County-Level Travel Demand Modeling Using TransCAD

for the

2002 Conference on Transportation Planning for Small and Medium-sized Communities

by

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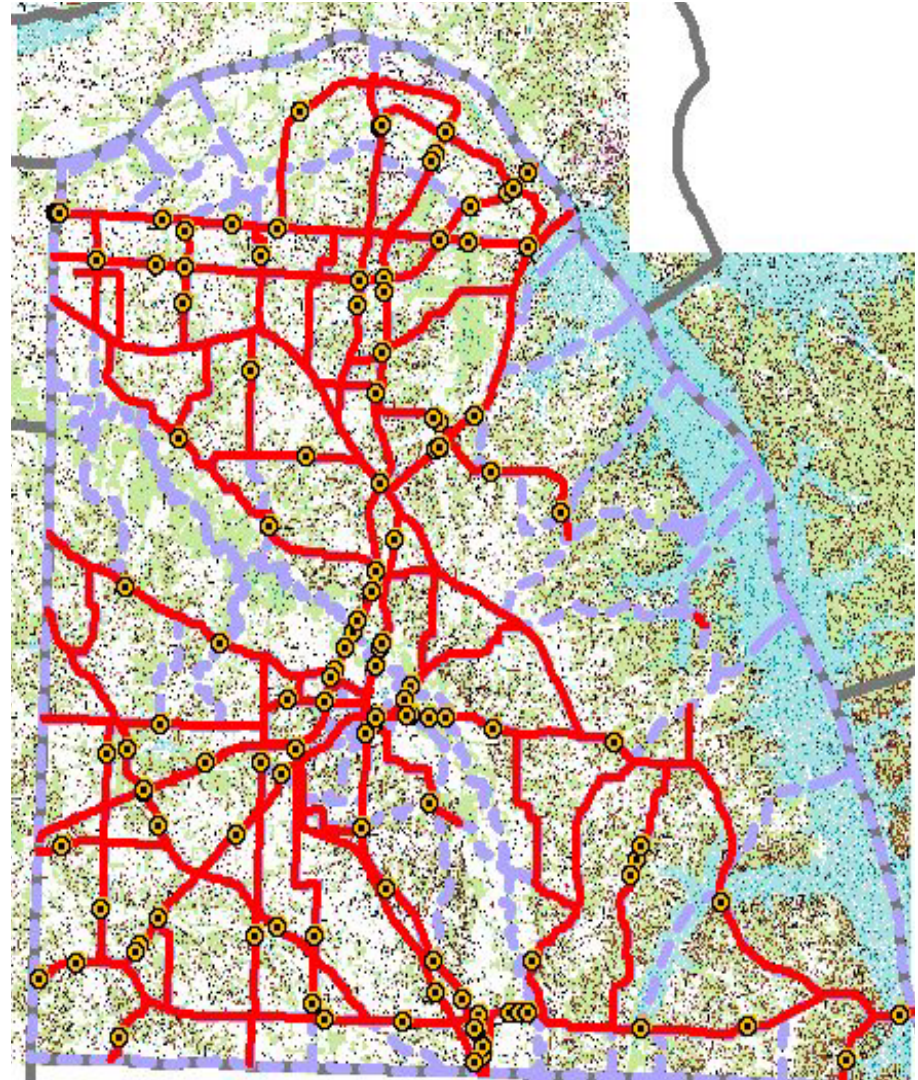
Division of Multimodal Programs

KENTUCKY TRANSPORTATION CABINET
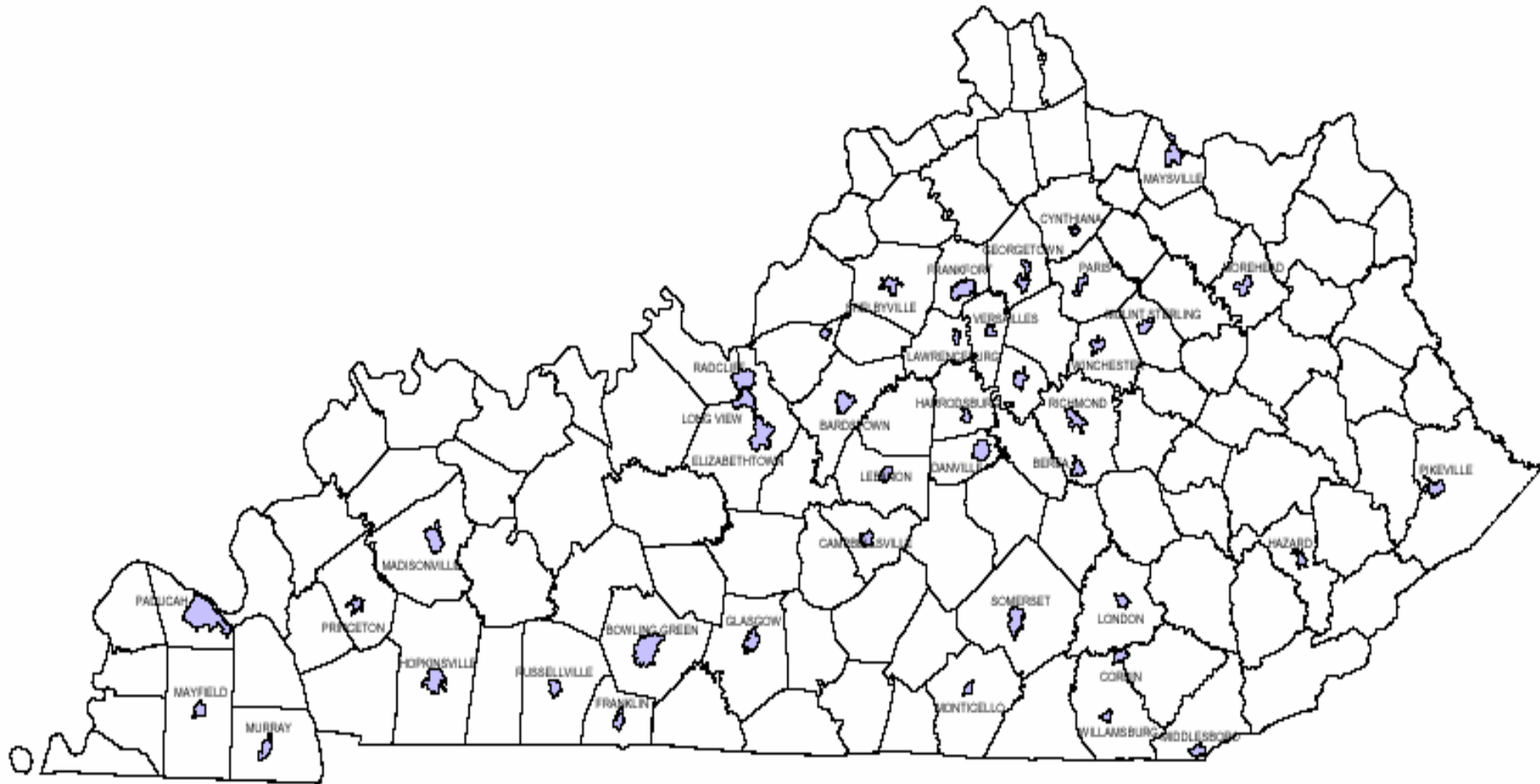
Presentation Overview

