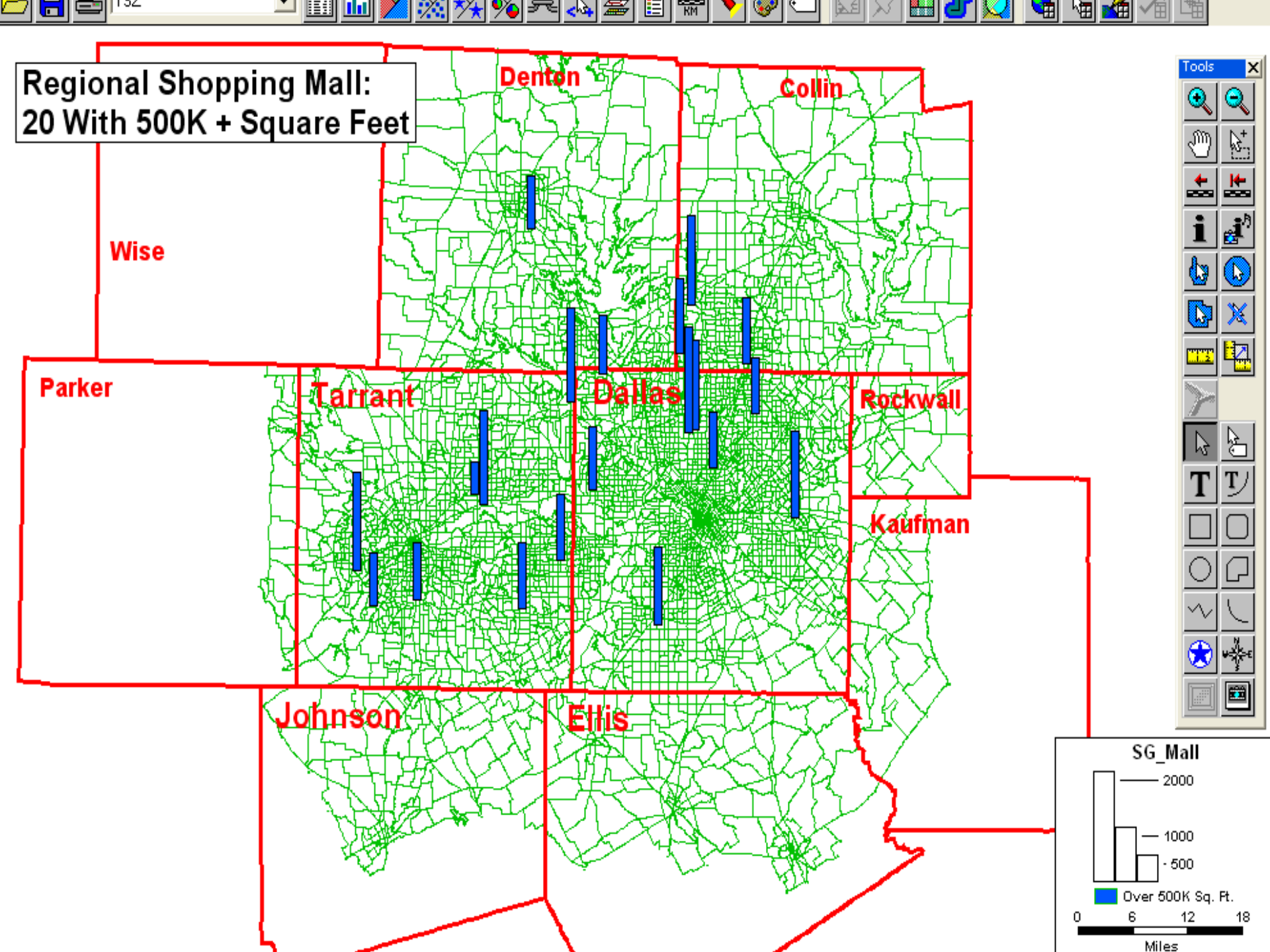
  Based On Lanes, Area Type, Functional Class, And Divided/Undivided Designation

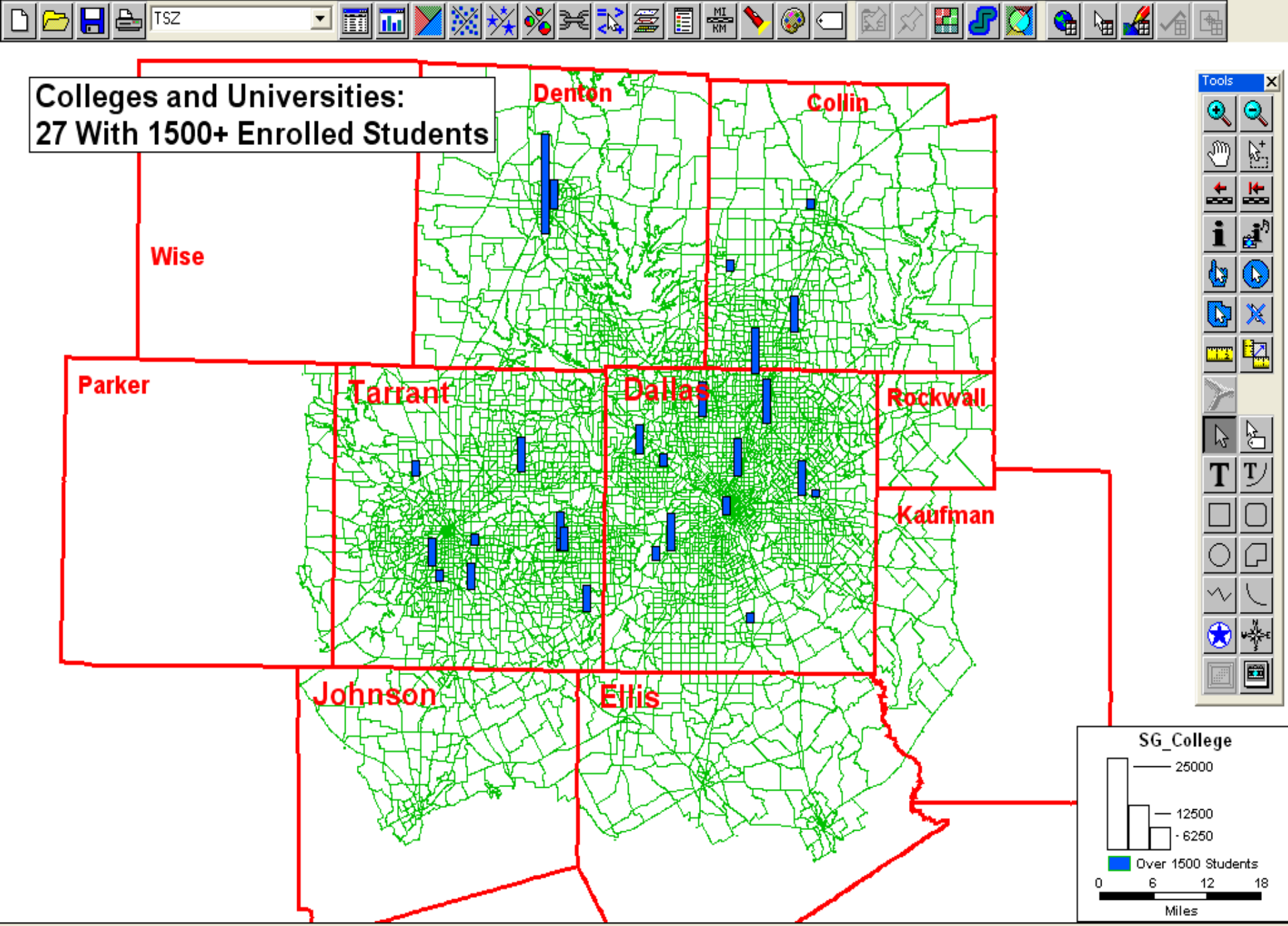
- Time Period Capacity

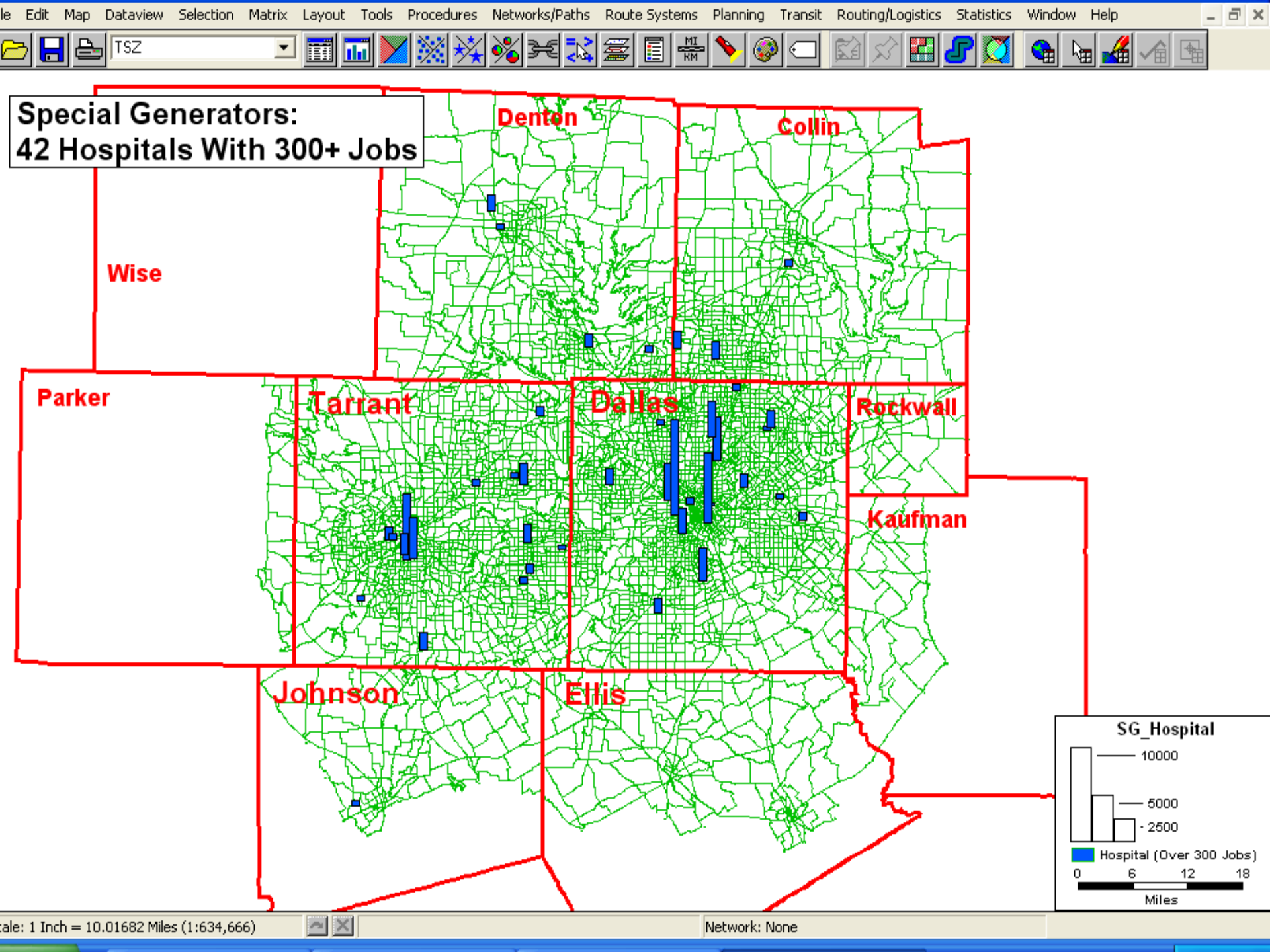
  AM Peak, PM Peak, And OffPeak

# Trip Generation

- GISDK Macro Language
  - Seven “Regular” Internal-Internal Trip Purposes
  - 4 HBW, 1 HNW, 1 NHB, And 1 Truck
- Inputs
  - Population, Households, Median Household Income
  - Basic, Retail, And Service Jobs (From SIC Codes)
  - Special Generators (Shopping Malls, Colleges, Hospitals, Airports)


Regional Shopping Mall:
20 With 500K + Square Feet
Denton
Collin
Wise
Parker
Tarrant
Dallas
Rockwall
Kaufman
Johnson
Ellis
Tools
SG_Mall
2000
1000
500
Over 500K Sq. Ft.
0
6
12
18
Miles


Colleges and Universities:
27 With 1500+ Enrolled Students
Denton
Collin
Wise
Parker
Tarrant
Dallas
Rockwall
Kaufman
Johnson
Ellis
Tools
SG_College
25000
12500
6250
Over 1500 Students
0
6
12
18
Miles
Map scale: 1 Inch = 10.01682 Miles (1:634,666)
Network: None


Edit Map Dataview Selection Matrix Layout Tools Procedures Networks/Paths Route Systems Planning Transit Routing/Logistics Statistics Window Help
TSZ
Special Generators:
42 Hospitals With 300+ Jobs
Denton
Collin
Wise
Parker
Tarrant
Dallas
Rockwall
Kaufman
Johnson
Ellis
SG_Hospital
10000
5000
2500
Hospital (Over 300 Jobs)
0 6 12 18
Miles
ale: 1 Inch = 10.01682 Miles (1:634,666)
Network: None

# What Is A Trip Production And A Trip Attraction?

TRIP = Use Of Motorized Transportation (Auto, Motorcycle, Truck, Or Public Transit) For At Least A Portion Of The Journey Between Two Activities

