



Better Methods. Better Outcomes.

TMIP Webinar Series

Agency Experience using Activity-Based Models

Experience in the State of Ohio

Date:

April 9, 2013

Speakers:

Rebekah Anderson (ODOT)
Zhuojun Jiang (MORPC)



Disclaimer

The views and opinions expressed during this webinar are those of the presenters and do not represent the official policy or position of FHWA and do not constitute an endorsement, recommendation or specification by FHWA. The webinar is based solely on the opinions and experience of the presenters and is made available for knowledge and experience sharing purposes only.

- Why Ohio?
 - Anytown, USA





The Simmering Debate on ABM Transferability

Activity/Tour-Based Modeling- Transferability

Tuesday, May 7, 2013 8:30 AM - 10:00 AM

Moderator: Rebekah Anderson

Assistant: Zhuojun Jiang

Room: Union D&E

Further Test of a Simplified Tour-Based Model ([Abstract](#))

William Allen, Transportation Planning Consultant

Anna Gallup, Department of Transportation

Making advanced travel forecasting models affordable through model transferability ([Abstract](#))

John Bowman, Bowman Research and Consulting

Mark Bradley, Resource Systems Group

Joe Castiglione, Resource Systems Group

Supin Yoder, FHWA

Comparison of Activity-Based Model Parameters Between Two Cities ([Abstract](#))

Thomas Rossi, Cambridge Systematics, Inc.

Jason Lemp, Cambridge Systematics, Inc.

Anurag Komanduri, Cambridge Systematics, Inc.

A Test of Transferability: The SE Florida Activity-Based Travel Demand Model ([Abstract](#))

Rosella Picado, Parsons Brinckerhoff

Meet the Latest in Activity-Based Modeling

Activity/Tour-Based Modeling - Development

Tuesday, May 7, 2013 10:30 AM - 12:00 PM

Moderator: Rebekah Anderson

Assistant: Zhuojun Jiang

Room: Union D&E

Usual Work Arrangements: Impact on Travel Behavior and Incorporation in Activity-Based Travel Models ([Abstract](#))

Peter Vovsha, Parsons Brinckerhoff

Vyas Gaurav, Parsons Brinckerhoff

Danny Givon, Jerusalem Transportation Masterplan Team (JTMT)

Yehoshua Birotker, Jerusalem Transportation Masterplan Team (JTMT)

Comparing a household activity-based model with a person activity-based model ([Abstract](#))

John Bowman, Bowman Research and Consulting

Mark Bradley, Resource Systems Group

Joe Castiglione, Resource Systems Group

John Gibb, DKS Associates

Chris Johnson, Puget Sound Regional Council

New Features to Represent Pricing in the SACSIM Activity-Based Model ([Abstract](#))

Mark Bradley, RSG

John Bowman, Bowman Research and Consulting

Bruce Griesenbeck, Sacramento Area Council of Governments

Joe Castiglione, RSG

John Gibb, DKS Associates

Metropolitan Planning Organization (MPO) Modeling Efforts in the Development of an Activity-Based Model (ABM): The San Diego Experience ([Abstract](#))

Wu Sun, San Diego Association of Governments

Ziying Ouyang, San Diego Association of Governments

Rick Curry, San Diego Association of Governments

Clint Daniels, San Diego Association of Governments

Urban Models

Statewide Models

S2: Statewide Modeling Workshop

Sunday, May 5, 2013 1:00 PM - 5:00 PM

Moderator: Greg Gaimo

Room: Franklin C



The Evolving Needs Challenges and Experiences in Statewide Modeling

[\(Abstract\)](#)

Alan Horowitz

Challenge 1: Staffing Statewide Models: Using the Travel Forecasting Resource Center to Further the Profession

[\(Abstract\)](#)

Julie Dunbar

Challenge 2: Spatial Aggregation Level: Multi-tier Modeling in Ohio Attempts to Balance Run Time and Forecast Granularity

[\(Abstract\)](#)

Gregory Gaimo, Ohio Department of Transportation
Sasanka Gandavarapu, CDM Smith

Challenge 3: Developing Statewide Land Use and Socio-Economic Forecasts: Experience in Florida with Statewide Parcel-Level Land Use Forecast Allocation

[\(Abstract\)](#)

Stephen Lawe

Challenge 4: Policy Sensitivity: Uses of the Model in the Ohio Statewide Plan

[\(Abstract\)](#)

Niels (Rob) Bostrom, CDM Smith, Inc.
Gregory Gaimo, Ohio Department of Transportation
Sasanka (Sashi) Gandavarapu, CDM Smith, Inc.
Paul Hershkowitz, CDM Smith, Inc.

Challenge 5: Transportation Economics: Development of an Enhanced User Benefit and Cost Calculator for Ohio

[\(Abstract\)](#)

Christopher Beard, 411 North 10th Street
Vincent Bernardin Jr., Resource Systems Group, Inc.
Gregory Gaimo, Ohio Department of Transportation

Challenge 6: Freight Modeling: Florida's Next Generation Freight Model

[\(Abstract\)](#)

Vidya Misore

Challenge 7: Assignment Convergence: Big Model, Small Projects; Improving Assignment Convergence in Ohio for Estimating Project Impacts

[\(Abstract\)](#)

Vince Bernardin, Resource Systems Group
Aaron Keegan, Bernardin, Lochmueller & Associates
Gregory Gaimo, Ohio Department of Transportation
Sam Granato, Ohio Department of Transportation

Challenge 8 Integration with Urban Models: Are Dueling Models Good or Bad and What Can They Learn from Each Other?

[\(Abstract\)](#)

Subrat Mahapatra

Challenge 9 Integrating Statewide Models into the National Picture: What Should be the Federal Government Role in Statewide Modeling?