- Background
  - KYTC Modeling
  - Air Quality Issues
- County-level Modeling
  - Model Development
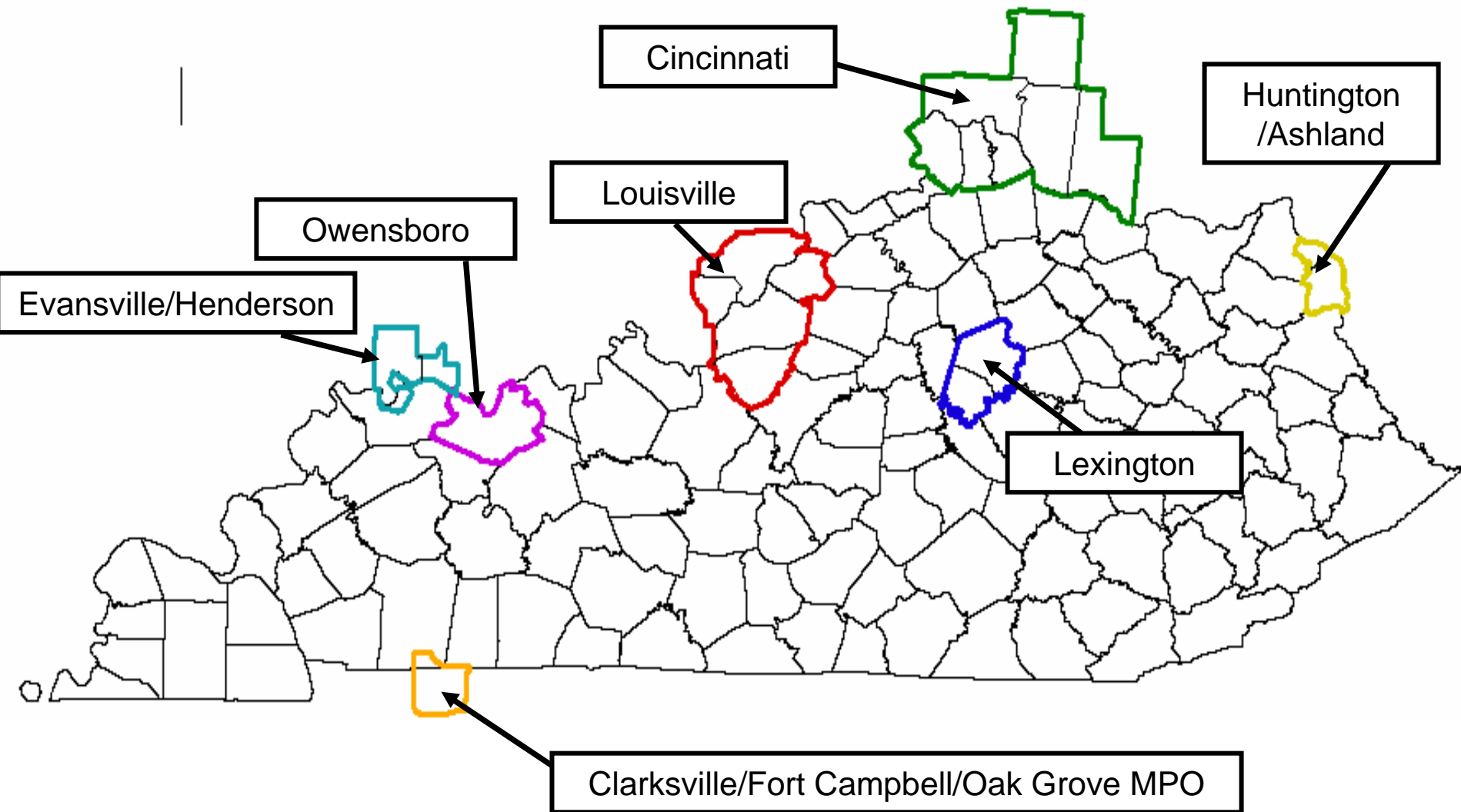 - Use of Model
  - Issues
- Conclusion

KYTC Travel Demand Modeling Types

- Small Urban Area - 37 Areas/Cities in KY

- Air Quality County-level
  - 3 completed
  - Future counties based on new monitoring data