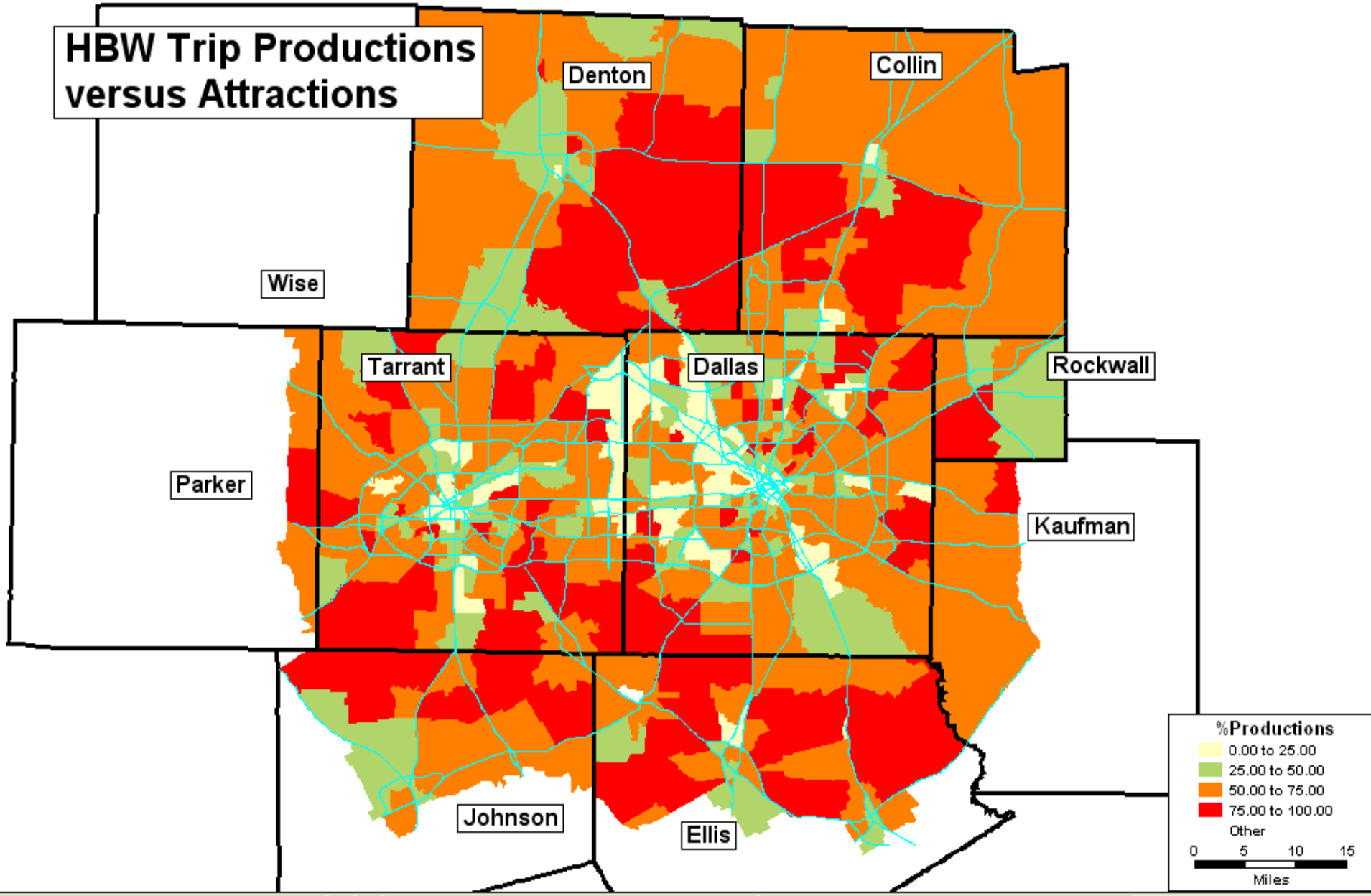
Home to Work = Home-Based Work (HBW) trip; Home is both Origin and Production end, while Work is both Destination and Attraction end

Work to Home = Also a HBW trip; Work is both Origin and Attraction end, while Home is both Destination and Production end

Nonhome to Nonhome = Nonhome-Based (NHB) trip; first activity of a NHB trip is always the Origin and Production end, while the second activity is always the Destination and Attraction end

RAA

# HBW Trip Productions versus Attractions



# Trip Production Rate Table for HBW

| Inc.Q. | Household Size | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6+ |
| 1 | 0.870 | 1.347 | 2.082 | 2.354 | 2.003 | 2.003 |
| 2 | 1.288 | 1.916 | 2.491 | 2.583 | 2.908 | 3.524 |
| 3 | 1.288 | 2.192 | 2.756 | 2.771 | 3.168 | 3.168 |
| 4 | 1.288 | 2.192 | 2.866 | 2.866 | 3.213 | 4.458 |

# External Station Trip Tables

Internal-External And External-Internal (IE/EI) Weekday Passenger Vehicles (Total Trip Ends)

External-External (EE) Weekday Passenger Vehicles

IE/EI Weekday Trucks (Six Or More Tires)

EE Weekday Trucks (Six Or More Tires)

# TRIP GENERATION LIMITATIONS

**Calibrated Trip Rates Represent Survey-Based Averages**

- **A low-income, two-person household in Frisco has the same number of HNW trip productions as a low-income, two-person household in downtown Dallas**
- **A suburban furniture store with 50 retail employees (jobs) has the same number of HNW attractions as a suburban grocery store with 50 retail employees**

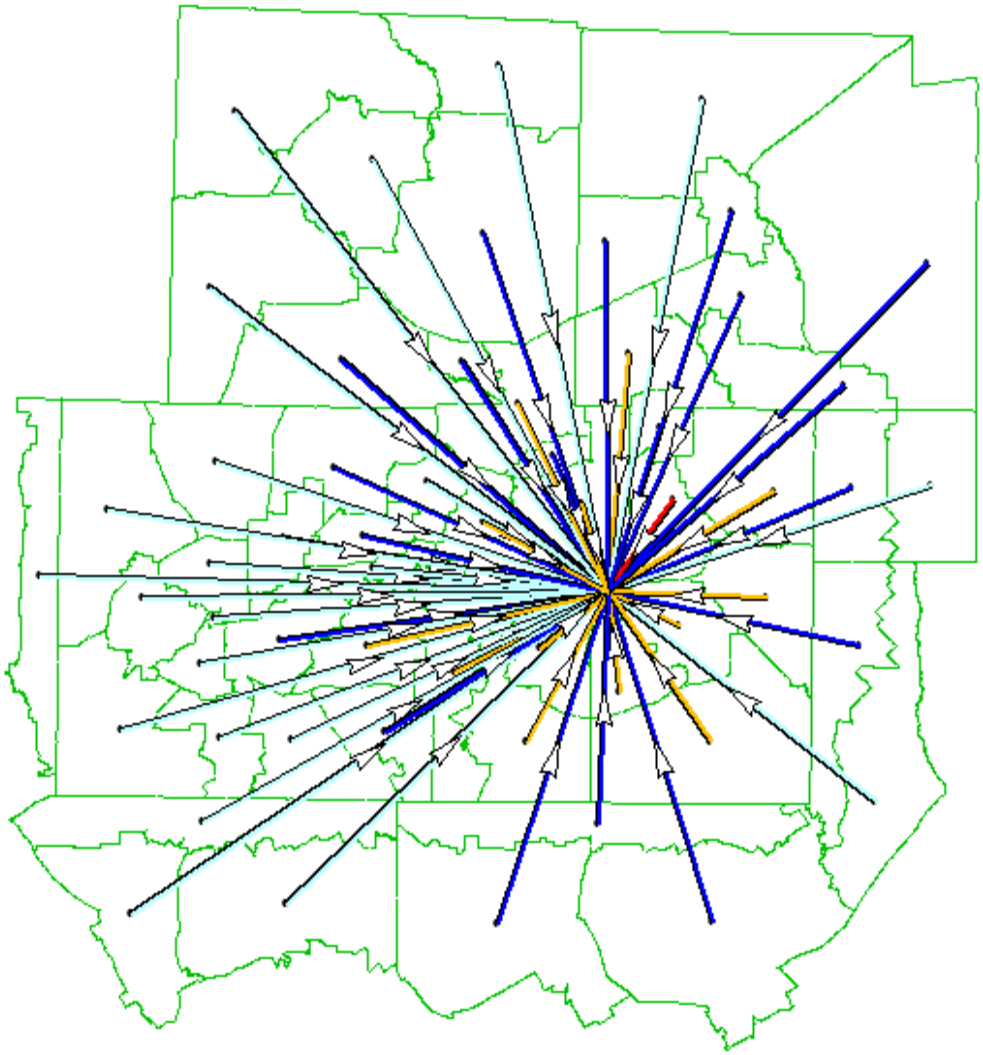
**Trip Rates Are Not Impacted By Changes In Accessibility**

- **Trip rates remain fixed, regardless of changes in roadway travel times or accessibility to transit**

# Trip Distribution

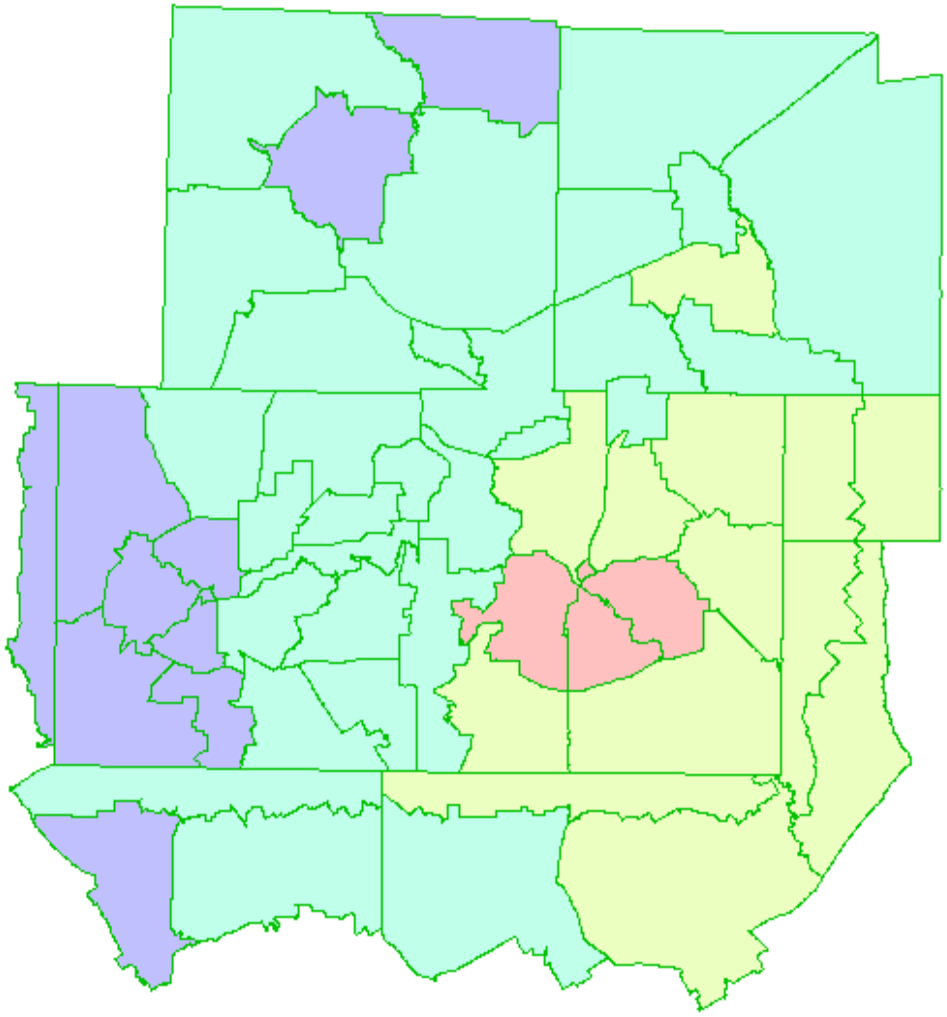
- Gamma-Format Gravity Model (7 Purposes)
  - Four HBW Groups (Income Quartiles) – AM Peak Skims
  - HNW (Non-Airport) -- OffPeak
  - NHB (Non-Airport) -- OffPeak
  - Trucks (Vehicles With Six Or More Tires) -- OffPeak
- Base Year Trip Table Factoring (6 Purposes)
  - HNW And NHB Airport Trips
  - Four External-Related Auto/Truck Trips

# Home-Based Work Trip Productions To Dallas CBD (2003)



AB
1 to 1000 Trips
1000 to 5000 Trips
5000 to 25000 Trips
25000 to 50000 Trips
0 6 12 18
Miles