[\(Abstract\)](#)

Jeremy Raw
Brad Gudzinas

Traffic and Revenue Forecasting for the Ohio Turnpike Asset Evaluation

[\(Abstract\)](#)

Greg Erhardt, Parsons Brinckerhoff
Tara Weidner, Oregon Department of Transportation

Analyzing long-distance truck travel for Statewide Freight Planning in Ohio

[\(Abstract\)](#)

Rolf Moeckel, Parsons Brinckerhoff
Gregory Gaimo, Ohio Department of Transportation, Office of Statewide Planning and Research
Zhuojun Jiang, Mid-Ohio Regional Planning Commission
Gregory Erhardt, Parsons Brinckerhoff
Howard Wood, Parsons Brinckerhoff

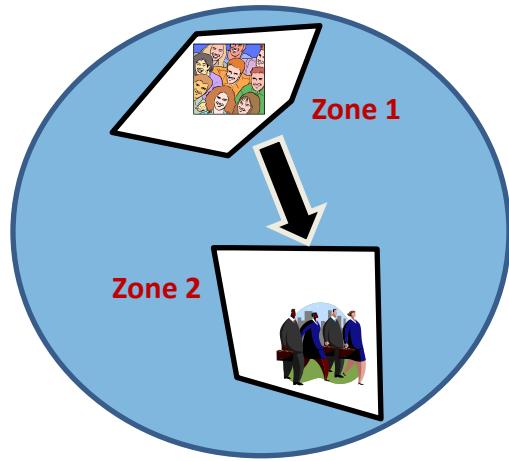
Tuesday

- Rebekah Straub Anderson
 - 614-752-5735
 - rebekah.anderson@dot.state.oh.us
- Zhuojun Jiang
 - 614-233-4741
 - zjiang@morpc.org

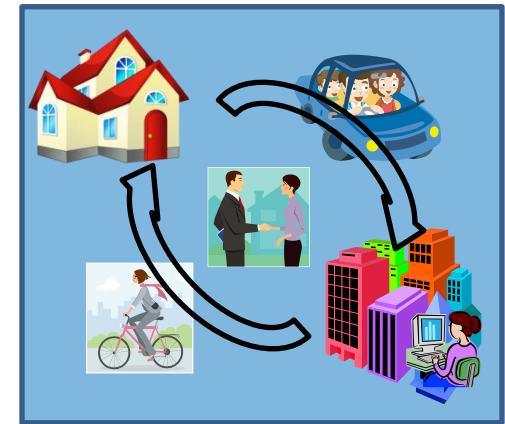
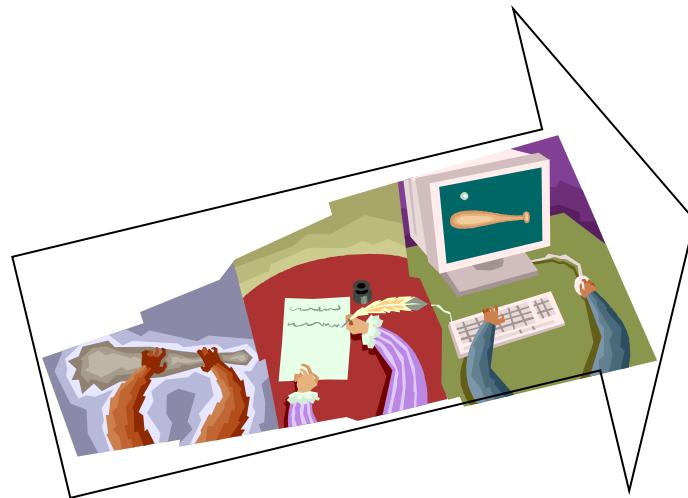
- **MORPC Model Overview**
- **How Current MORPC Model Works**
- **Model Investigation Studies**
- **Issues and Future Directions**

- **Statewide Model Overview**
- **Various Studies**
- **Future Directions**

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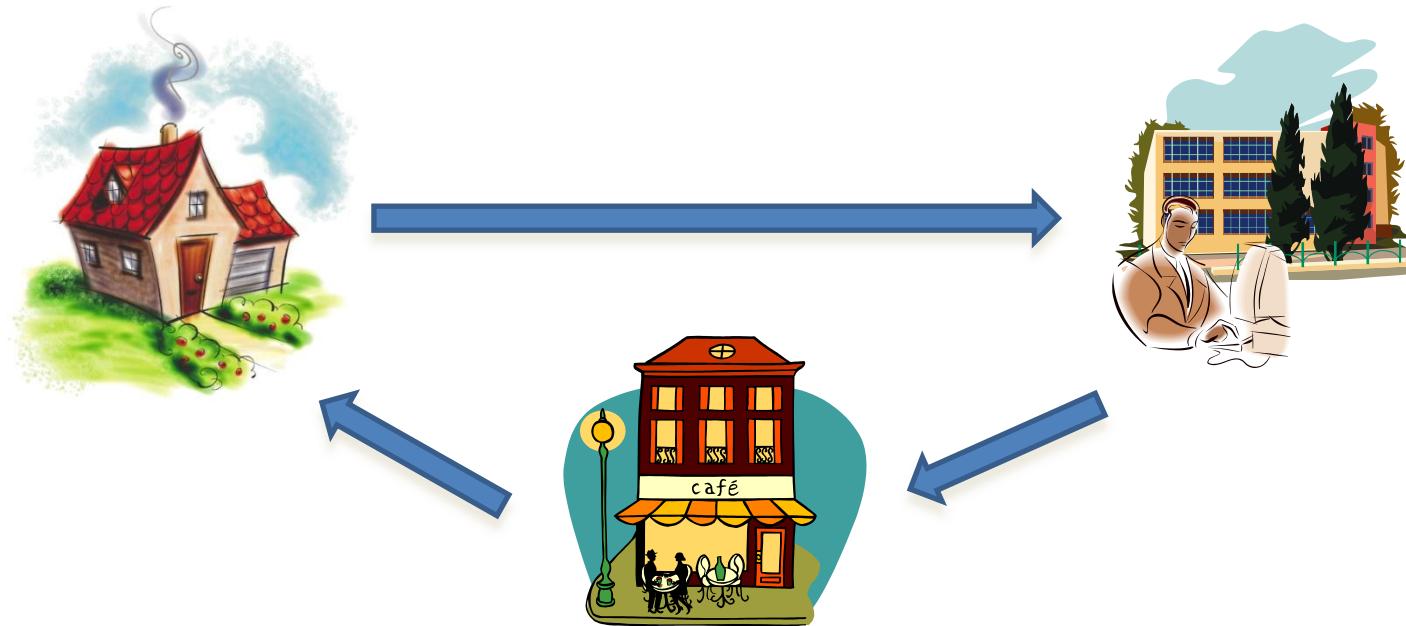