- MPO - 8 w/ models, 4 do their own modeling
  + 2 by consultant

- Special -
  - Sub-area models for special projects
  - Greater detail than full scale model
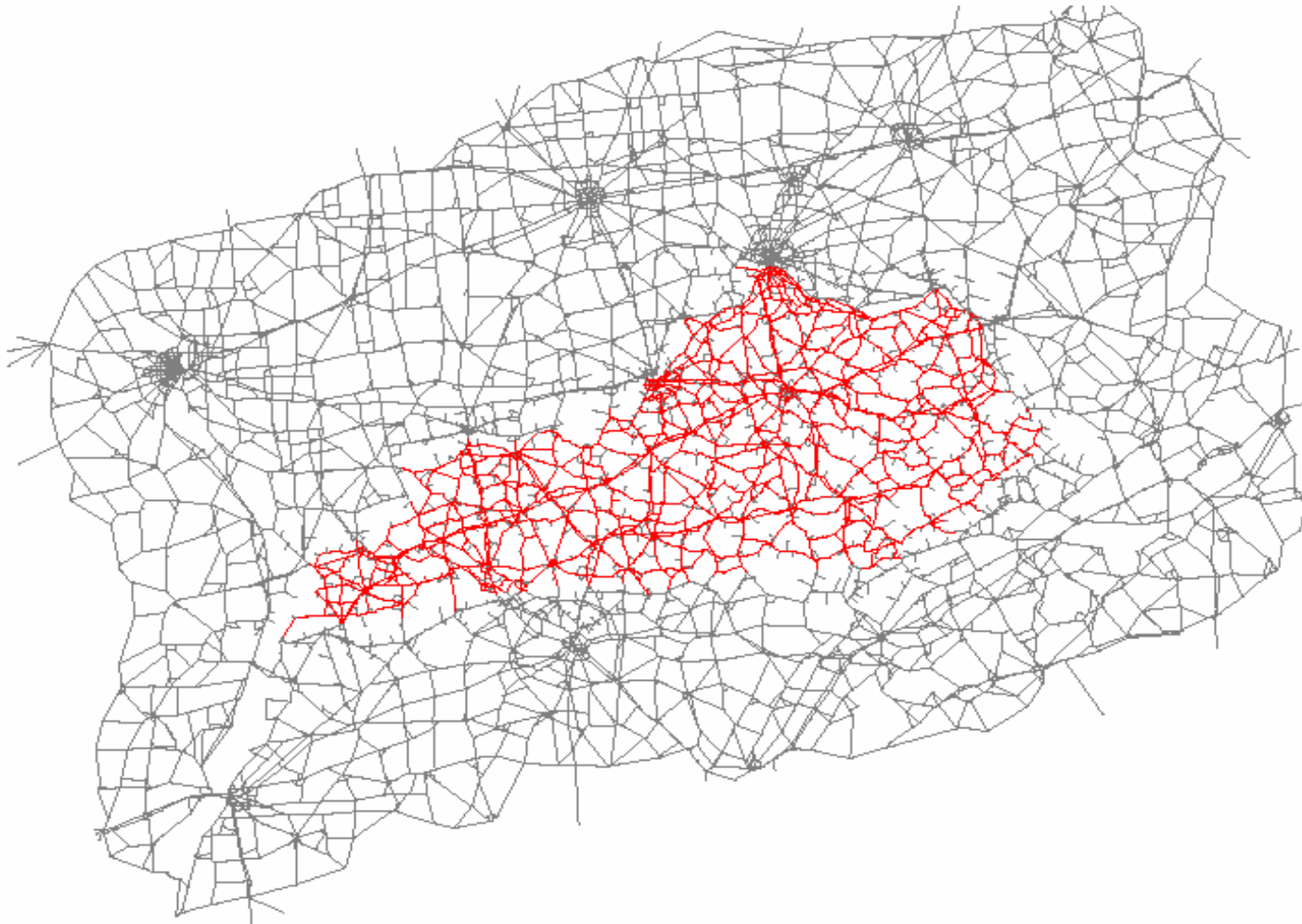
- Statewide - since 1975

Travel Demand Models: Small Urban
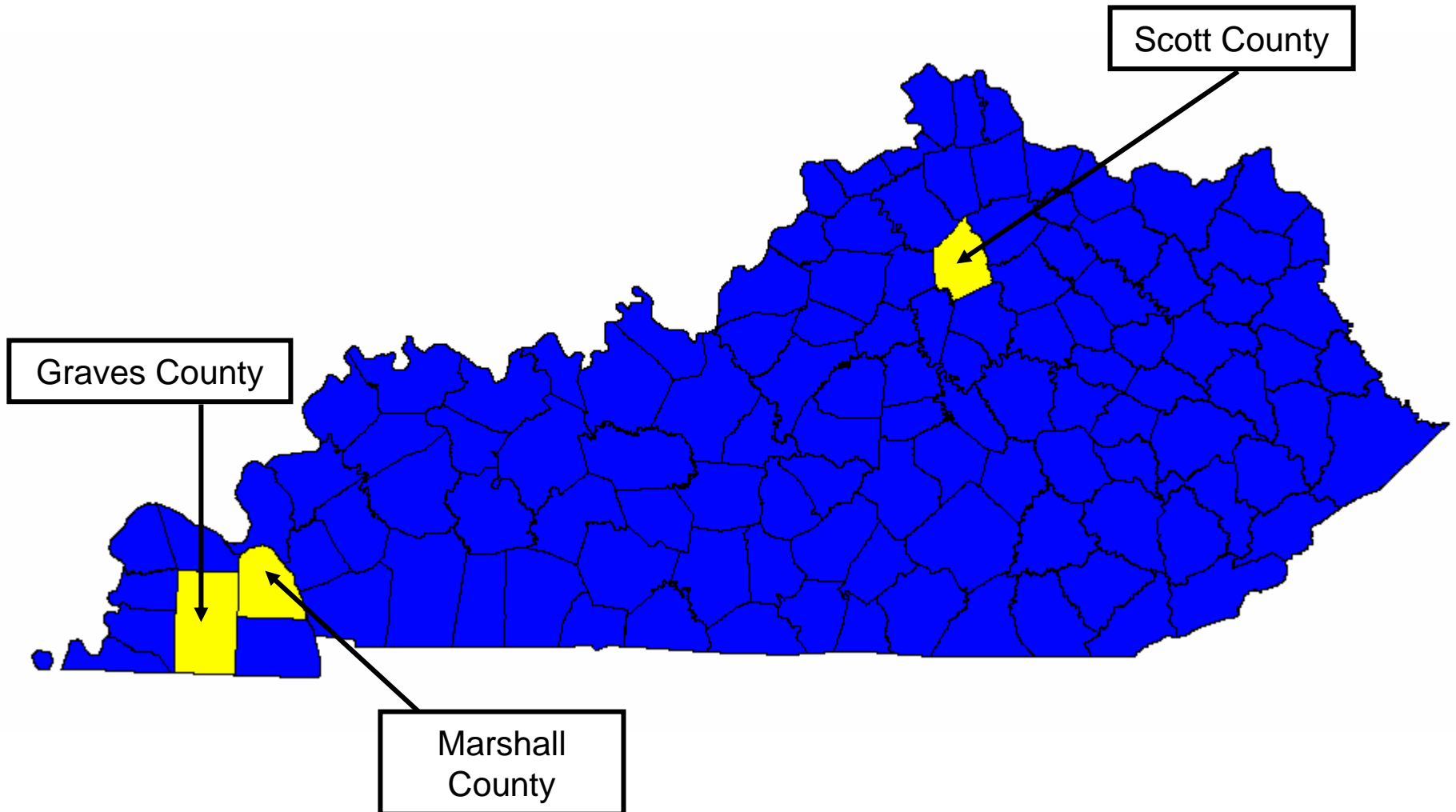
Travel Demand Models: MPO