# Percent of HBW Trip Productions in a Zone With Dallas CBD as Destination (2003)



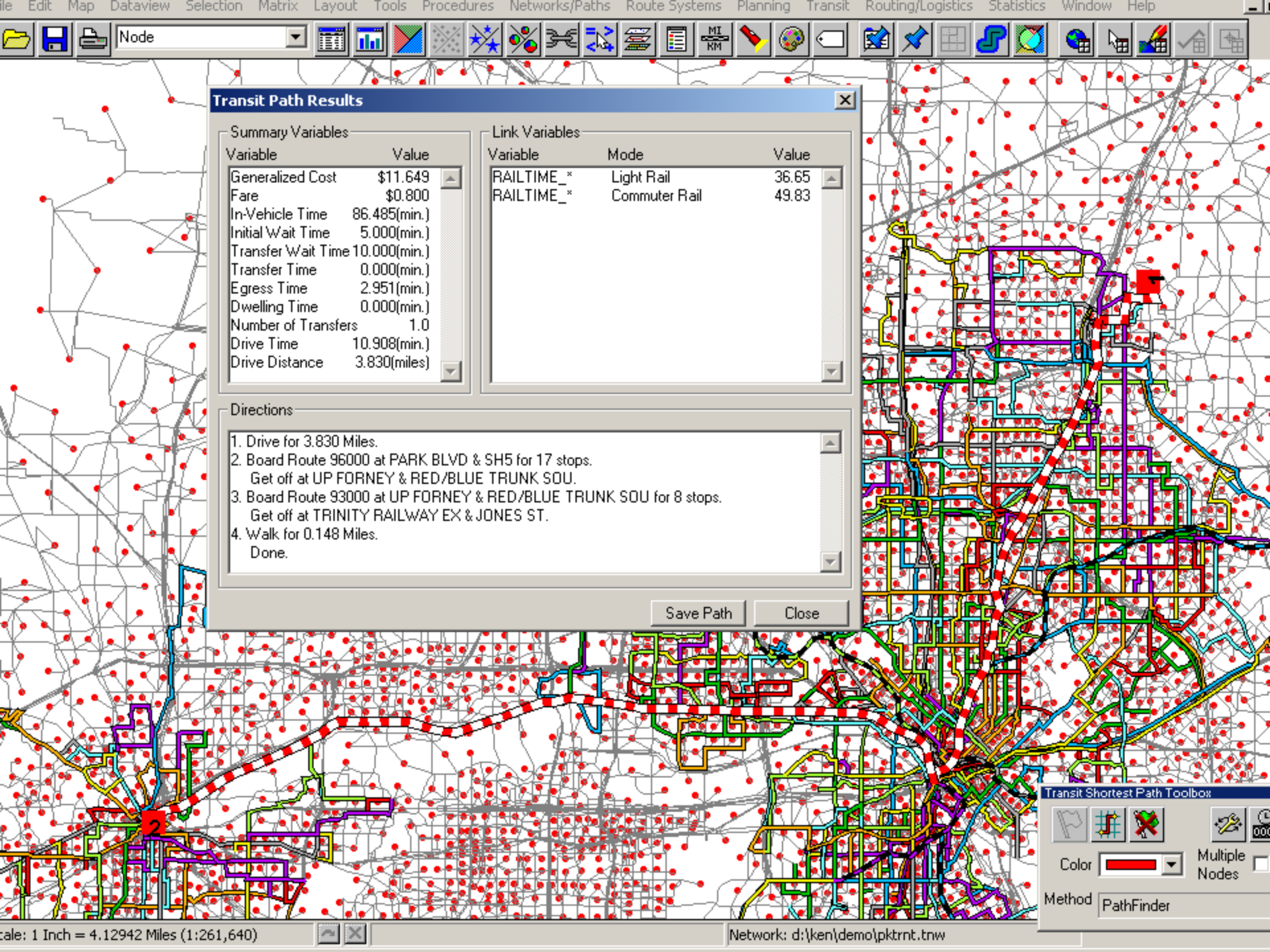
Percent_To_DallasCBD
0.000 to 1.000
1.000 to 5.000
5.000 to 10.000
10.000 to 35.000
0 7 14 21
Miles

# Zone To Zone Impedance Tables For Mode Choice

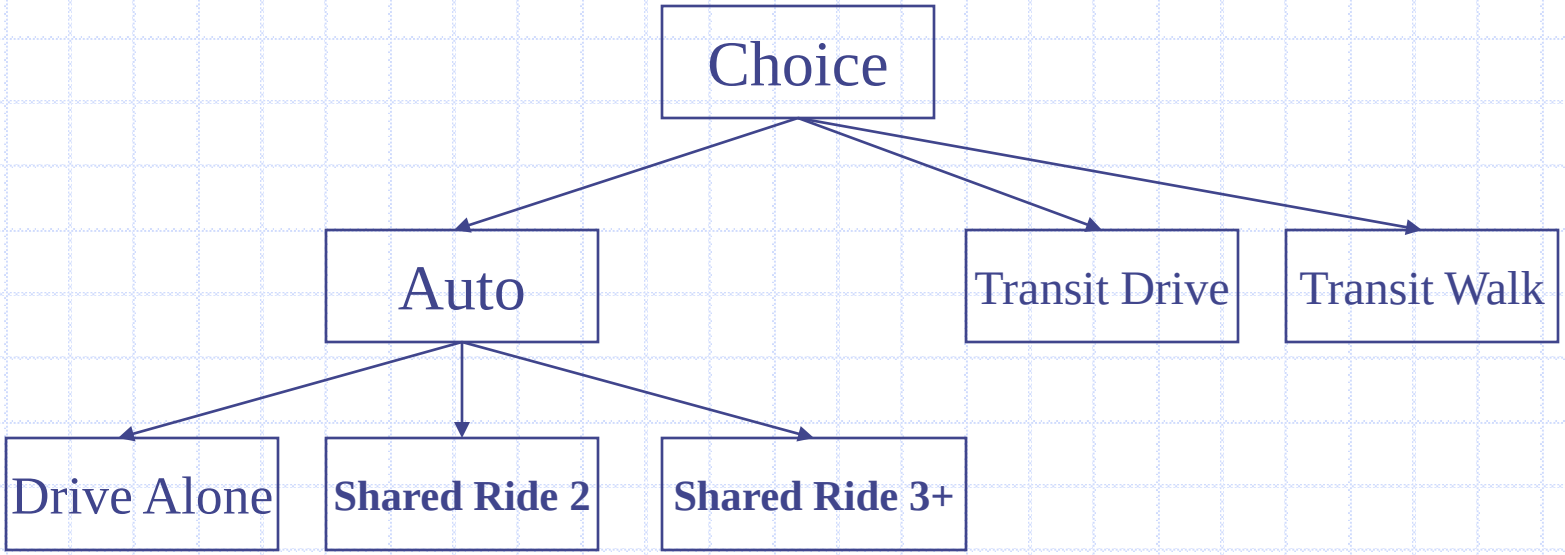
- Four AM Peak Skims (6:30a – 8:59a)
  - Roadway – Without HOV Links Available (Drive Alone)
  - Roadway – With HOV Links Available (Shared Ride 2 And 3+)
  - Transit – Drive Access (PA Format)
  - Transit – Walk Access (PA Format)
- Four OffPeak Skims
  - Roadway Is 18-hour Offpeak
    - Without HOV Links Available (Drive Alone)
    - With HOV Links Available (Shared Ride 2 And 3+)
  - Transit Is 6-hour Mid-Day Offpeak (9:00a – 2:59p)
    - Drive Access (PA Format)
    - Walk Access (PA Format)

# Mode Choice Inputs

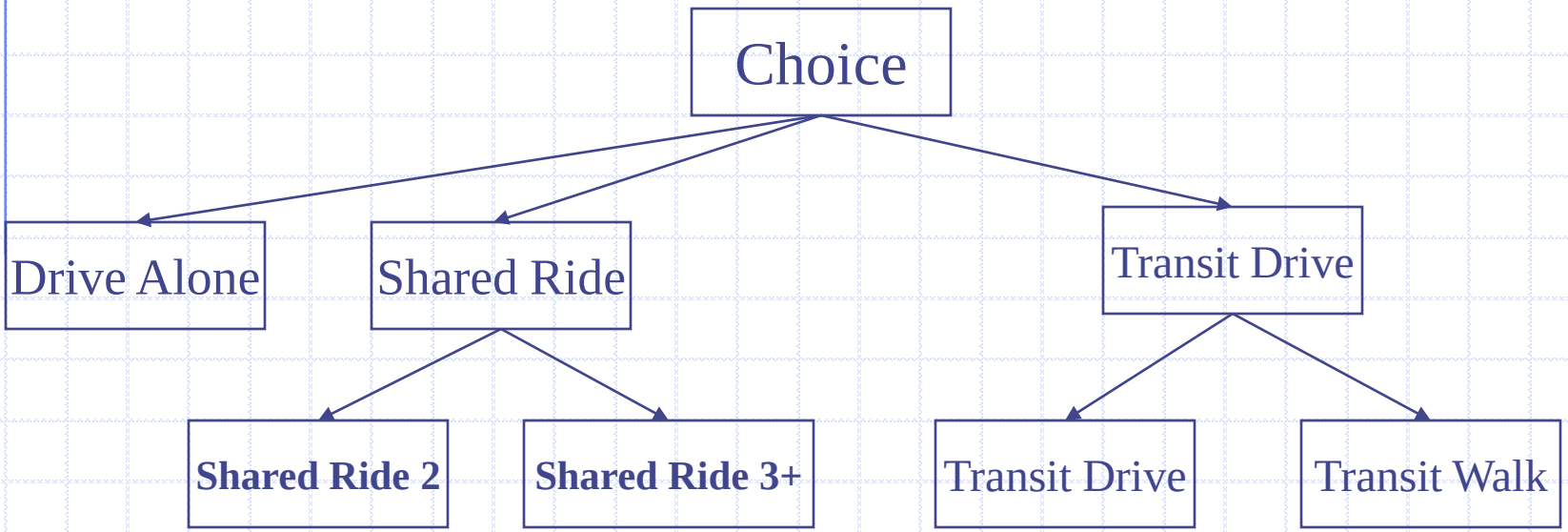
- Auto Travel
  - Roadway Travel Time
  - Roadway Length (Operating Cost)
  - Daily Parking Cost
- Transit Travel
  - In-Vehicle Transit Travel Time (Includes Dwell)
  - Walk (Or Drive) Access Time
  - Walk Transfer And Egress Time
  - Initial And Transfer Wait Time
  - Transit Fare
  - Market Segment And Area Type Constants


Edit Map Dataview Selection Matrix Layout Tools Procedures Networks/Paths Route Systems Planning Transit Routing/Logistics Statistics Window Help
Node
MI
KM
Transit Path Results
Summary Variables
Variable Value
Generalized Cost $11.649
Fare $0.800
In-Vehicle Time 86.485(min.)
Initial Wait Time 5.000(min.)
Transfer Wait Time 10.000(min.)
Transfer Time 0.000(min.)
Egress Time 2.951(min.)
Dwelling Time 0.000(min.)
Number of Transfers 1.0
Drive Time 10.908(min.)
Drive Distance 3.830(miles)
Link Variables
Variable Mode Value
RAILTIME_* Light Rail 36.65
RAILTIME_* Commuter Rail 49.83
Directions
1. Drive for 3.830 Miles.
2. Board Route 96000 at PARK BLVD & SH5 for 17 stops.
Get off at UP FORNEY & RED/BLUE TRUNK SOU.
3. Board Route 93000 at UP FORNEY & RED/BLUE TRUNK SOU for 8 stops.
Get off at TRINITY RAILWAY EX & JONES ST.
4. Walk for 0.148 Miles.
Done.
Save Path
Close
Transit Shortest Path Toolbox
Color
Multiple Nodes
Method
PathFinder
2
cale: 1 Inch = 4.12942 Miles (1:261,640)
Network: d:\ken\demo\pktrnt.tnw

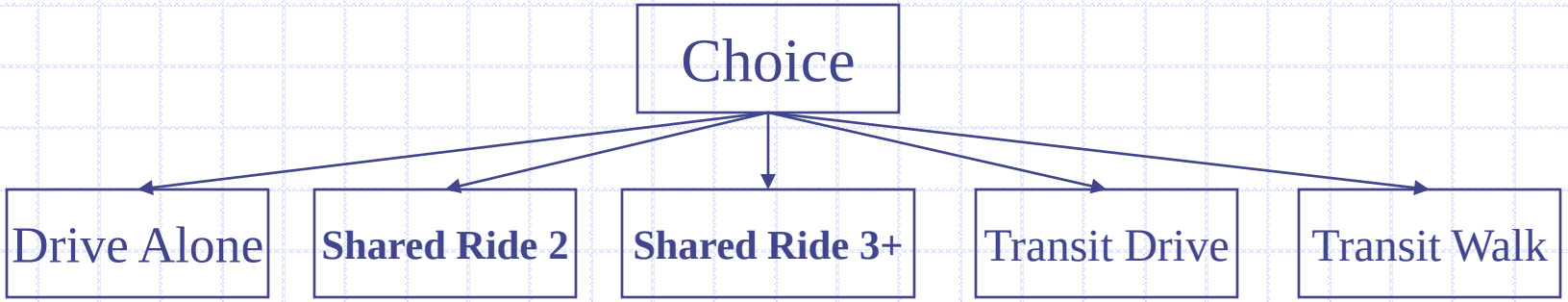
# HBW Mode Choice Model Structure



# HNW Mode Choice Model Structure



# NHB Mode Choice Model Structure



# Mode Choice Outputs

For each trip purpose, person trip tables by mode:

- Drive-alone
- Shared-ride
- Walk to Transit
- Drive to Transit

# Transit Assignment

Four Multi-Path (TransCAD Pathfinder) Production-Attraction Assignments

For All HBW Transit Trips

- Peak Transit-Initial Drive Access (Park-and-Ride)
- Peak Transit-Initial Walk Access (No Park-and-Ride)

For All HNW And NHB Transit Trips

- Offpeak Transit-Initial Drive Access (Park-and-Ride)
- Offpeak Transit-Initial Walk Access (No Park-and-Ride)

# Wardrop's Principles

- The journey times on all the routes actually used are equal and less than those which would be experienced by a single vehicle on any unused route.
- The average journey time is a minimum