Aggregate
4-step



Tour-based
Activity-based
Micro-simulation

A closed chain of trips starting and ending at the same base location

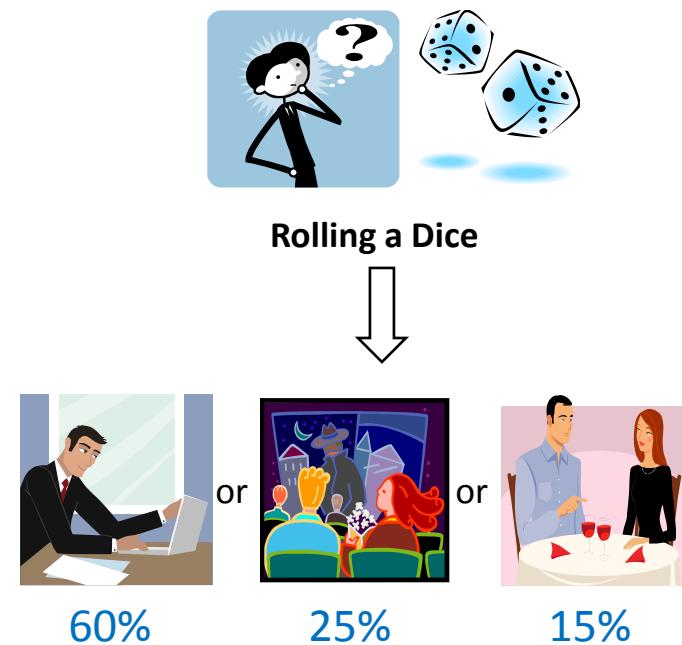


Travel demand is derived from the **Daily Activities** that households/individuals need to undertake.



Monte Carlo realization for individual choices at the fully-disaggregate level of persons and households