Cincinnati

Huntington/Ashland

Louisville

Owensboro

Evansville/Henderson

Lexington

Clarksville/Fort Campbell/Oak Grove MPO

Travel Demand Models: Statewide

# Travel Demand Models: County-level

KYTC Travel Demand Model Usage

- Forecasting - especially new facilities

- Air Quality - VMT, speed forecasting, Mobile 5.0b/6.0 inputs

- Transportation Plans - used for MPO and small urban area needs analysis

- Corridor studies - I-66, I-69, Cincinnati-Dayton, and other major routes

- Special - CVM (Commercial Vehicle Monitoring) station optimization, User Cost Analysis, Detour Analysis

Statewide I-66 Study

Other Travel Model Related Activities

- Travel Model Contract
- NHTS Add-on Surveys
- New Software
- Model Users Group
- TAZ-UP / CTPP
- Research
- GIS Output for Public Meetings
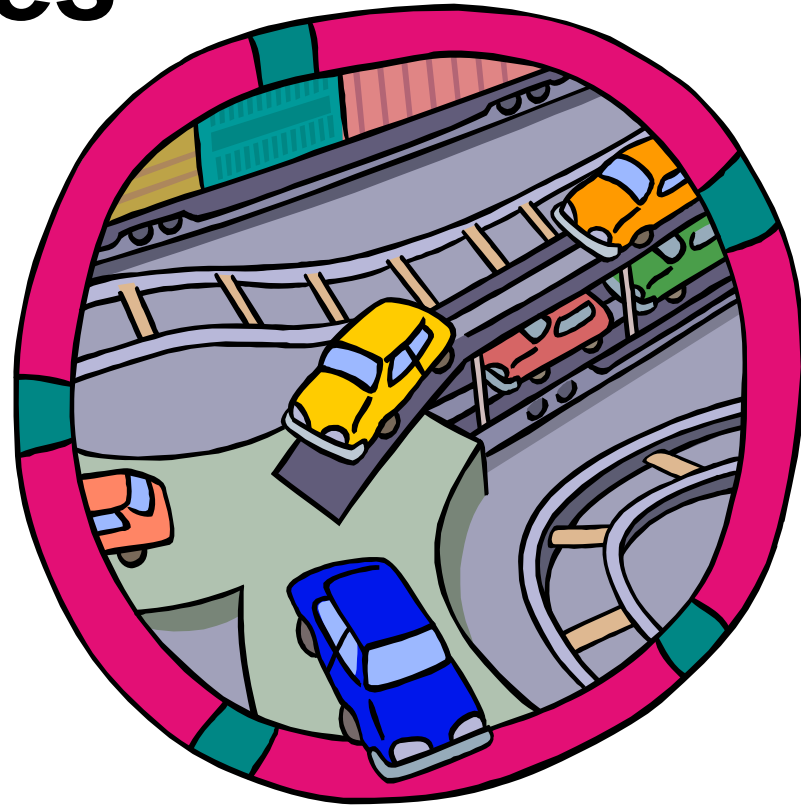
Kentucky Travel Demand Model Users Group

- Seven years, meet 3 times/yr., annual workshop

- Next meeting- October 25, 2002
  - Modeling case studies

- Web: http://www.kytc.state.ky.us/Multimodal/KyTraffic_MUG.htm

- Topics: software, freight, air quality, traffic simulation, forecasting, TRANSIMS, projects, data

- Participants: State, local, consultants, MPO, academic, FHWA
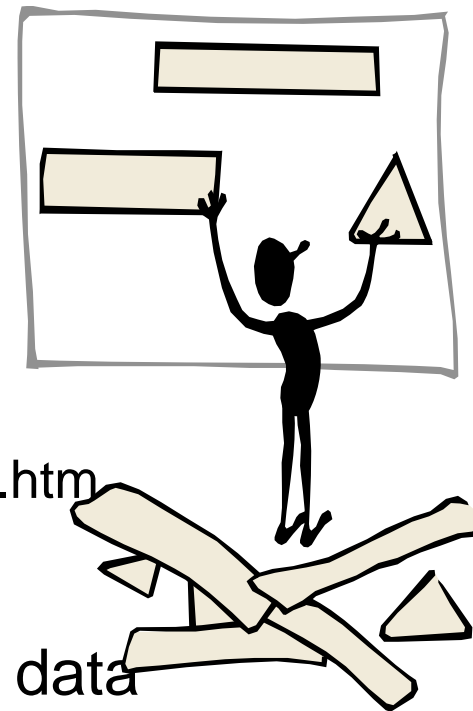
Overview of Air Quality Issues