# Formulation

Letting $\mathcal{R}_{pq}$ denote the index set of simple routes[4] in origin-destination pair $(p,q) \in \mathcal{C}$, $h_{pqr}$ the flow on route $r$, and $\pi_{pq}$ the travel time on the shortest route from $p$ to $q$, given the flow $\mathbf{h} = (h_{pqr})_{r \in \mathcal{R}_{pq}, (p,q) \in \mathcal{C}}$, the above Wardrop user equilibrium conditions may equivalently be stated as

$$h_{pqr} > 0 \implies c_{pqr} = \pi_{pq}, \qquad \forall r \in \mathcal{R}_{pq}, \tag{2.1a}$$

$$h_{pqr} = 0 \implies c_{pqr} \geq \pi_{pq}, \qquad \forall r \in \mathcal{R}_{pq}, \tag{2.1b}$$

to hold for all pairs $(p,q) \in \mathcal{C}$. Including the feasibility restrictions for the flow $\mathbf{h}$, the conditions for user equilibrium may be summarized as

$$h_{pqr}(c_{pqr} - \pi_{pq}) = 0, \qquad \forall r \in \mathcal{R}_{pq},\ \forall (p,q) \in \mathcal{C}, \tag{2.2a}$$

$$c_{pqr} - \pi_{pq} \geq 0, \qquad \forall r \in \mathcal{R}_{pq},\ \forall (p,q) \in \mathcal{C}, \tag{2.2b}$$

$$\sum_{r \in \mathcal{R}_{pq}} h_{pqr} = d_{pq}, \qquad \forall (p,q) \in \mathcal{C}, \tag{2.2c}$$

$$h_{pqr} \geq 0, \qquad \forall r \in \mathcal{R}_{pq},\ \forall (p,q) \in \mathcal{C}, \tag{2.2d}$$

$$\pi_{pq} \geq 0, \qquad \forall (p,q) \in \mathcal{C}, \tag{2.2e}$$

# Formulation

The objective functions of the mathematical programs to be derived in this section are based on total link flows. The route and link flows, and their associated travel times, are related according to the following. The commodity link flows, $\mathbf{f}_{pq} = (f_{apq})$, given the route flows $\mathbf{h}$, are given by

$$f_{apq} \stackrel{\text{def}}{=} \sum_{a \in \mathcal{A}} \delta_{pqra} h_{pqr}, \qquad \forall (p,q) \in \mathcal{C}, \ \forall a \in \mathcal{A}, \tag{2.5a}$$

where

$$\delta_{pqra} \stackrel{\text{def}}{=} \begin{cases} 1, & \text{if route } r \in \mathcal{R}_{pq} \text{ uses link } a, \\ 0, & \text{otherwise,} \end{cases} \qquad \forall a \in \mathcal{A}, \ \forall r \in \mathcal{R}_{pq}, \ \forall (p,q) \in \mathcal{C} \tag{2.5b}$$

defines the *link-route incidence matrix*, $\mathbf{\Delta}^{\mathrm{T}} = (\delta_{pqra})$, for the network $\mathcal{G}$. The total link flows, $\mathbf{f} = (f_a)$, are then given by

$$f_a \stackrel{\text{def}}{=} \sum_{(p,q) \in \mathcal{C}} f_{apq}, \qquad \forall a \in \mathcal{A}, \tag{2.5c}$$

# UE Formulation

$$\min\ T(\mathbf{f}) \stackrel{\text{def}}{=} \sum_{a \in \mathcal{A}} \int_0^{f_a} t_a(s)ds, \tag{2.6a}$$

subject to

$$\sum_{r \in \mathcal{R}_{pq}} h_{pqr} = d_{pq}, \quad \forall (p,q) \in \mathcal{C}, \tag{2.6b}$$

$$h_{pqr} \geq 0, \quad \forall r \in \mathcal{R}_{pq},\ \forall (p,q) \in \mathcal{C}, \tag{2.6c}$$

$$\sum_{(p,q) \in \mathcal{C}} \sum_{r \in \mathcal{R}_{pq}} \delta_{pqra} h_{pqr} = f_a, \quad \forall a \in \mathcal{A}. \tag{2.6d}$$

# Traffic Assignment Preparation

Production-Attraction To Origin-Destination Trip Table Transposing, Factoring, And Aggregation

AM Peak Period (2.5 Hours)

PM Peak Period (3.5 Hours)

Off Peak Period (18 Hours)

# Traffic Assignment

- Equilibrium Principle (Wardrop 1952)
- Mathematical Program (Beckman 1956)
- Algorithm for practical implementation (LeBlank 1973)

# Traffic Assignment

User Equilibrium Generalized Cost (Three 30-Iteration Assignments)

- A.M. Peak (6:30a – 8:59a:  2.5 hours)
- P.M. Peak (3:00p – 6:29p:  3.5 hours)
- OffPeak (18 hours)

Four Vehicle Classes Loaded Simultaneously

- Drive Alone
- Shared-Ride “Sees” HOV Lanes
- Shared-Ride “Doesn’t See” HOV Lanes
- Trucks (Vehicles With 6 Or More Tires)

# Model Outputs: Supply-Side Calculations

**Number Of Coded Transit Lines**

**Roadway Network Links (Or Miles) With Transit**

**Total Physical Stops And "Line" Stops**
- **How Many Are Rail Stations**
- **How Many Are Transit Park-And-Ride Locations**

**AM Peak And Mid-Day OffPeak Vehicle Miles And Hours Of Travel**

**Population And Employment Within "Buffer" Areas**

# Direct Model Outputs

**Person Trip (Production-Attraction) Matrices (4874 x 4874) By Trip Purpose And Mode Of Travel**

**Roadway And Transit Skim Matrices (4874 x 4874)**

**ONs And OFFs (Boardings And Alightings) For Each Coded Transit Stop**

**Transit "Link" Flow File (Stop To Stop)**

**Movements File (Line To Line Rider Transfers)**

**Link-Level Traffic Volumes And Speeds By Vehicle Class and Time Of Day**

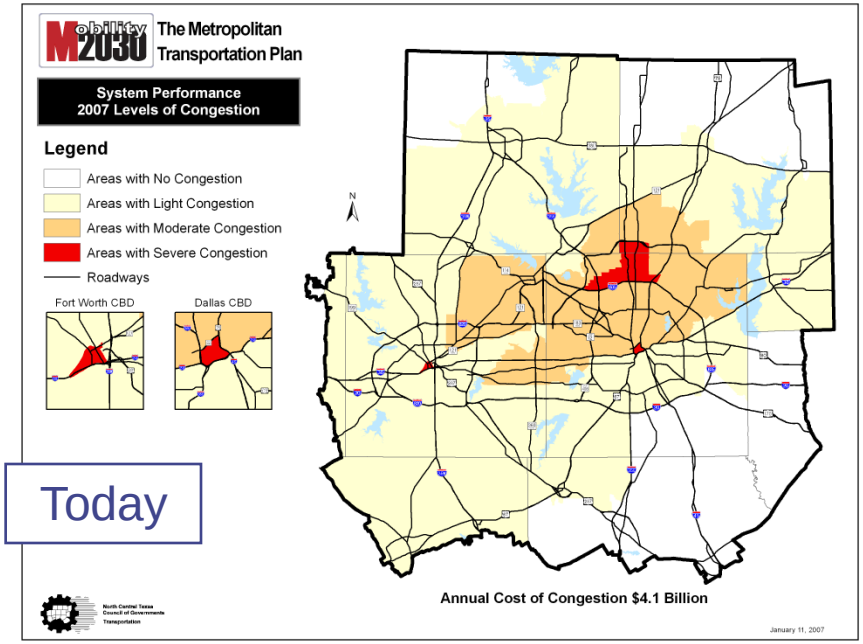
# Model Outputs: Demand-Side Calculations

**Transit Boardings And Alightings**
- **By Mode, By Route, By Line, Or By Rail Station**
- **For Weekday, Or For Each Of Four Assignments**

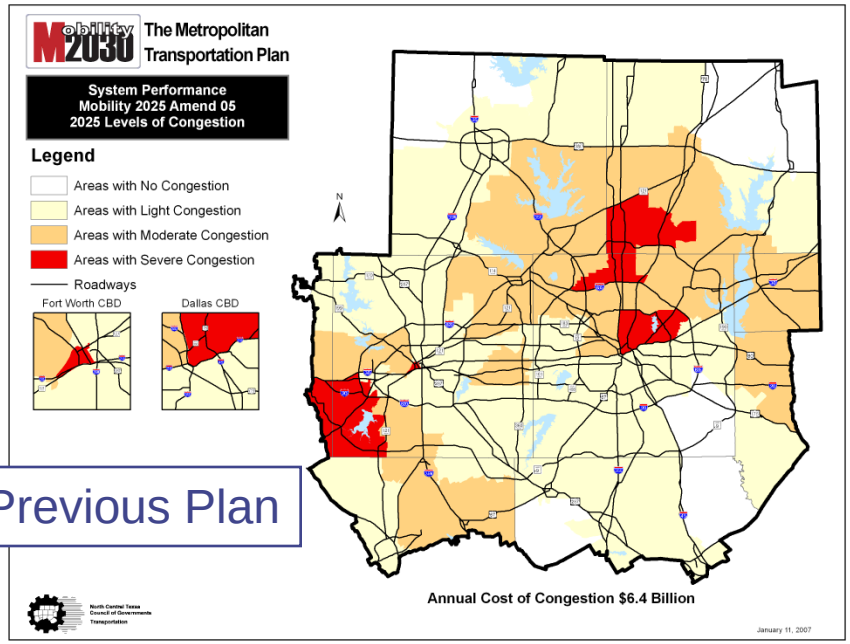
**Regional Average Transfer Rates**
- **Boardings, Riders, And Boardings Per Rider**

**Transit Passenger Miles And Hours**

**Rail Station Mode-Of-Access/Egress Summaries**



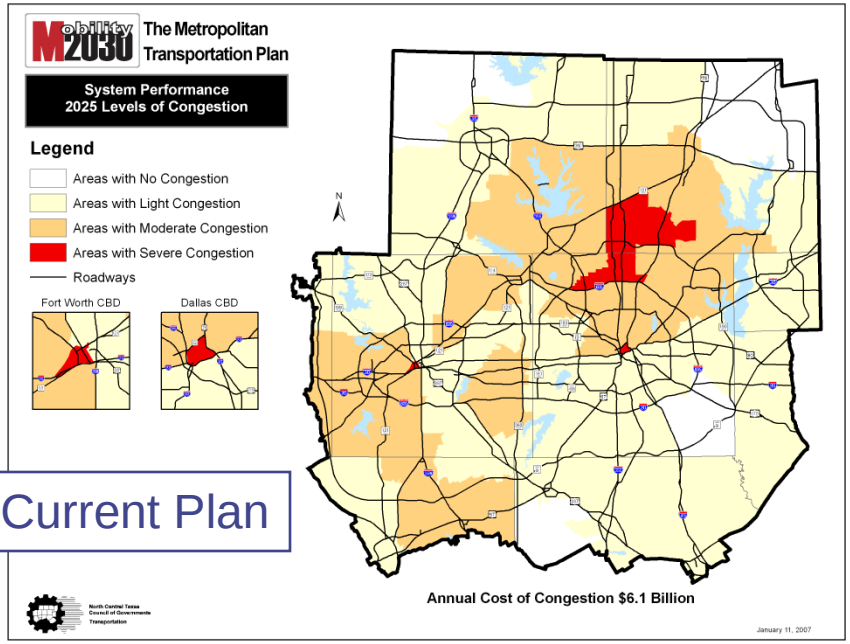

Today




Previous Plan

## CURRENT AND FORECAST CONGESTION LEVELS

For The First Time, The Current Mobility Plan Shows Lower Congestion Than The Previous Plan. Innovative Policies, Programs And Projects Are Beginning To Show The Promise Of Long-term Congestion Relief. Public And Private Financial Partnerships Are Allowing The Region To Increase Transportation System Capacity At A Rate Not Seen In Decades.




Current Plan

# Mobility 2030 The Metropolitan Transportation Plan

## Funded Roadway Recommendations

**Legend**

- New Freeway Facilities
- New Tollway Facilities
- Additional Capacity To Existing Freeway/Tollway
- HOV/Managed Lanes
- Improvements to Existing Freeway and HOV/Managed Lanes
- Selected New/Improved Regionally Significant Arterials
- Freeways/Tollways

Fort Worth CBD

Dallas CBD

Corridor specific design and operational characteristics for the Freeway/Tollway system will be determined through ongoing project development.