Monte Carlo Realization



- **Initial Development**

- 1998-1999: Household Interview Survey

- 2001-2004: Model Development

- **Additional Refinements**

- 2005-2006: Transit Enhancement

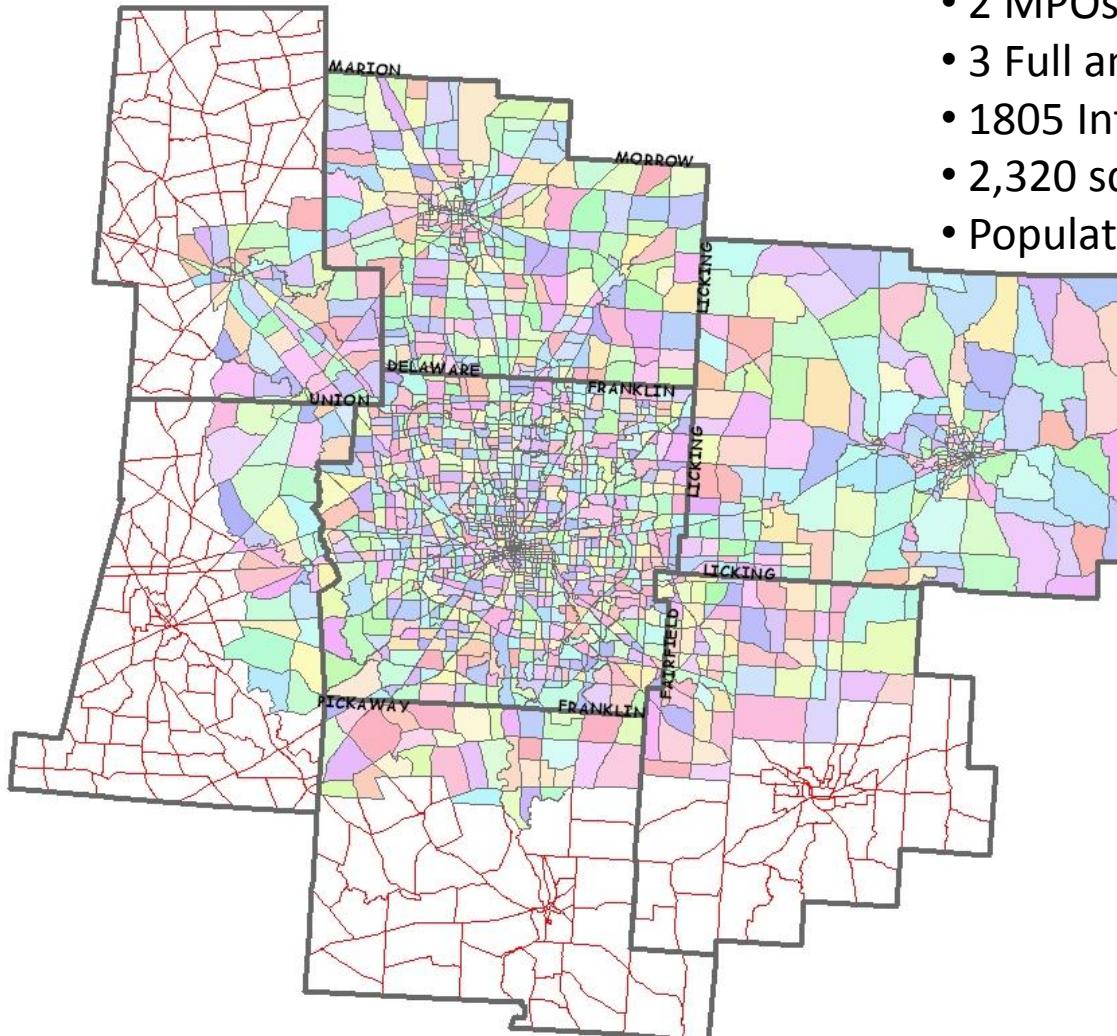
- 2006-2007: Model Enhancement

- 2008-2009: Transit On-Board Survey

- 2010: Mode-Choice Model Update

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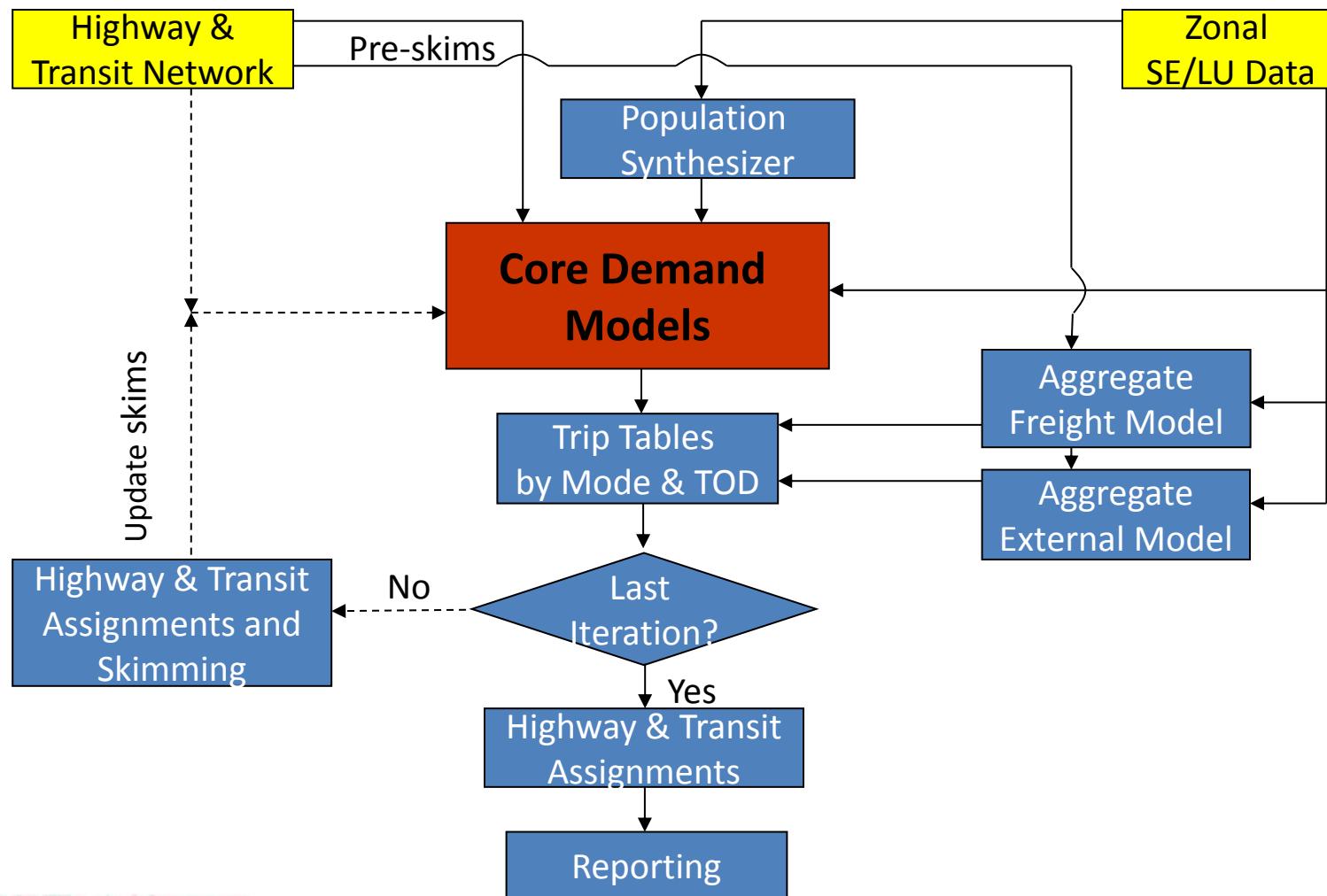
Travel Model Area



- 2 MPOs – MORPC and LCATS
- 3 Full and 4 Partial Counties
- 1805 Internal TAZs and 72 Externals
- 2,320 square Miles
- Population of 1.66 Million in 2010

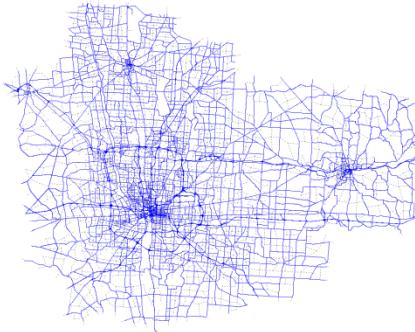
How Current MORPC Model Works

Model System Components

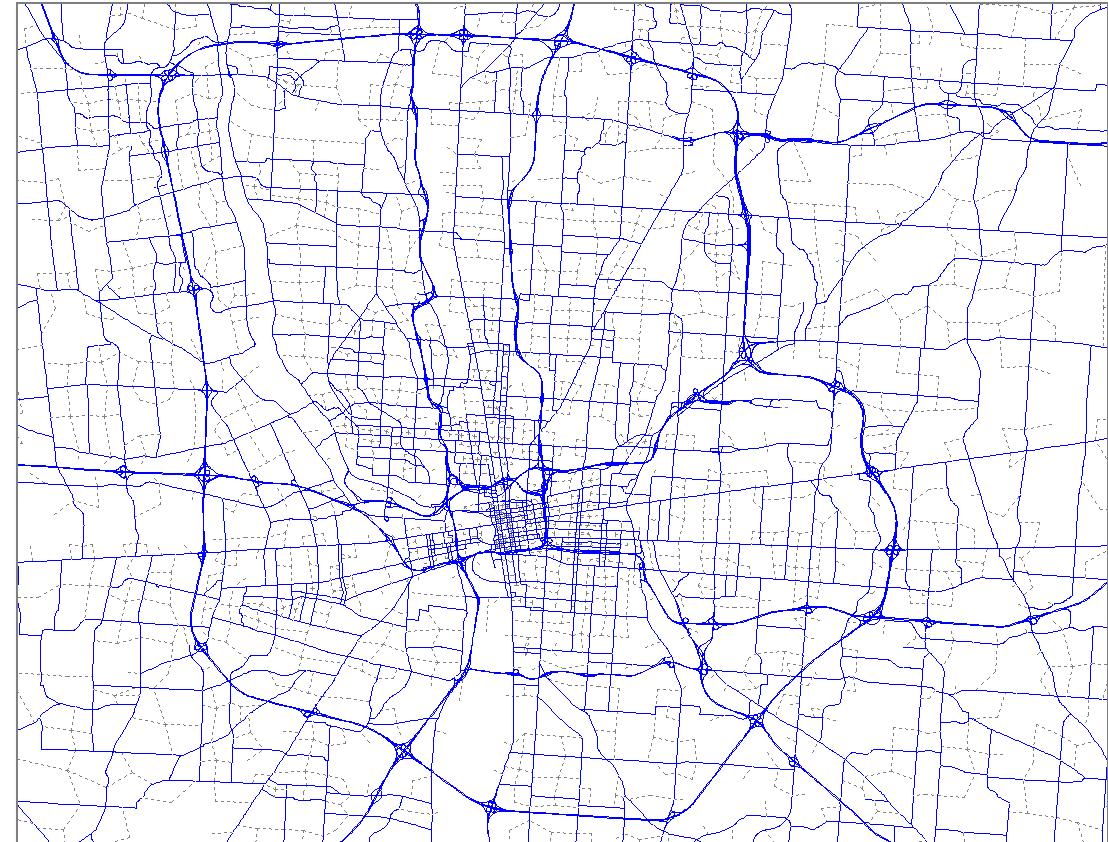


- **Population** (population synthesizer)
 - Population/Households
 - Labor force
 - Average household income
- **Employment** (destination choice models)
 - Office/Retail goods/Retail goods/Other
 - Average work earn
- **Enrollment** (destination choice models)
 - University/college
 - School (K-12)
- **Parking** (parking models)
 - Total parking spaces/long term parking spaces
 - %Free parking