- Potential nonattainment areas for ozone,carbon monoxide, & PM

- State Implementation Plan (SIP)
  - Emission Budgets (thresholds)
    - Mobile 6.0
      - Emission factor calculations (g/mi) use driving cycles (speed)
      - VMT provided from various sources
        » TDM models, post processors, & HPMS
    - Data needs : VMT & speed
  - Conformity - need to assess impact of transportation plan upon future VMT, use model to calculate emissions and compare to emission budgets in the SIP
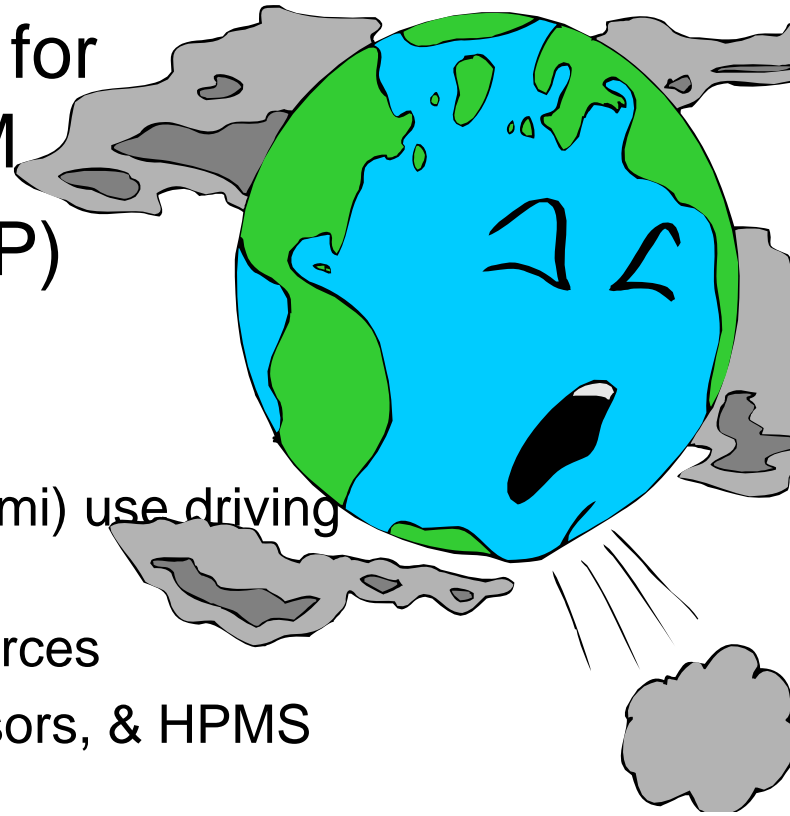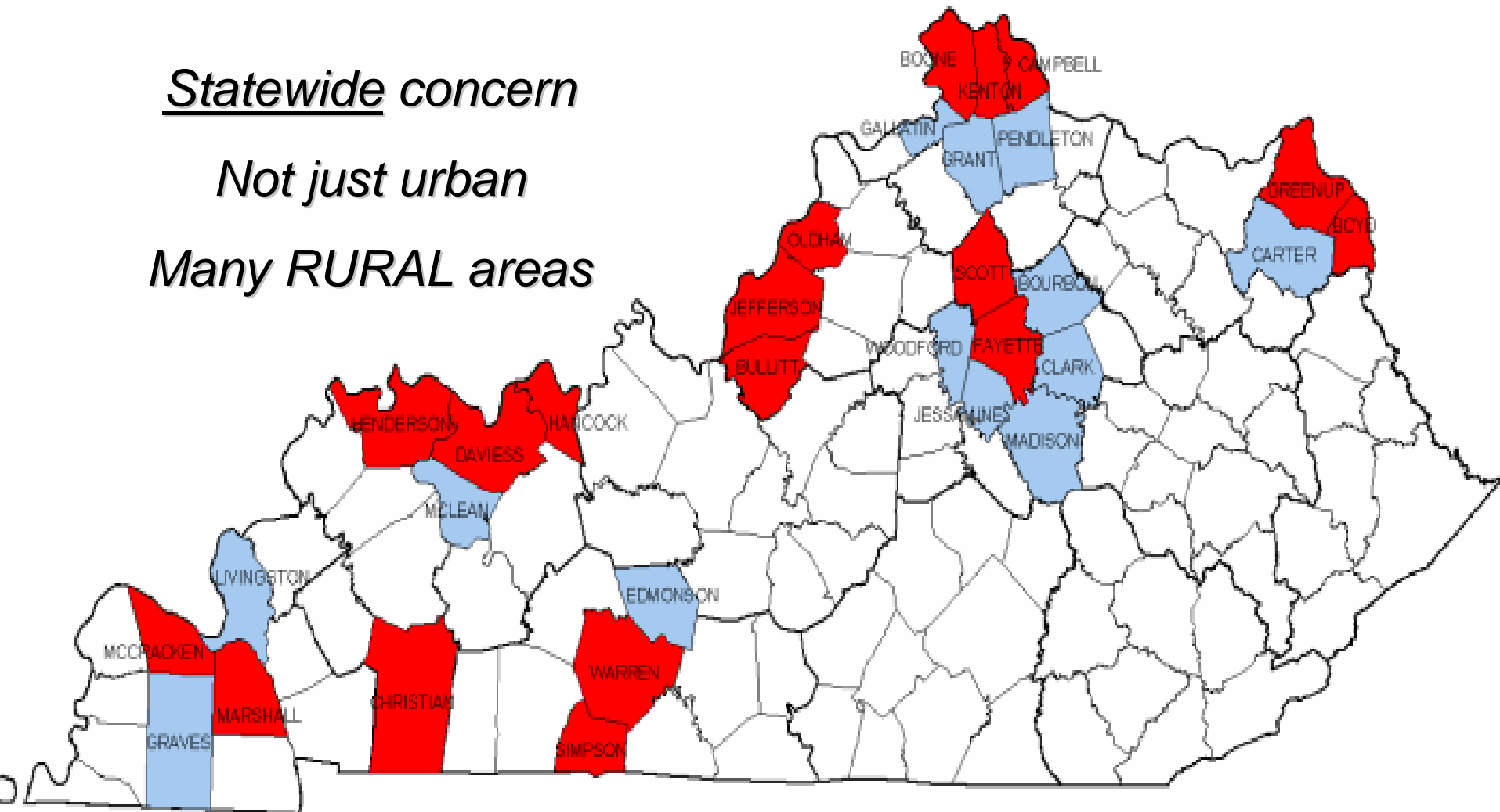
Potential Ozone Nonattainment Areas (8-hour period as of July 2000)

Statewide concern

Not just urban

Many RURAL areas

Kentucky Response

- VMT
  - County-level models for plan changes
  - Local data not available through HPMS for setting SIP emission budgets or conformity
  - Research on local VMT data

- Speed estimation
  - Need for setting SIP emission budgets and conformity determination

- Ramp - New *Facility* type
  - Need for setting emission budgets and conformity determination
  - Developed draft in-house ramp VMT %

VMT Research

- KTC Research Study
  - New **local road traffic volume sample**
  - Develop a process for estimating local road VMT
  - Future estimation at county-level failed
- Developed a means for forecasting future VMT in-house
  - Interstate & non-interstate breakdown
  - Based on trends in VMT per capita growth and projected population increase.