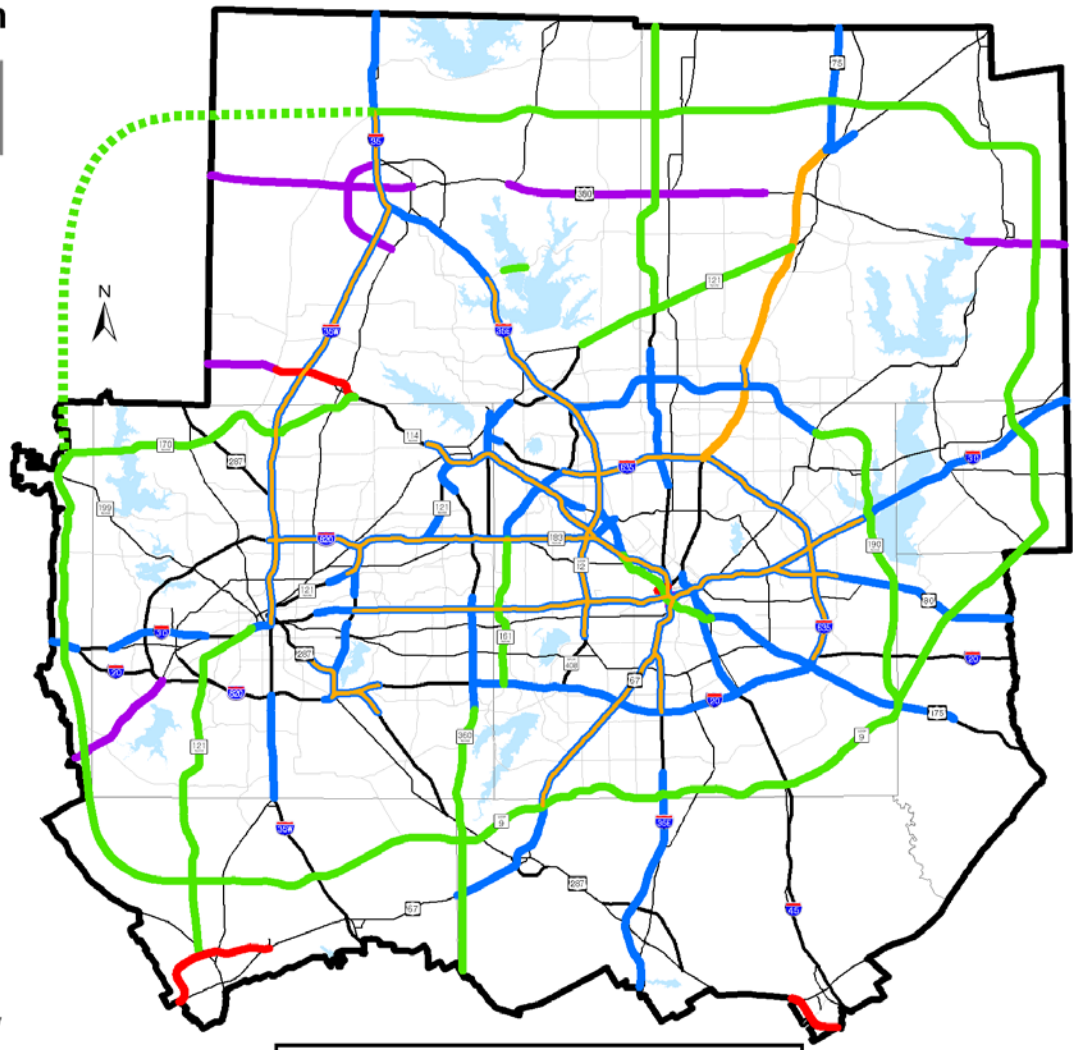
Additional and improved Freeway/Tollway interchanges and service roads should be considered on all Freeway/Tollway facilities in order to accommodate a balance between mobility and access needs.

All Freeway/Tollway corridors require additional study for capacity, geometric, and safety improvements related to truck operations.

New facility locations indicate transportation needs and do not represent specific alignments

Operational strategies to manage the flow of traffic should be considered in the corridors where additional freeway or tollway lanes are being considered.

North Central Texas Council of Governments
Transportation




**$29.8 Billion Regional Roadway System**

**Additional Freeway/Tollway lane miles = 3,444**
**Additional HOV/Managed lane miles = 626**

January 11, 2007

# Mobility 2030 The Metropolitan Transportation Plan

## Priced Facilities

### Legend

- Existing Toll Facilities
- Proposed Toll Facilities
- Proposed HOV/Managed Facilities*
- Freeways/Tollways

Fort Worth CBD

Dallas CBD

Corridor specific design and operational characteristics for the Freeway/Tollway system will be determined through ongoing project development.

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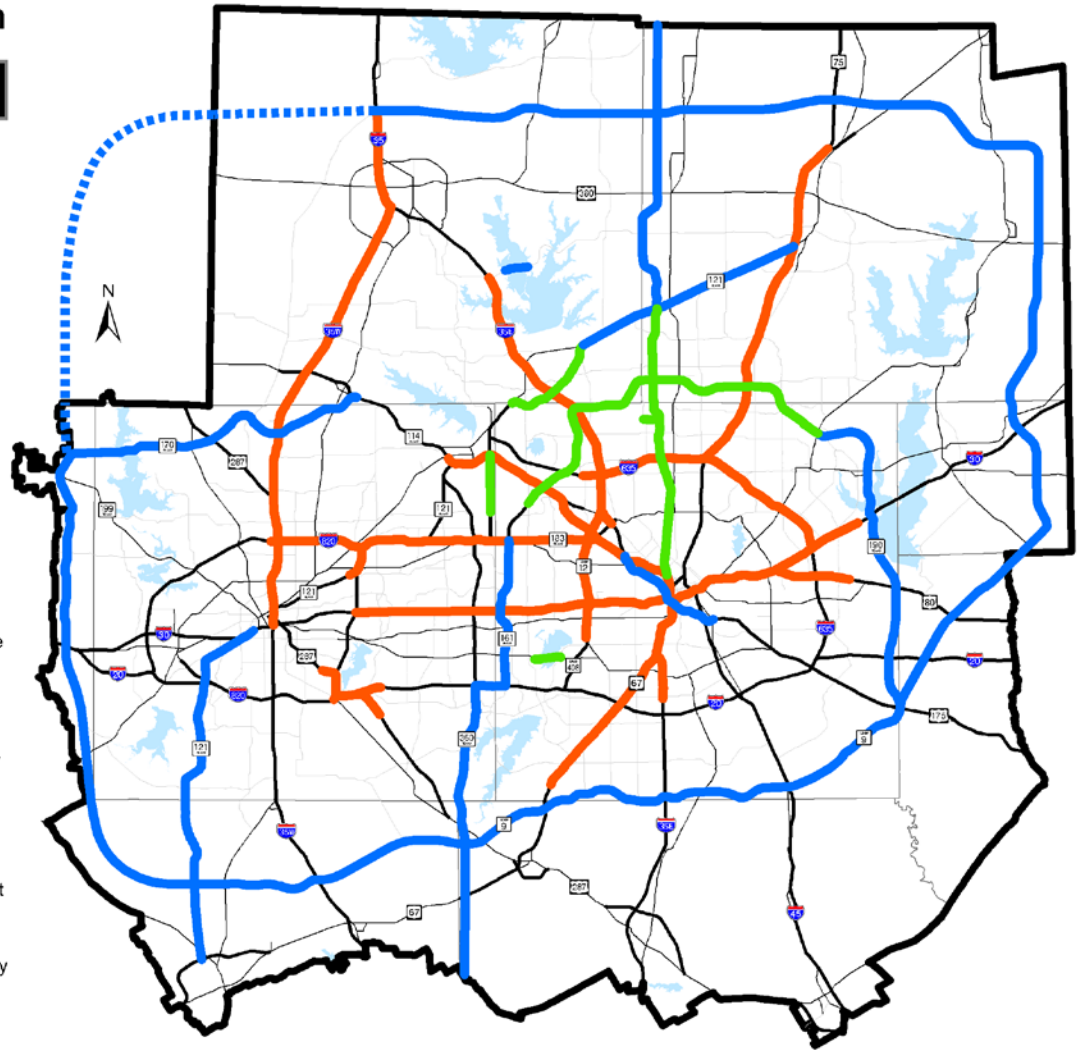
New facility locations indicate transportation needs and do not represent specific alignments

Operational strategies to manage the flow of traffic should be considered in the corridors where additional freeway or tollway lanes are being considered.

* Existing lanes in corridor remain free. Toll charged on new capacity only and will include HOV incentives.

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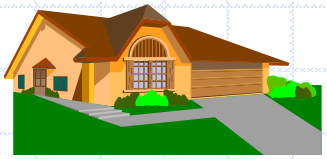
Transportation

**$17.7 Billion of Innovative Funding Strategies**

January 11, 2007

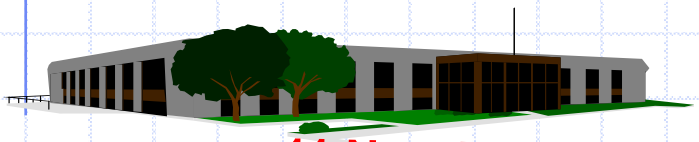
# ECONOMIC AND DEMOGRAPHIC GROWTH
# WHAT DOES IT MEAN?

500 New Schools



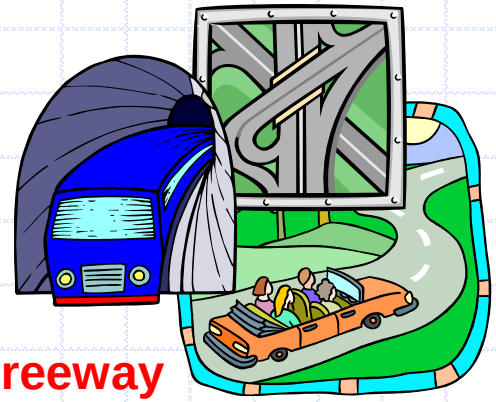
570,000 New Homes

28 New Hospitals



11 New Malls

267 New Neighborhood Retail Centers



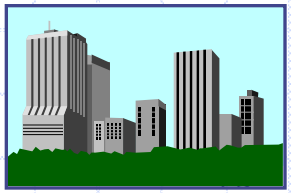
315,000 New Multi-Family Units

2000 Freeway Lane Miles

700 Miles of HOV

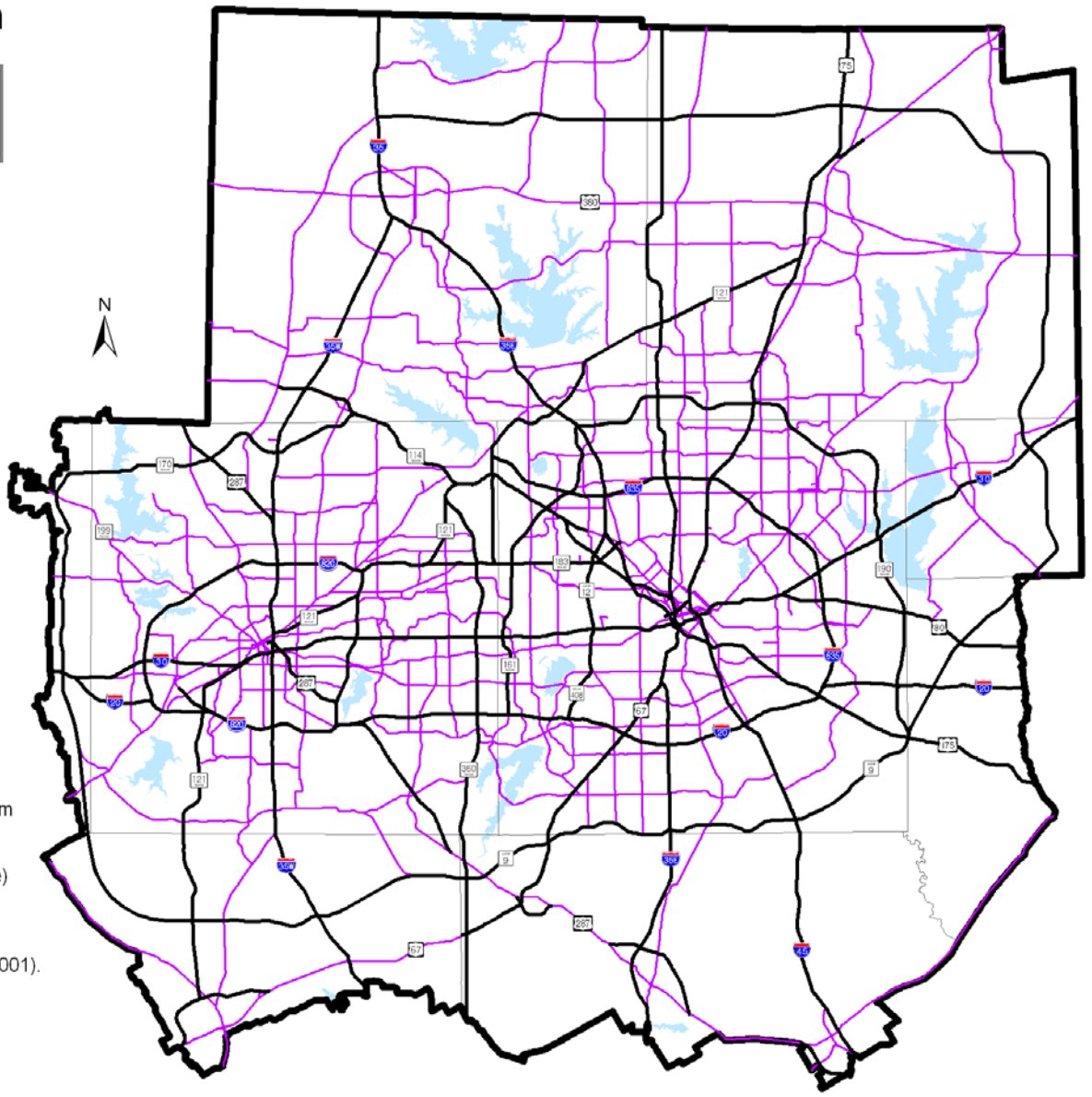
300 Miles of Rail

46 Million SQFT of Class A Office Space



# Mobility 2030 The Metropolitan Transportation Plan

## Regionally Significant Arterials




*Regionally Significant Arterials are derived from the following sources:

1) The National Highway System and National Highway System Intermodal Connectors (1995);

2) The Federal Functional Classification System (1997 Update) in addition to the locally approved (2005 Update); and

3) Regional Arterials as defined and adopted in NCTCOG's Regional Thoroughfare Plan (Amended May 10, 2001).