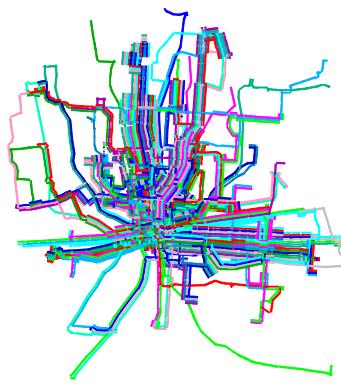
Transportation System - Highway Network



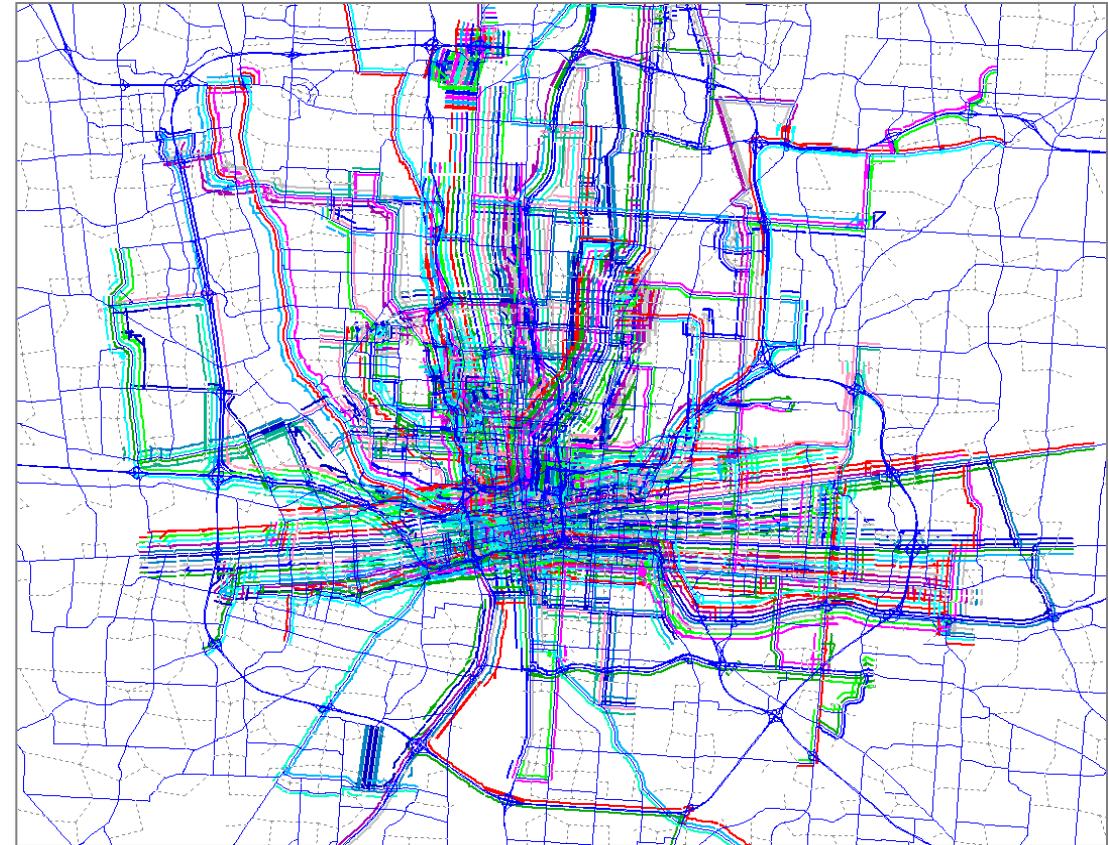
- Distance
- No. of Lanes
- Width
- Posted Speed
- Facility Type
- Turn Lanes
- TWLTL
- Intersection Type
- On-Street Parking
- by 4 Time Periods