Speed Estimation

- Speeds needed for Mobile 6.0 emission factors
  - Need freeway and arterial for each county
    - Data not available
    - HPMS Analytical Package discontinued

- Development of speed estimation methodology
  - Speed Estimation Seminar - use HERS
  - Suggested NCHRP research study
  - Model post-processing

County-level Modeling

- Data Needs & Sources

- Model Development Highlights

- Uses to Date

- Issues
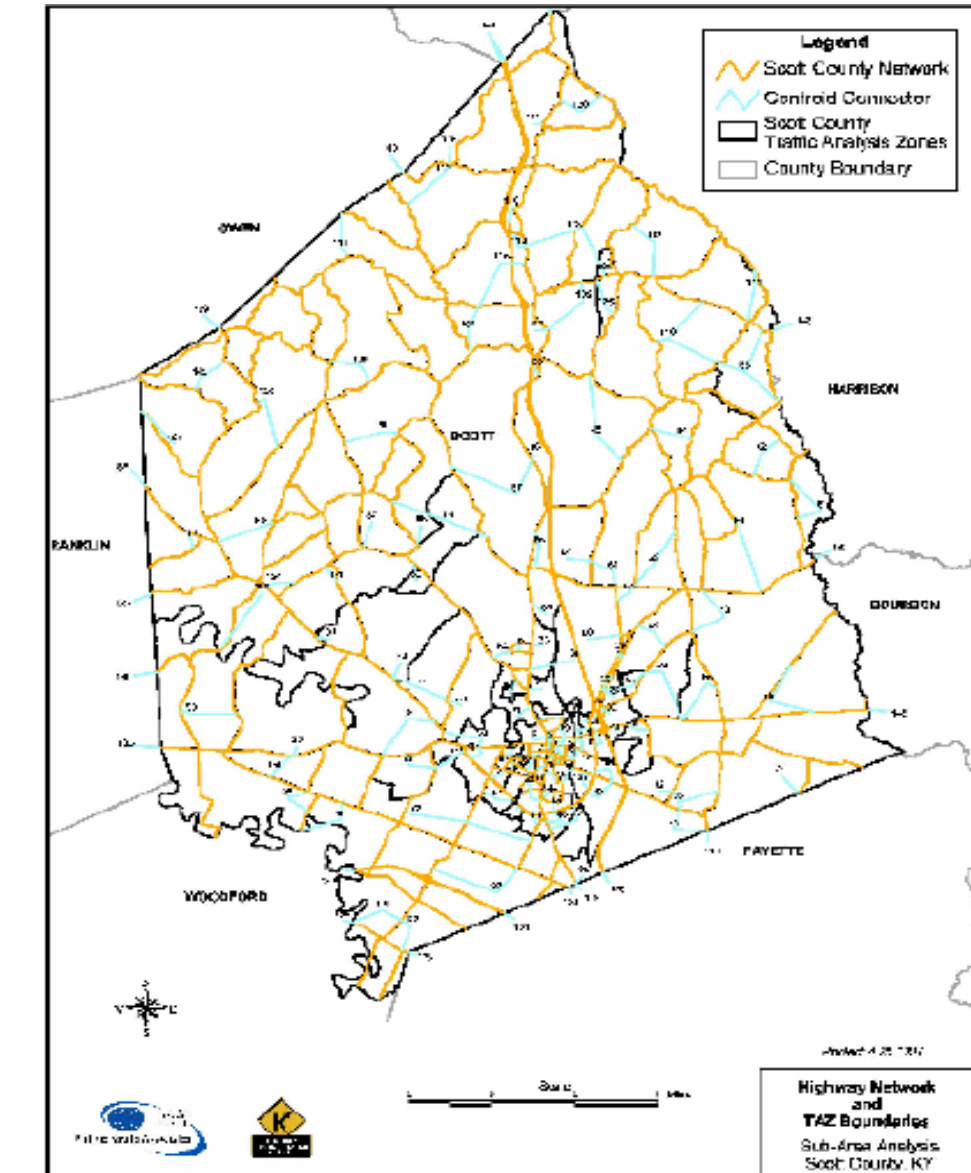
Data Needs and Sources

- Network
  - Kentucky's Highway Information System
  - Kentucky's Base GIS
  - Urban models
- Population data
  - Kentucky State Data Center (KSDC)
  - US Census Bureau
  - Area Development Districts (ADDs)

Data Needs and Sources

- Employment Data
  - Department of Employment Services (ES-202 data)
  - Area Development Districts (ADDs)
  - Harris Industrial Directory
- Travel data and model parameters
  - Statewide Model for external stations
  - NCHRP 365
  - NCHRP 187 trip rate table

# *Model Development*

- 3-step model
  - Trip generation
  - Trip distribution
  - Trip assignment
- Develop Networks
  - & Zone System
- Develop Socioeconomic Data
- Develop Model Trip Tables
- Perform Base Model Calibration
- Perform Future Model Network Assignments

Develop Network and Zone System

- Used all non-local roads plus some selected locals

- Used GIS coverage from KYTC's base GIS network

- Used KYTC's HIS for network attributes

- Imported into TransCAD

- TAZ structure follows census blocks or block group boundaries

Marshall County TAZs
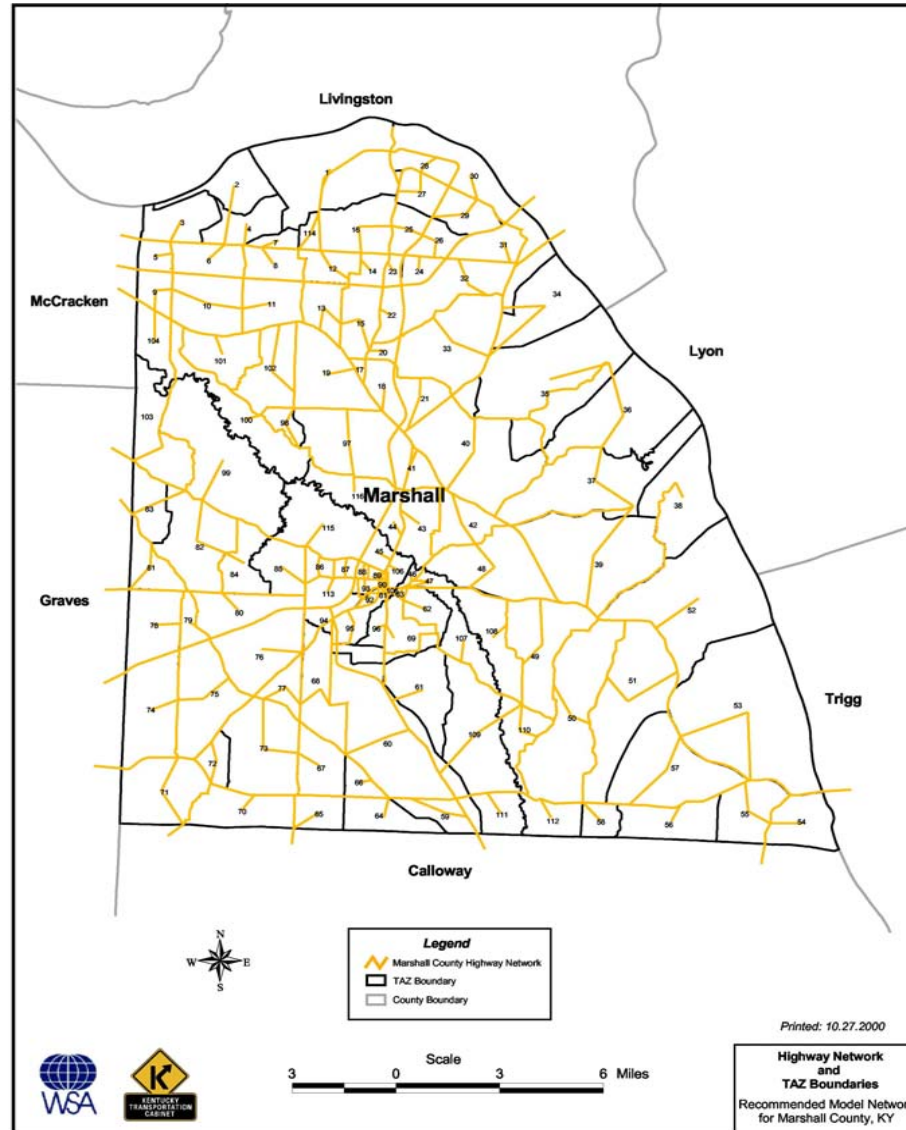
Current Socioeconomic Data