New facility locations indicate transportation needs and do not represent specific alignments

North Central Texas Council of Governments
Transportation

January 11, 2007

# Mobility 2030 The Metropolitan Transportation Plan

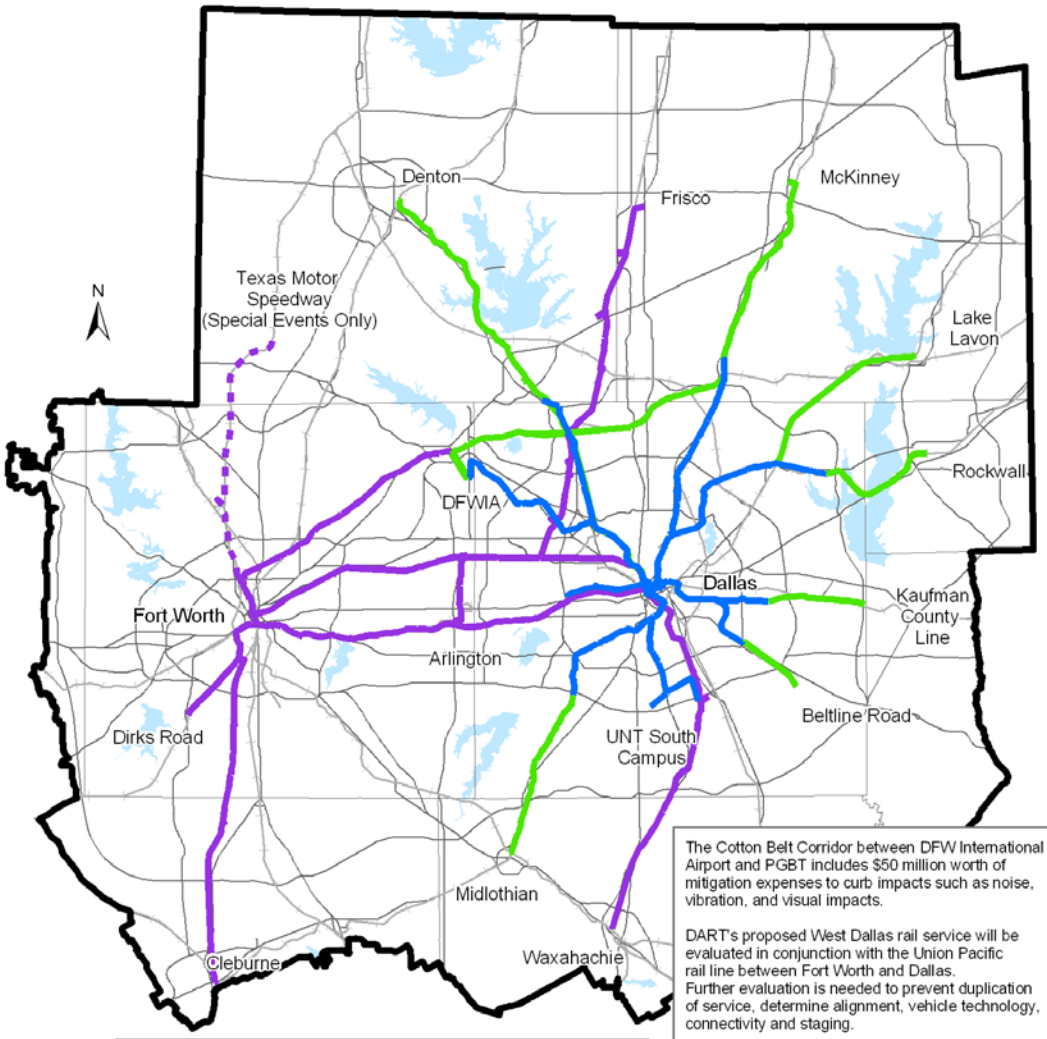
## Passenger Rail Recommendations

### Legend

- Light Rail
- Light Rail - New Technology
- Regional Rail
- Regional Rail - Special Events Only
- Existing Rail Corridors
- Highways

Fort Worth CBD

Dallas CBD




Corridor specific design and operation characteristics for the Intercity Passenger, Regional Passenger and Freight Rail Systems will be determined through capacity evaluation and ongoing project development. Refined rail forecasts are necessary to determine technology and alignment in Future Rail corridors.

All existing railroad rights-of-way should be monitored for potential future transportation corridors. New facility locations represent transportation needs and do not reflect specific alignments.

Institutional structure being reviewed for the region.

The need for additional rail capacity in the Dallas CBD, Fort Worth CBD, DFW International Airport, and other inter-modal centers will be monitored. A grade separation is needed for the Dallas CBD second alignment.

**397 Additional Rail Miles**
**$9.6 Billion**

The Cotton Belt Corridor between DFW International Airport and PGBT includes $50 million worth of mitigation expenses to curb impacts such as noise, vibration, and visual impacts.

DART's proposed West Dallas rail service will be evaluated in conjunction with the Union Pacific rail line between Fort Worth and Dallas. Further evaluation is needed to prevent duplication of service, determine alignment, vehicle technology, connectivity and staging.

DART's proposed SouthPort rail line extension will be evaluated in conjunction with the Dallas to Waxahachie rail service. Further evaluation is needed to prevent duplication of service, determine alignment, vehicle technology, connectivity and staging.

North Central Texas Council of Governments
Transportation

January 11, 2007

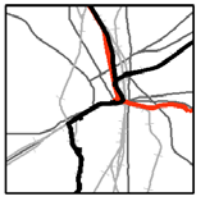
# Mobility 2030 The Metropolitan Transportation Plan

## Rail Recommendations Dependent on Regional Transit Initiative Funds

**Legend**

- Existing Service, Programmed Projects and Projects Under Development
- Projects Pending Alternative Funding
- Existing Rail Corridors
- Highways

Fort Worth CBD



Dallas CBD

Corridor specific design and operation characteristics for the Intercity Passenger, Regional Passenger and Freight Rail Systems will be determined through capacity evaluation and ongoing project development. Refined rail forecasts are necessary to determine technology and alignment in Future Rail corridors.

All existing railroad rights-of-way should be monitored for potential future transportation corridors. New facility locations represent transportation needs and do not reflect specific alignments.

Institutional structure being reviewed for the region.

The need for additional rail capacity in the Dallas CBD, Fort Worth CBD, DFW International Airport, and other inter-modal centers will be monitored. A grade separation is needed for the Dallas CBD second alignment.


**239 Rail Miles in Jeopardy**

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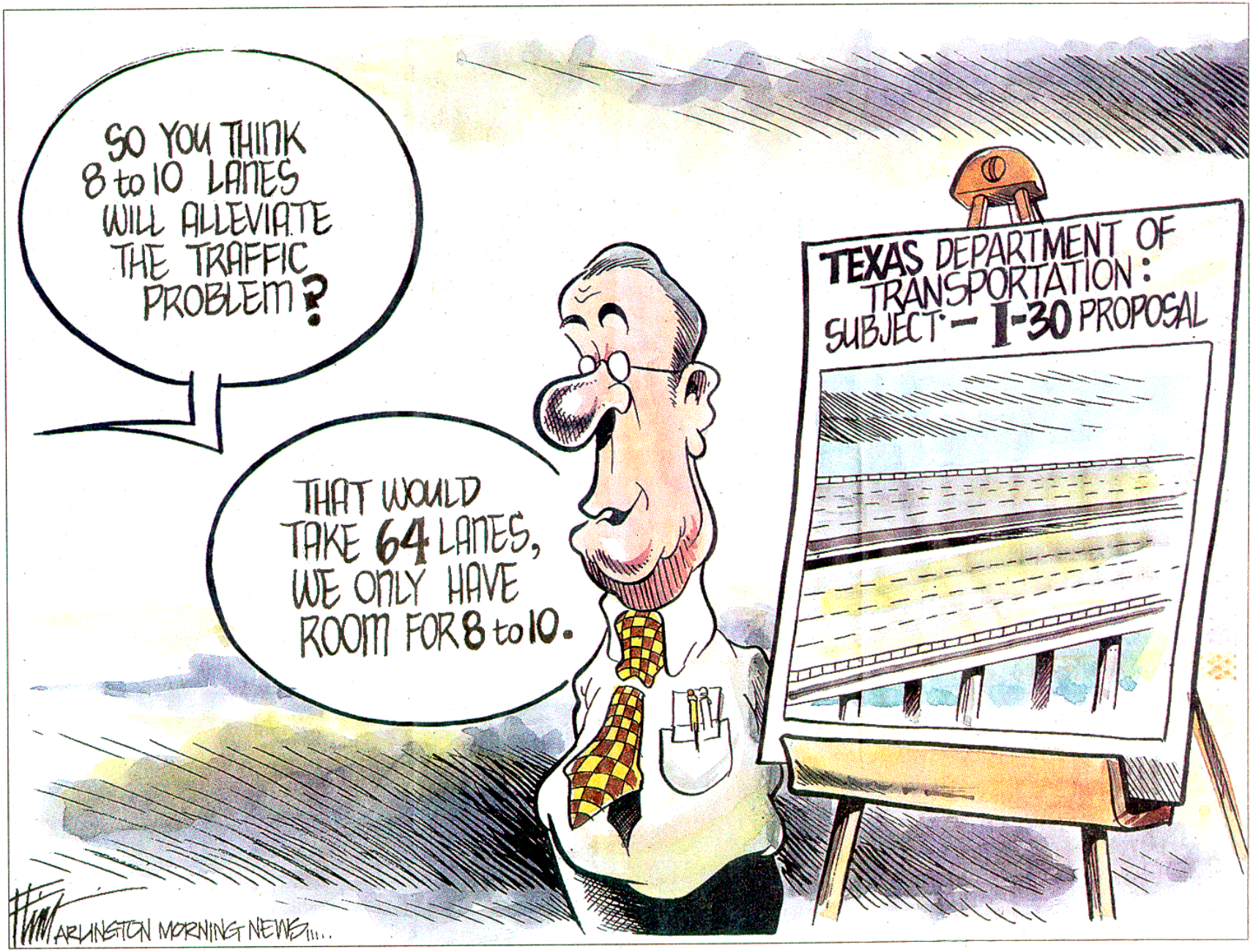
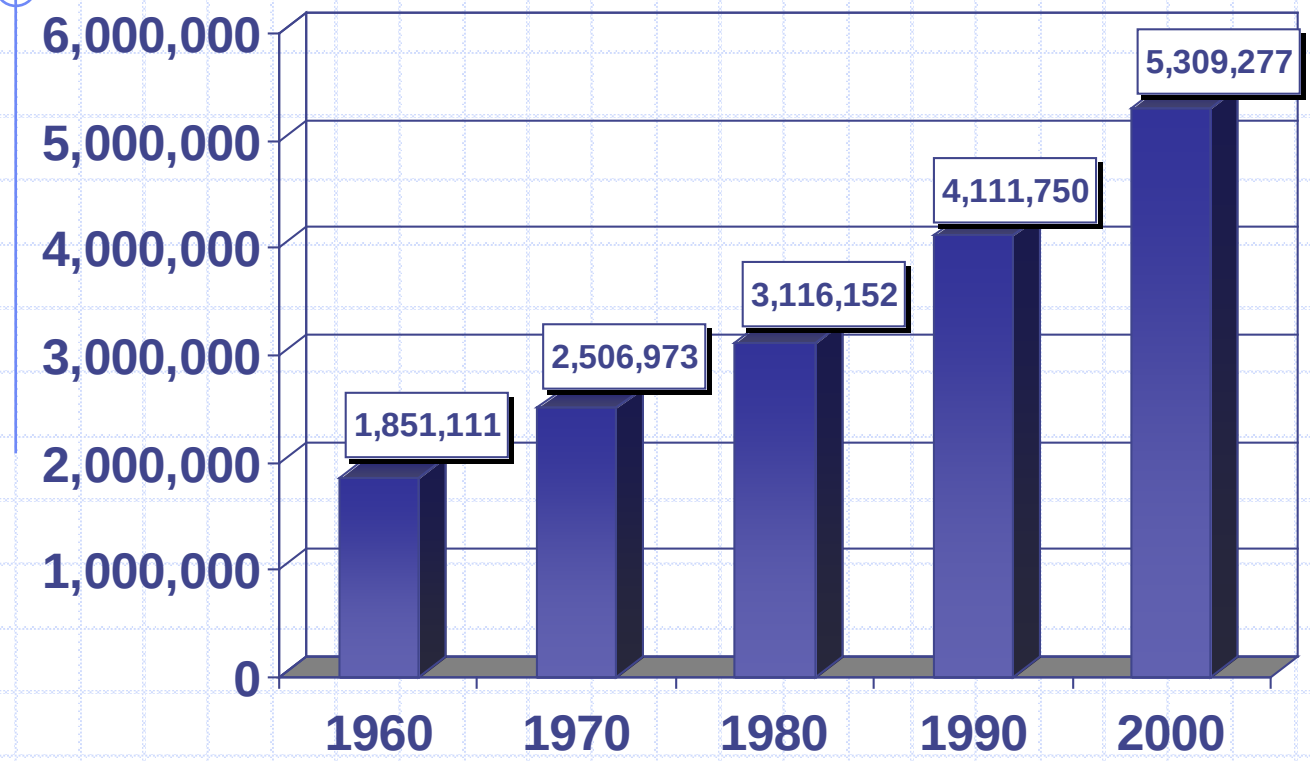
January 11, 2007


SO YOU THINK 8 to 10 LANES WILL ALLEVIATE THE TRAFFIC PROBLEM?
THAT WOULD TAKE 64 LANES, WE ONLY HAVE ROOM FOR 8 to 10.
TEXAS DEPARTMENT OF TRANSPORTATION: SUBJECT - I-30 PROPOSAL
ARLINGTON MORNING NEWS