Transportation System - Transit Network



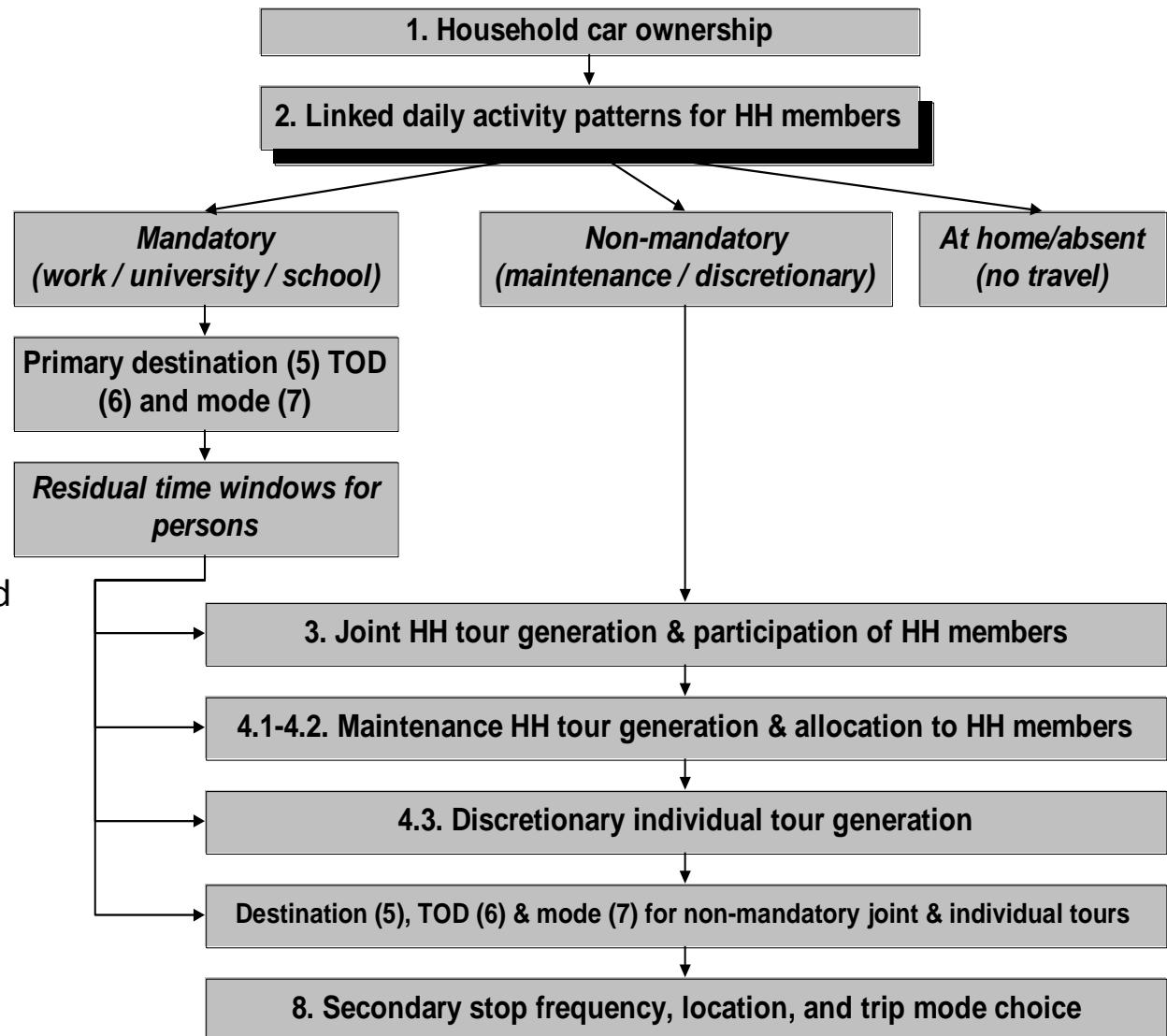
- Route Type
- Headway
- Fare
- P&R Lots



Skims are built for 4 time periods by 5 access/egress combinations.

Core Demand Models

1. Car ownership
2. Daily Activity Pattern (w/ Mandatory Tour)
3. Joint Household Tour
4. Non-Mandatory Tour
5. Primary Destination Choice
6. Time of Day Choice
7. Mode Choice
8. Stop Frequency, Locations and Trip Mode



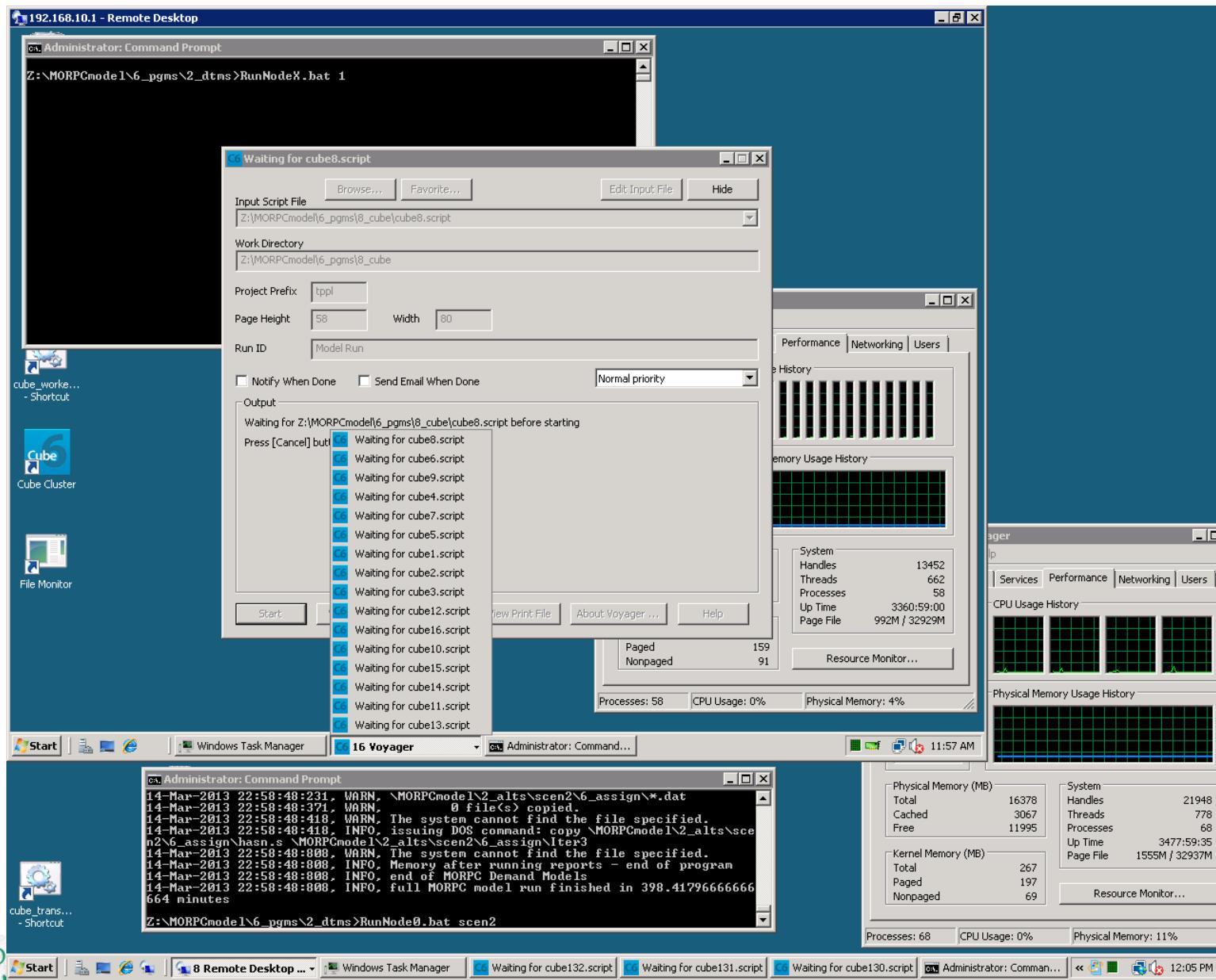
Final Output of Core Demand Models

- Tour Records for all the population within the model area, like person daily travel logs (one record per tour):
 - HH ID/PUMS Serial Number/HH TAZ
 - Person ID/Person Type
 - Tour ID/Tour Purpose
 - Tour Party Size/Person IDs in the Party
 - Tour Origin/Destination/Intermediate Stops/Parking Zone
 - Tour Start Hr/End Hr
 - Modes for all legs of the tour