- Population data:
  - 2000 census county total
  - 1990 census block group data
  - If developed now, would use 2000 census data exclusively

- Employment:
  - by commercial, industrial & public employment
  - converted to retail-nonretail

Develop Model Trip Tables

- External to External trips (X-X) taken from KySTM

- External to Internal trips (X-I)
  - X-I = ADT minus X-X
  - NCHRP 365 methodology used to develop Ps& As for HBW, HBO and NHB trip purposes
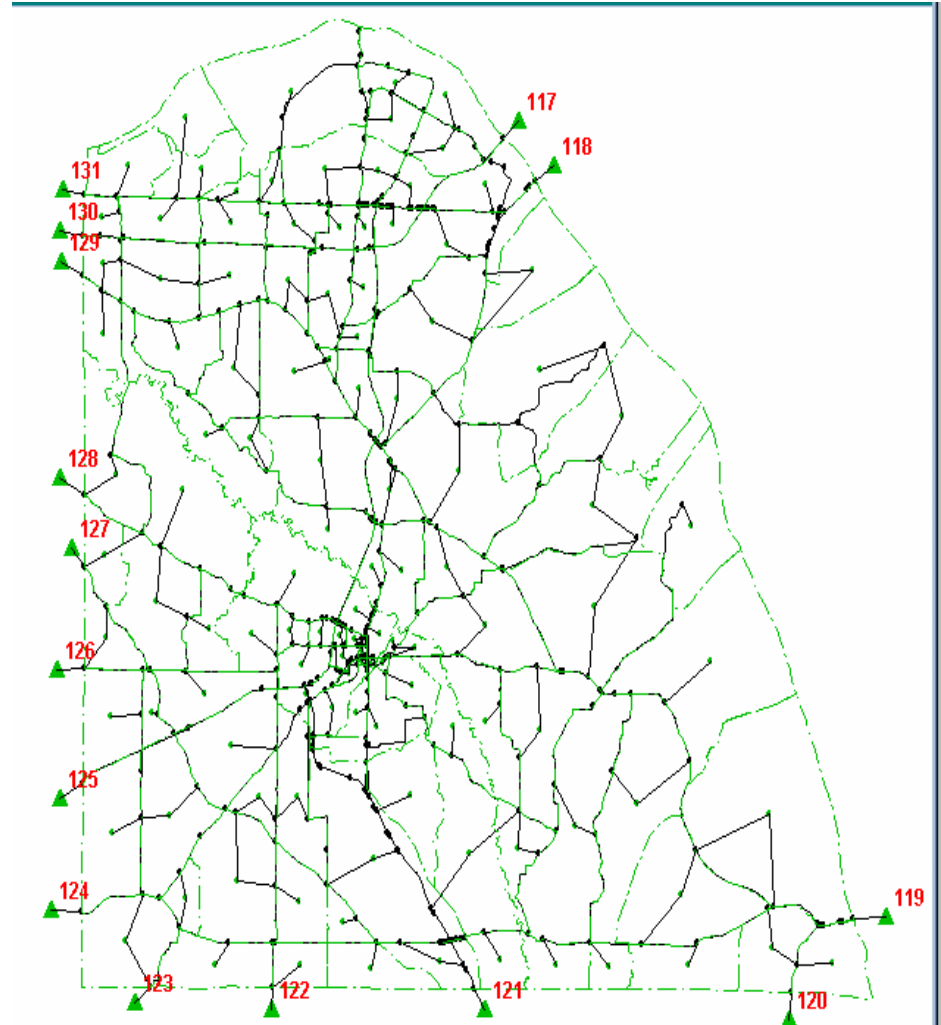
Develop Model Trip Tables

- Trip Generation - used TransCAD's QRM method to develop P/A's for HBW, HBO and NHB trip purposes

- Trip Production - HBW - 16%, HBO, 61% & NHB - 23%

- Trip Attraction
  - QRM uses regression on SE variables (retail emp., non-retail emp. & DUs)
  - Attractions balanced to productions

TransCAD Trip Generation

Develop Model Trip Tables

- Person trips converted to vehicle trips - NCHRP vehicle occupancy rates

- Trip Distribution
  - Gravity model gamma function
  - NCHRP 365 gamma function coefficients

Perform Base Model Calibration & Validation

- Traffic assignment using User Equilibrium
- Comparison of model volumes to ground counts
- Matrix estimation to improve results
- Final model volume & VMT
  - Summarized by FC
  - Compared to HPMS data

Marshall County Calibration by Link

Functional Class Code	Existing Traffic Volume	Initial Model Volume	Calibrated Model Volume	Ratio (Calibrated / Existing)	Total Links	Links w/ Counts
1	264,600	221,966	260,804	0.99	10	10
2	1,075,770	1,458,415	1,142,035	1.06	155	155
6	282,300	275,159	244,809	0.87	54	54
7	548,630	841,512	594,565	1.08	118	118
8	60,805	95,9940	72,863	1.20	55	55
9	52,848	125,424	85,223	1.61	107	75
TOTAL	2,284,953	3,018,470	2,400,299	1.05	688	467

