Ohio Statewide Travel Demand Forecasting Model

Presented to the TRB Annual Meeting

Washington, DC
January 12, 2004

Overview

• Background

• Interim Model
  - Network
  - Zones
  - Seed Trip Table
  - Trip Table Adjustment
  - Forecasting Model
  - Application

• Advanced Model
  - Components
  - Zone Systems
  - Data Sources
Background

• Development Begins in mid 90's

• Phase 1 Needs Study Identifies 3 Priorities:
  1. Truck/Freight Flow
  2. Economic Vitality
  3. Traditional Congestion Measures

• Therefore, an Advanced Model was Proposed Incorporating:
  1. Econometric Models
  2. Demand Microsimulation
  3. Land Use Modeling

• This Model Would Not be Complete Until 2005 Necessitating an Interim Capability

Interim Model Components

• Highway Network Developed from ODOT Roadway Information Database

• Seed Car & Truck Trip Tables Constructed from 700 Roadside Survey Locations, MPO Trip Tables and QRM Methods

• Adjusted Car & Truck Trip Tables Using Matrix Estimation Techniques

• Simple Growth Factoring for Forecasts Using Population & Employment Forecasts
Network

• Interim Model Network Only Includes Highway Network in Ohio (plus Ohio MPO areas outside the state)

• Automated Process Creates Network from ODOT GIS Files & Roadway Information Database

• MPO Model Networks Were Used as Well for Some Items

• Various Manual Interventions Required as Well to Obtain Clean Network
• Interim Model TAZ’s Developed During Roadside Surveys
• 1214 Zone System Referred to as Statewide Traffic Analysis Districts (STAD’s) to Distinguish Them from the Final Model’s 6000-7000 TAZ’s.
• Large Zone Size Has Implications for Matrix Estimation & Result Reporting
Developed Seed Car & Truck Trip Tables as a Composite of 3 Sources

1. Roadside Surveys Around All MPO Cordons & State Line
2. Compressed MPO Trip Tables
3. Quick Response Method (QRM) Generation/Distribution to Fill in Holes in Rural Areas

Seed Trip Table Data Source Schematic

Percentages show the proportion of trips in each region of trip table, values in parentheses are trucks.
• Very Important to Check Consistency When Using Disparate Trip Table Sources

Trip Table Adjustment

• Adjusted Seed Trip Table Using Transcad’s Matrix Estimation

• Used Subset of Counts Crossing STAD Boundaries Due to Large Zone Size

• Needed to Adjust Car & Truck Matrices Independently

• Preloaded a Fully Populated Truck Count Field When Adjusting Car Matrix and Vise Versa

• Toll’s Were Not Available When Doing Matrix Estimation so Had to Reflect Their Impact in the Free Flow Time
• Checked Matrix Estimation Impact on:

  1. Number of Trips (trip rates reduced dramatically in QRM generated portions of matrix prompting adjustment of that process)
  2. Trip Lengths (slight reductions were seen with more iterations)
  3. Proportion of Nonzero Cells (ME reduces this, 5 iterations reduces cars by 10% and trucks by 34%)

• Used Minimum Number of Iterations to Give Reasonable Agreement with Counts in Terms of:

  1. %RMSE by Volume Group
  2. VMT by Functional Class

%RMSE Indicates 3 Iterations of ME are Sufficient to Meet the %RMSE Validation Criteria, Additional Iterations Produce Only Marginal Gains
• 6 Iterations Needed to Bring Truck VMT’s in Line

• Final VMT Summary with Respect to:
  
  ME Counts: Car 100%, Truck 101%
  All Counts: Car 93%, Truck 94%

• Lower VMT with Respect to All Counts Due to Large Volume of Intrazonal Traffic

**Forecasting Model**

• Developed Population & Employment Totals by STAD

• Population from Census

• Employment From ES202
• Regression Analysis Establishes Relationship Between Numbers of Car & Truck Trips and Population, Employment & Land Use

• The Trip Generation is Only Applied to the Differential Socio-economic Variable Totals

• These Trips are Added/Subtracted from Base Year Totals

• The Forecast to Base Year Ratio Establishes Growth Factors for Internal STAD's

--Application--

• Great Interest Within ODOT For Using the Interim Model

• Initial Results for the Access Ohio Update Are Show As An Example

• Access Ohio Has Various Stages, One of Which is Establishment of Priority Corridors (Known as Macro Corridors)

• Model Used to Help Identify These Corridors
• To Facilitate Model Application, Network Expanded Out of State to Allow Diversion Between Entering Routes

Traffic Counts Show Roadways Currently Meeting Conditions for Inclusion as Macro Corridors
Expanded Freeway System Based on Federal Functional Class 02 Roads used to identify potential candidates

Model Assignment Then Identifies Sections that Could Meet Macro Corridor Criteria if Improved
Model Results Consolidated into Corridors Using GIS Capabilities of Transcad

Additional Corridor Criteria Related to Population & Employment Analyzed with Model Data and GIS
Further Analysis Conducted on Impact of Turnpike Tolls on Truck Volumes

• Conceptual Framework Evolving During Data Collection/Processing

• Development to Begin This Year

• To be Complete in 2005

Advanced Model
18 Major Submodels

- Aggregate National Trends
  1. Interregional Economic Model
  2. Aggregate Demographic Model
- Spatial Activity Distributions
  3. Land Development Model
  4. Activity Allocation Model
  5. Employment Spatial Disaggregation Model
  6. Disaggregate Household Synthesis Model
• Personal Travel Models
7. Short Distance Home-Based Person Tour Model
8. Long Distance Home-Based Person Tour Model
9. Visitor Person Tour Model

• Commercial Travel Models
10. Commercial Work-Based Person Tour Model
11. Disaggregate Commercial Vehicle Tour Model
12. Aggregate Commercial Vehicle Trip Model
13. Aggregate Internal/External Vehicle Trip Model

• Assignment Models
14. Full Road Network Assignment Model
15. Full Transit Assignment Model

• Post Processors
16. Network Emissions Model
17. Traffic Accident Model
18. Sub-Area Road Network Traffic Micro-Simulation
Zone Systems

Subzones (~20000)
Smallest level, employment & population data maintained at this level, used for characterizing development pattern of zone and disaggregating traffic assignment

Traffic Analysis Zones (~5000)
Origin-Destination matrices for assignment maintained at this level

Traffic Analysis Districts (~1200)
Used only for the Interim Model

Activity Model Zones (~700)
Level at which economic exchanges are modeled
Data Sources

New Data

Household Travel Surveys
Household Long Distance Travel Survey
GPS Based Travel Survey
Business Establishment Survey

Existing Data

National Transport Networks
ODOT Roadway Information Database
Census
ES 202
Transearch
Department of Natural Resources Land Use Data
County Assessor Land Value Data
ODOT Traffic Counts
IMPLAN