hh_id	pums_ser	hh_taz_id	person_id	personType	patternTy	tour_id	tourCateg	purpose	jt_party_size	jt_person_0_id	tour_orig	tour_orig	M5_DC_Ti	M5_DC_W	M6_TOD	M6_TOD	M6_TOD	M6_TOD	TOD_Out	TOD_Out	M7_MC	M7_Tour	M7_Tour	M81_SFC	M82_SLC	M82_SLC	M82_SLC	M83_SMC		
25565	8158482	120	1	2	1	1	1	1	0	0	120	1	291	0	12	5	16	1	5	4	2	1	6	6	3	0	0	325	1	0
25565	8158482	120	2	2	1	2	1	1	0	0	120	1	101	1	139	14	17	4	5	3	2	1	6	6	1	0	0	0	0	0
25565	8158482	120	2	2	1	1	3	5	0	0	120	1	133	1	75	9	13	2	4	1	3	1	6	6	1	0	0	0	0	0
25565	8158482	120	1	1	1	2	3	6	0	0	120	1	46	1	166	17	20	5	6	2	4	1	6	6	1	0	0	0	0	0
25565	8158482	120	2	2	1	3	3	7	0	0	120	1	641	1	180	19	23	6	7	4	4	2	6	6	3	0	0	99	1	0
25565	8158482	120	2	2	1	21	4	3	0	0	101	1	697	2	155	16	16	5	5	2	2	1	6	6	1	0	0	0	0	0
25566	4692254	120	1	1	1	1	1	1	0	0	120	1	106	1	10	5	14	1	4	4	3	1	6	6	1	0	0	0	0	0
25566	4692254	120	2	2	1	2	1	1	0	0	120	1	212	1	96	10	20	3	6	3	4	1	6	6	1	0	0	0	0	0
25566	4692254	120	1	1	1	11	4	3	0	0	106	1	96	1	136	14	14	4	4	3	3	5	6	6	0	0	0	0	0	0
25567	8778678	120	1	1	1	1	1	1	0	0	120	1	194	2	80	9	18	2	5	1	2	1	6	6	1	0	0	0	0	0
25567	8778678	120	2	1	1	2	1	1	0	0	120	1	754	1	79	9	17	2	5	1	2	1	6	6	1	0	0	0	0	0

- Core choice models in Java code
- Network coding, skimming/assignment, external and freight models in Cube Voyager
- 1 Server Computer plus 8 Workers Computers
 - Server: Dual Core Processor (3.5GHz 6MB Cache, 1333MHz FSB) (4=2 x 2 Nodes)
 - Worker: Dual Quad Core Processor (2.66GHz 8MB Cache, 6.4GT/s QPI) (16=2 x 4 x 2 Nodes)

How Current MORPC Model Works



- Run the full model when there are big changes in land use and/or transportation system
- “Post-model” traffic assignment with fixed trip tables for different highway network scenarios in corridor studies and such
- No big difference from old 4-step models in terms of daily applications

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- **Model Investigation Studies**
 - Comparison Study
 - TRANSIMS Study
 - Sensitivity Analysis
- Issues and Future Directions
- Statewide Model Overview
- Various Studies
- Future Directions

Comparison of Four-Step vs. Tour-Based Models

Comparison of Four-Step Versus Tour-Based Models in Predicting Travel Behavior Before and After Transportation System Changes – Results Interpretation and Recommendations

Nazneen Ferdous and Chandra Bhat, *Center for Transportation Research, The University of Texas at Austin*
Lakshmi Vana and David Schmitt, *AECOM Consult*
John L. Bowman, *Bowman Research and Consulting*
Mark Bradley, *Mark Bradley Research and Consulting*
Ram Pendyala, *Arizona State University*

for the
Ohio Department of
Transportation
Office of Research and
Development

State Job Number
134368
December 2010

**Presented at
13th TRB Apps
Conference**

VCTR CENTER FOR TRANSPORTATION RESEARCH
THE UNIVERSITY OF TEXAS AT AUSTIN

FHWA
U.S. DEPARTMENT OF TRANSPORTATION
RESEARCH & DEVELOPMENT

- Research led by University of Texas-Austin with AECOM, John Bowman, Mark Bradley & Ram Pendyala
- Main objective: examine the performance of the trip-based and tour-based frameworks for Columbus in the context of a before-and-after project analysis (focusing on **highway results**)

Comparison Study – What we did

- Updated trip-based model to resolve differences in estimation datasets, TOD, geographic coverage and other areas
- Developed 1990, 2000 and 2005 scenarios (including socio-economic data, networks, traffic counts, etc.)
- Compared models' regional-level results to Census (1990, 2000), Household Interview Survey (1999), ACS (2005)
- Decided on study projects
- Compared models' project level-results

Comparison Study – Findings

- Overall there are few major differences between the two models (slight overall edge to tour-based model)
- It is difficult to make disaggregate model comparisons when the models have different units of travel
 - Translating units leads to inconsistencies at a disaggregate level, making the tour-based model's full range of potential benefits impossible to trip-based models

Comparison Study - Conclusions

- With an aggregate assignment, you can't see much difference between the demand models for your run-of-the-mill project traffic forecasts.
- Biggest difference is in what questions your model can answer
- Develop a model that answers questions that are being asked in your region.
 - Use your mystifying oracle to determine what questions are likely to be asked over the next 20 years.
- More comparisons between trip- and tour-based models are needed to verify these findings

Interfacing MORPC Model with TRANSIMS

U.S. Department of Transportation Federal Highway Administration

Broad Agency Announcement TRANSIMS Deployment Case Studies – DTFH61-09-R-00012

Interfacing Activity Model Outputs with TRANSIMS Microsimulation (Phase II)
January 2012

Final Report

Submitted to:
Federal Highway Administration (FHWA)