Marshall County Model Calibration by VMT

Functional Class		1999 VMT Estimates		
Code	Description	HPMS	Model	Ratio
1	Rural Interstate	319,131	314,309	0.98
2	Rural Principal Arterial	491,942	485,458	0.99
6	Rural Minor Arterial	103,002	93,919	0.91
7	Rural Major Collector	166,747	174,034	1.04
8	Rural Minor Collector	45,643	57,543	1.26
9	Rural Local	138,703	198,591	0.54
	Rural TAZ	-	198,591	-
	Summary:	1,265,168	1,398,150	1.11
Summary of Common Links:		1,188,050	1,199,559	1.01

Perform Future Model Network Assignments

- Developed E + C network
  - KYTC's Six-Year Plan
- Projected future SE data (2025)
  - County control totals based on HPMS
  - Growth allocated to zones manually based on local input
  - Interpolated for years between current year and year 2025
- Remaining future model development steps similar to current model

County-level Model Usage

- Scott County
  - Needed VMT for review of Fayette County/Scott County plan conformity
  - Needed interim forecast years: 2010 & 2020 in addition to plan year of 2025
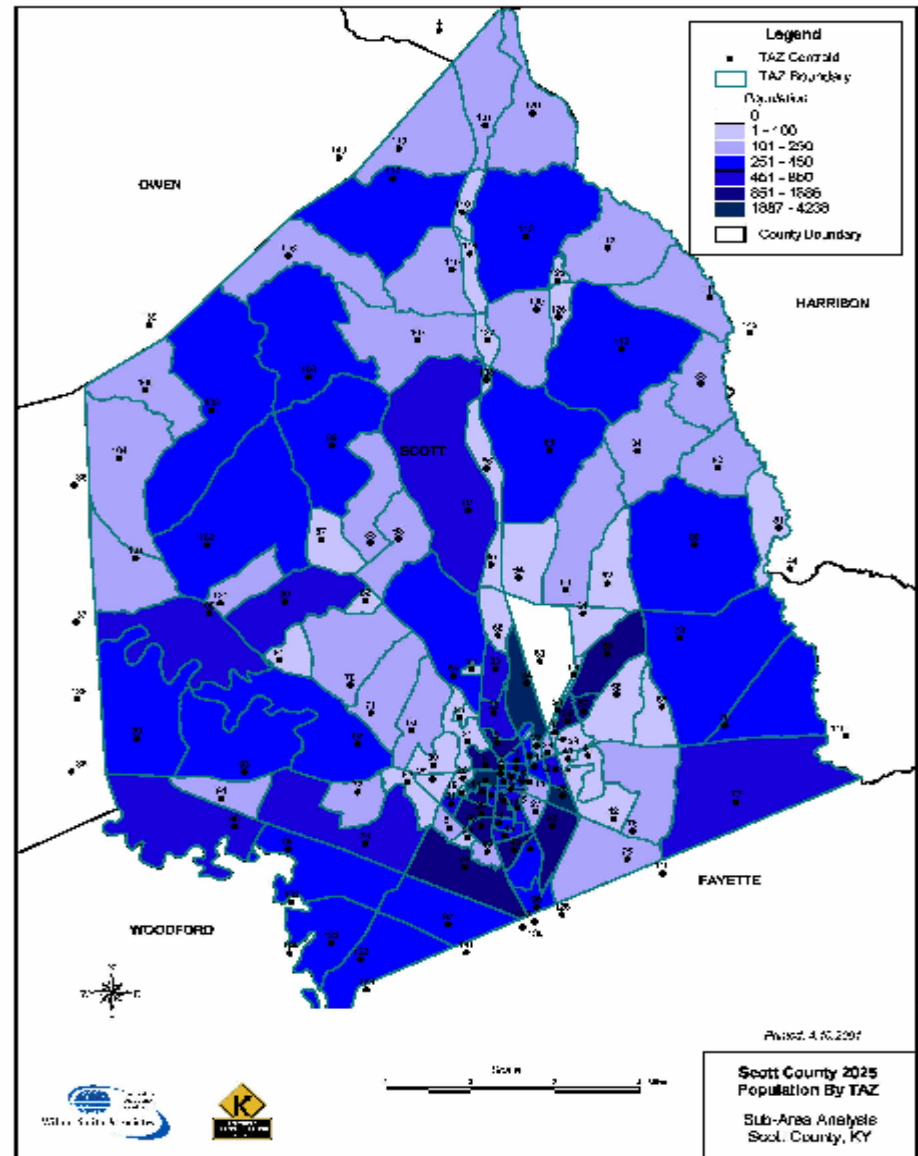
County-level Modeling Issues

- Accuracy
- State of practice at KYTC evolving
  - Lack of script
  - Post processing awkward
- AQ Changes
  - 8-hour standard
  - New monitoring results

Assessment of County-level Modeling

- Cost effective and quick - ~ $30-35K & 4 months

- Future models lack some accuracy due to use of matrix estimation

- Can be used for project development traffic forecasting (e.g. new bypasses)
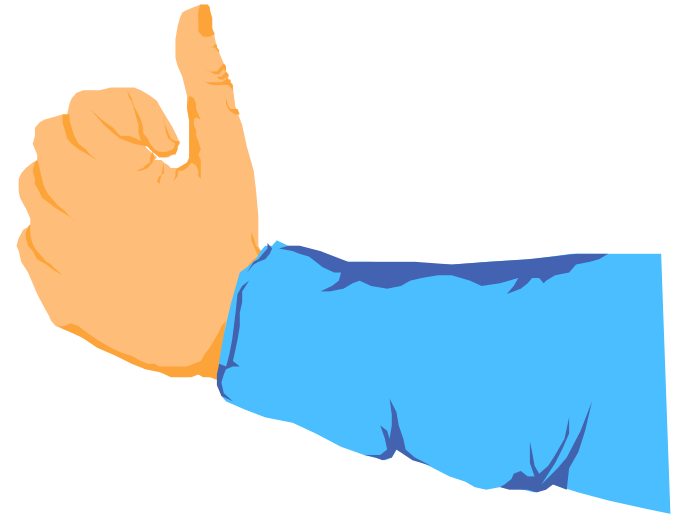
Conclusion

- Thank you for your attention!
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  - WSA
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