# REGIONAL POPULATION 1960-2000



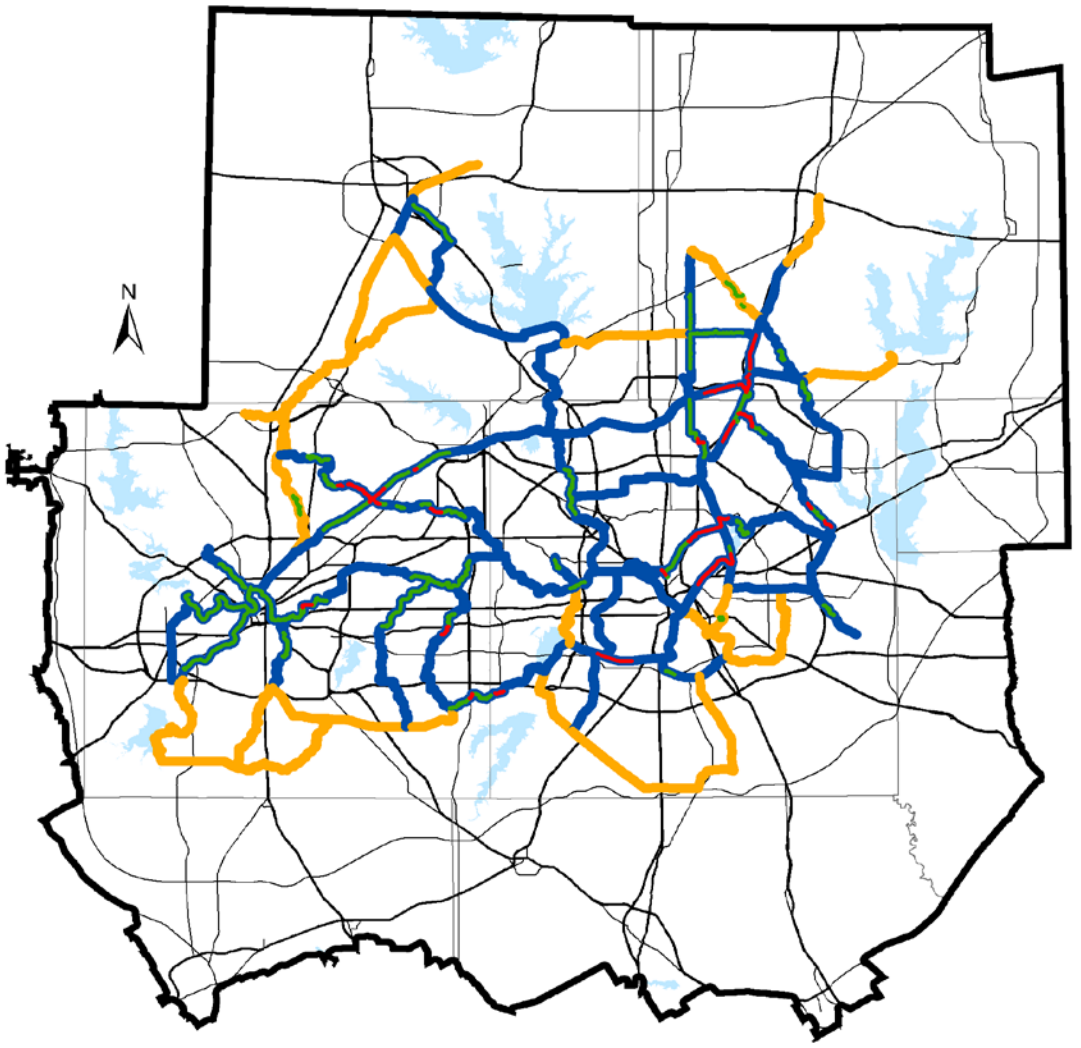

***Absolute Change:***
**3,458,166**

***Percent Change:***
***186.82%***

***Average Decennial Growth:***
***864,542***
**(2½ Arlingtons!)**

Mobility 2030 The Metropolitan Transportation Plan

# Bicycle and Pedestrian Facilities




**Legend**

**Recommended Veloweb Routes**

- Completed: 112 miles
- Funded: 34 miles
- Needed: 289 miles

**Candidate Veloweb Routes**

- Completed: 7 miles
- Needed: 202 miles
- Freeways
- County Boundaries
- Metropolitan Planning Area Boundary
- Major Lakes

New facility locations indicate transportation needs and do not represent specific alignments.

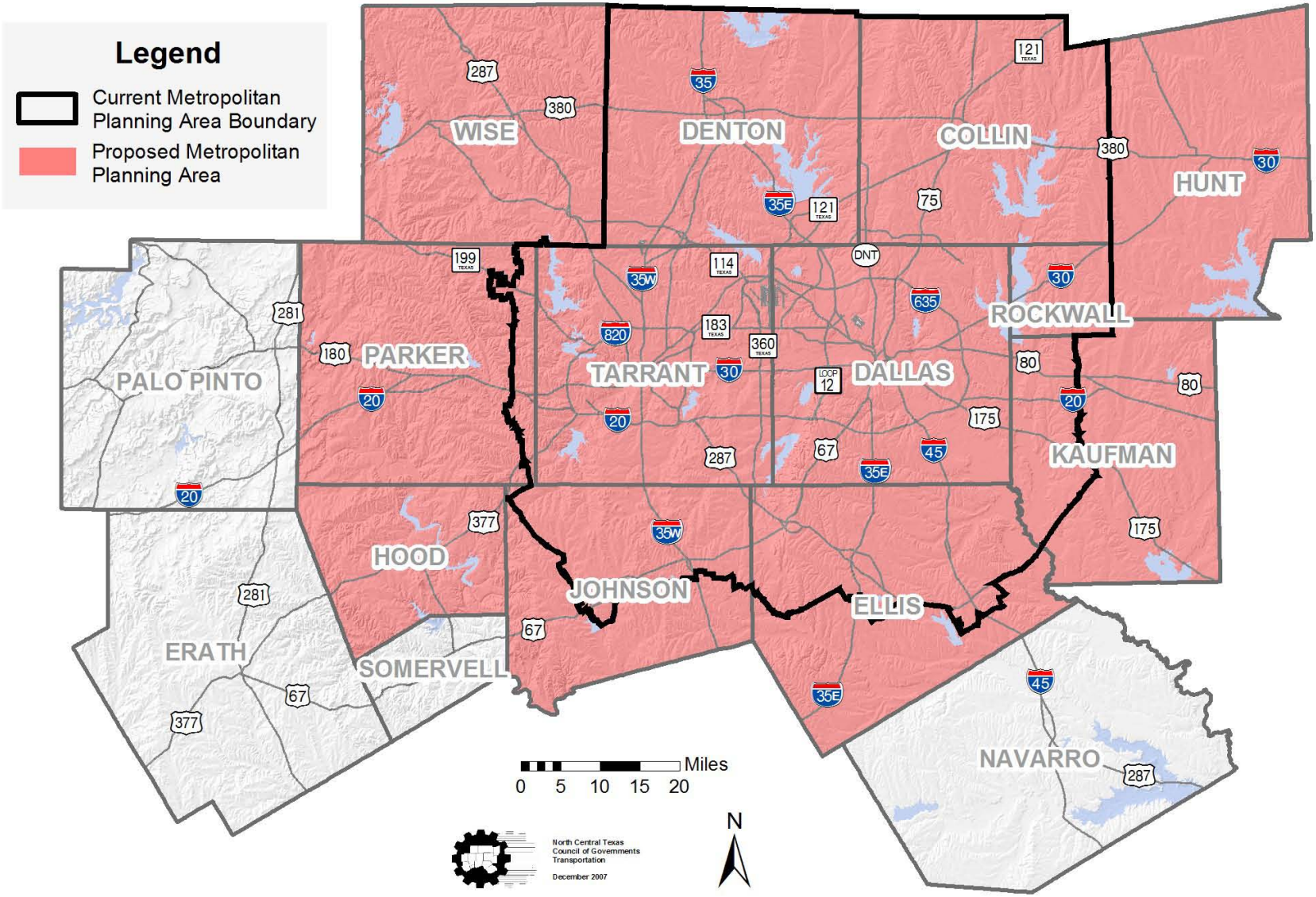
All existing railroad rights-of-way should be monitored for potential future transportation corridors.

All Veloweb routes should be targeted for right-of-way preservation.

North Central Texas Council of Governments Transportation

October 30, 2007

# Proposed 12-County Metropolitan Planning Area



# MOBILITY 2030
# Prioritization of Improvements

**Maintenance and Operation of Existing Facilities**

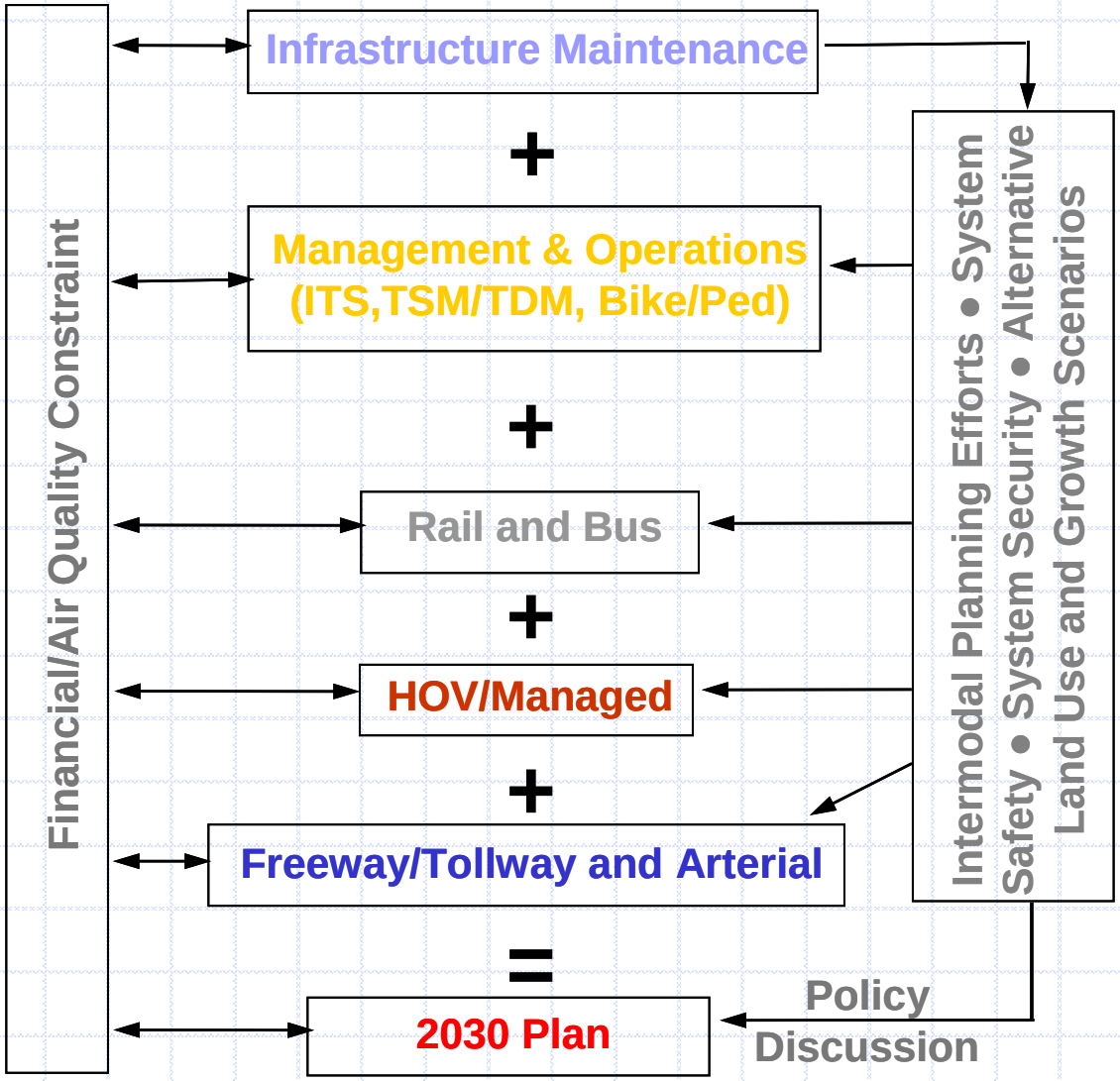
**Improve Efficiency of Existing Facilities**
- Trans. System Management
- Intelligent Trans. Systems

**Remove Trips From System**
- Carpool/Vanpool Program
- Pedestrian/Bicycle Facilities

**Induce Switch to Transit**
- Bus/Commuter Rail/Light Rail

**Increase Auto Occupancy**
- HOV System

**Additional Single Occupant Vehicle Capacity**
- Freeway/Tollway
- Regional Arterial



# Mobility 2030 The Metropolitan Transportation Plan

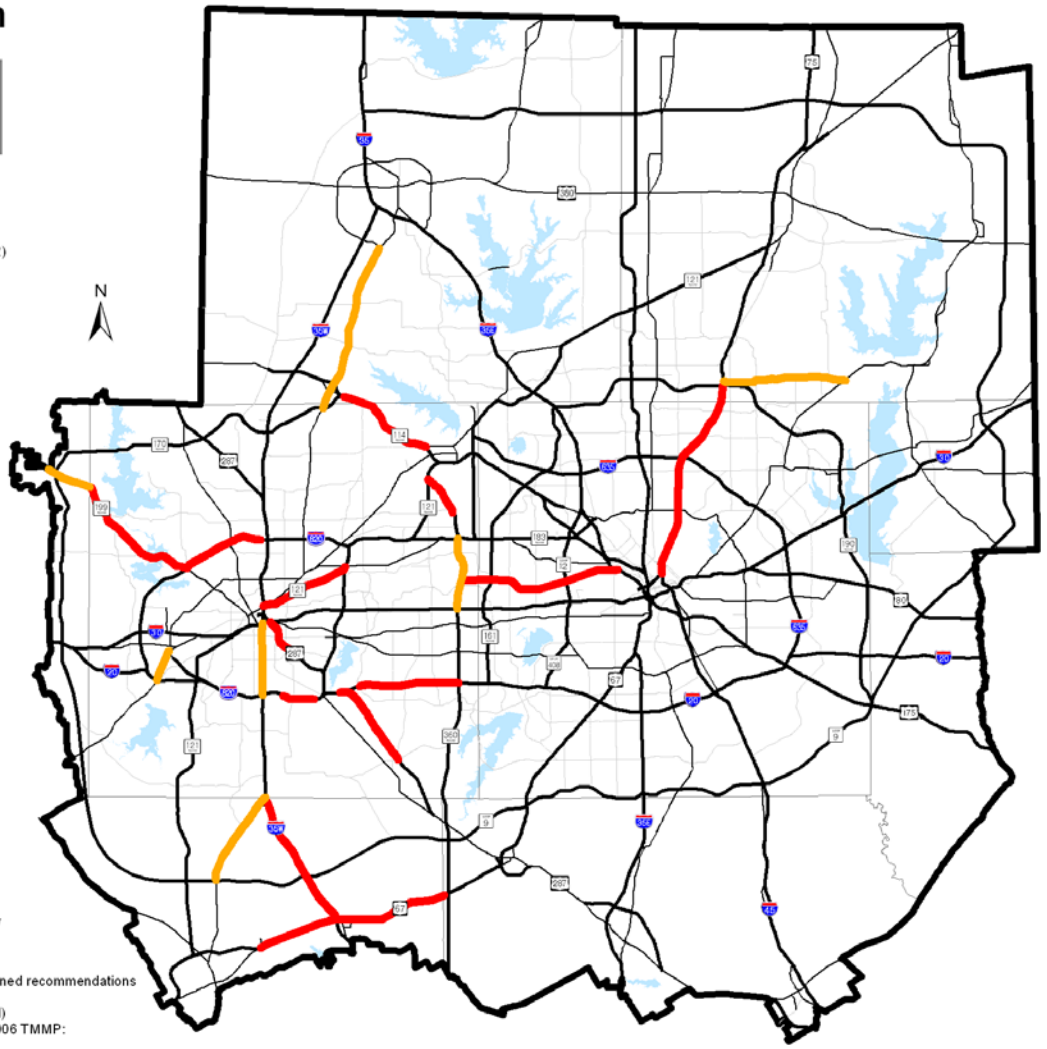
## Additional Roadway System Needs (1)

### Legend

- Unfunded Projects: Previously funded in Mobility 2025, 2005 Amendment (2)
- Other Unfunded Corridor Needs (3)
- Freeways/Tollways

Fort Worth CBD

Dallas CBD




Corridor specific design and operational characteristics for the Freeway/Tollway system will be determined through ongoing project development.

Additional and improved Freeway/Tollway interchanges and service roads should be considered on all Freeway/Tollway facilities in order to accommodate a balance between mobility and access needs.

All Freeway/Tollway corridors require additional study for capacity, geometric, and safety improvements related to truck operations.

New facility locations indicate transportation needs and do not represent specific alignments

Operational strategies to manage the flow of traffic should be considered in the corridors where additional freeway or tollway lanes are being considered.

(1) Represents additional needs above and beyond those of the financially-constrained recommendations
(2) Projects that are funded in Mobility 2025, 2005 Amendment, however, due to financial constraint issues, will be deferred until after 2030 ($2.2 Billion deferred)
(3) General Transportation Corridors requiring additional capacity as identified in 2006 TMMP: Needs do not represent specific alignments or modes

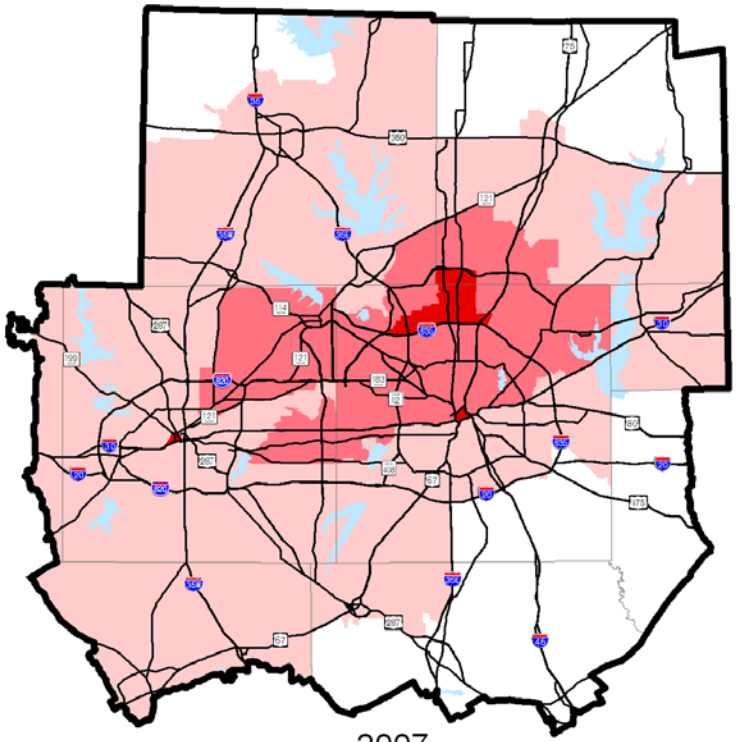
North Central Texas Council of Governments
Transportation

January 11, 2007

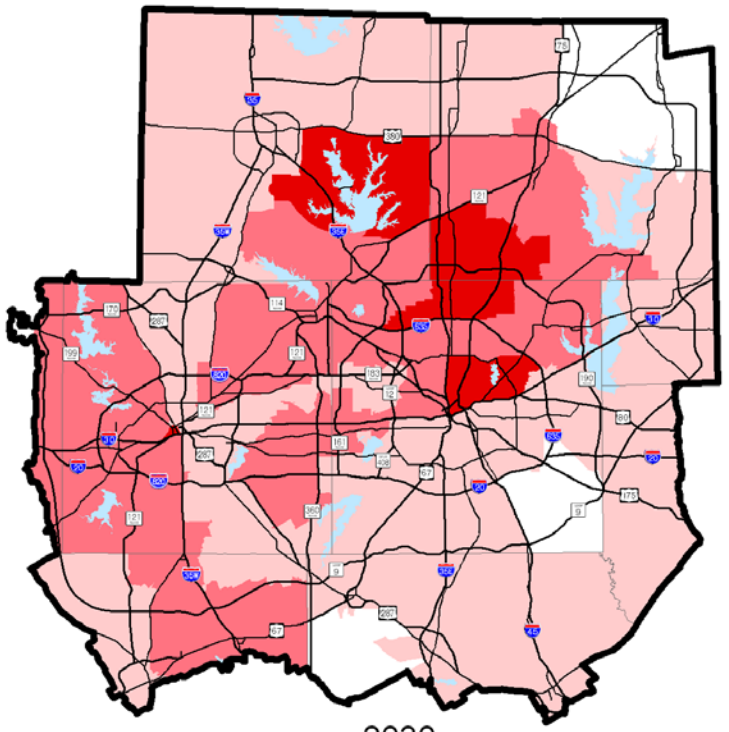
Mobility 2030 The Metropolitan Transportation Plan

**System Performance**
**Levels of Congestion**

- Areas with No Congestion
- Areas with Light Congestion
- Areas with Moderate Congestion
- Areas with Severe Congestion
- Roadways



2007
Annual Cost of Congestion $4.2 Billion



2030
Annual Cost of Congestion $6.6 Billion

North Central Texas Council of Governments
Transportation

N

**Benefit/Cost Ratio of Plan: 1.51**

January 11, 2007

Mobility 2030

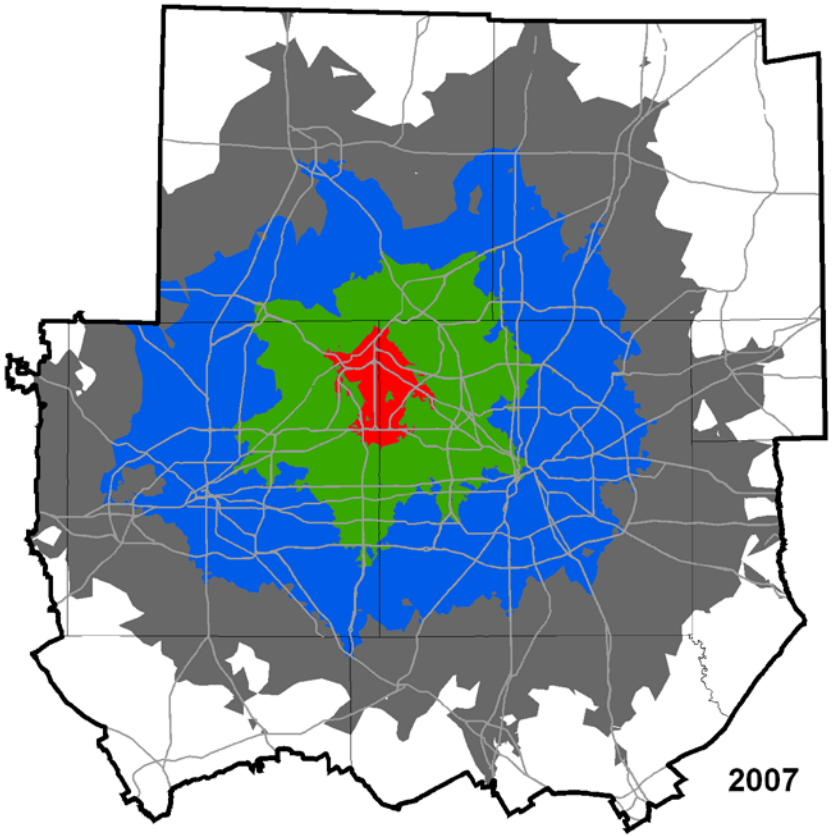
The Metropolitan Transportation Plan

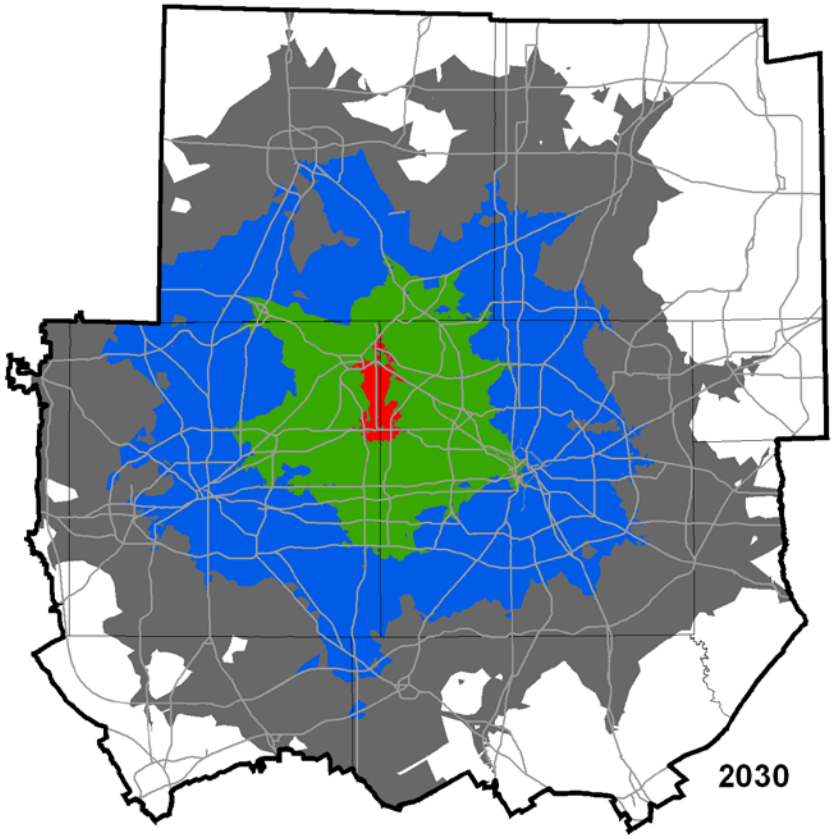
## Travel Time Contours: DFW Airport

Contours Based on Modeled Average Peak Period Speeds in 2007 and in 2030

**Travel Times to Airport**

- Up to 15 minutes
- Up to 30 minutes
- Up to 45 minutes
- Up to 60 minutes




N

North Central Texas Council of Governments Transportation

January 11, 2007

# Mobility 2030 The Metropolitan Transportation Plan

## Intelligent Transportation Systems

**Legend**

- Mobility Assistant Patrols
- Communication Systems
- Advanced Traffic Management
- TxDOT Transportation Management Center (TMC)
- City Transportation Management Center
- Transit Management Center
- Freeways / Tollways
- Highways
- Regional Arterials

Fort Worth CBD

Dallas CBD


North Central Texas Council of Governments
Transportation

January 11, 2007

Mobility 2030 The Metropolitan Transportation Plan

# Park-and-Ride Locations Existing, Planned and Candidate

**Legend**

- Existing Park-and-Ride Locations
- Planned Park-and-Ride Locations
- Candidate Park-and-Ride Locations
- Freeways / Tollways
- Highways
- Regional Arterials

Fort Worth CBD

Dallas CBD


North Central Texas Council of Governments Transportation

January 11, 2007