Submitted by:
AECOM

Presented at
13th TRB Apps Conference

- TRANSIMS Deployment Case Study led by AECOM/FHWA with active participation by MORPC and ODOT
- Main objective: Route and simulate MORPC's tour-based demand on a TRANSIMS network

TRANSIMS Study – What we did

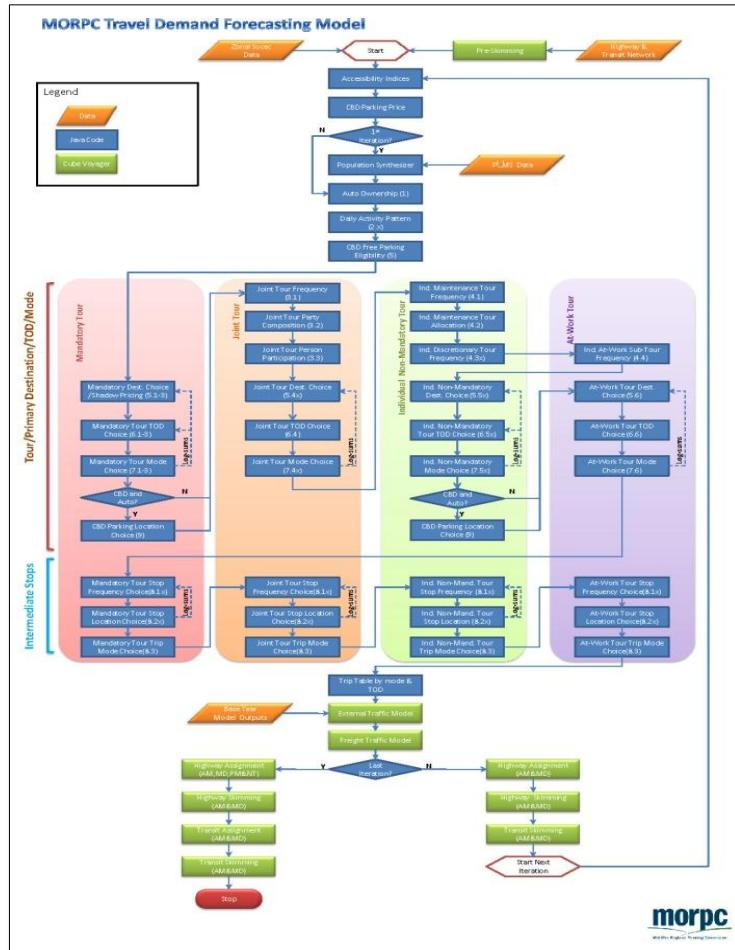
- Created time-dependent TRANSIMS highway and transit networks
- Routed and simulated parsed trip tables on the TRANSIMS networks
- Routed and simulated modeled tours on the TRANSIMS networks
- Fed back travel times from TRANSIMS to the Demand Model
- Performed sensitivity tests and future forecasts

TRANSIMS Study – Findings

- Successful integration of TRANSIMS with tour-based models developed and implemented outside of TRANSIMS
- Significant efforts to establish activity locations and volumes from zonal-based travel demand
- Promising traffic micro-simulation tool for real projects

- Consider incorporating TRANSIMS during our 2010 model update and validation
- Share the tool to all the large MPOs in the state of Ohio

Sensitivity Analysis on MORPC Model



- In-house model investigation
- One of the objectives: investigate how the model would react to the gas price changes as experienced in the summer of 2008

Sensitivity Analysis— What we did

- Developed a detailed model flow chart
- Identified all the sub-models with “direct”/“indirect” inputs related to travel costs
- Developed various measures to capture the resulting changes in the outputs of affected sub-models due to the variation in travel costs (including gas price and transit fare)
- Run the model for different travel cost scenarios

Sensitivity Analysis - Conclusions

- MORPC model is sensitive to travel costs
- Sensitivity analysis proved to be a good debugging tool
- Sensitivity analysis resulted in a better understanding of MORPC model
- Meaningful measures were a plus for sensitivity analysis
- Sensitivity analysis should be included as an essential part of model calibration and validation, especially for activity-based models with sophisticated structure

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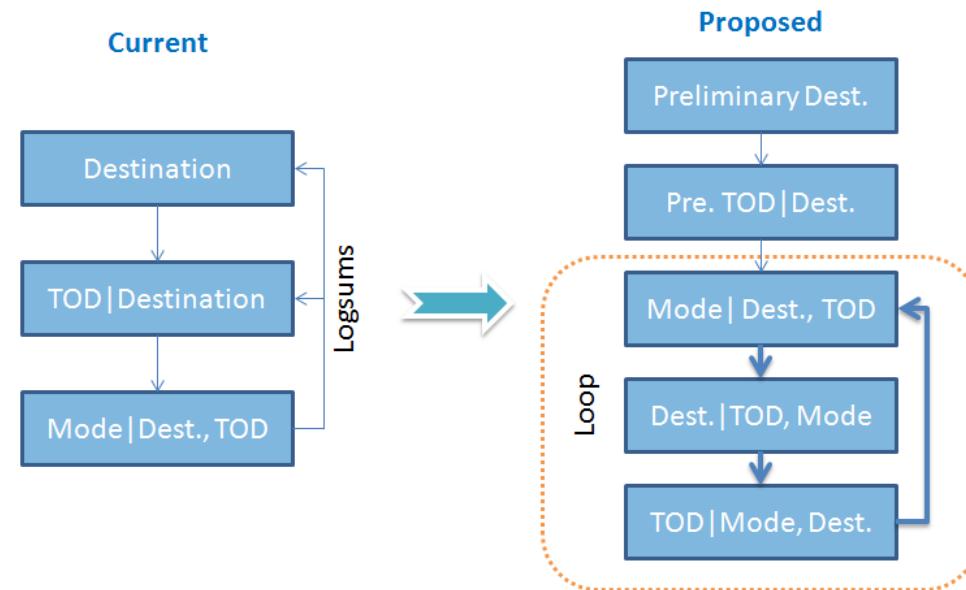
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Enhancements and 3C CT-RAMP ABM Update

- ~10 years of model application and continuous “small-scale” model improvements
 - Special generators
 - PUMS ID preservation
 - Output files downsizing
 - Model streamlining
- Coordinated Travel and Regional Activity Modeling Platform (CT-RAMP) Update for 3C
 - Columbus/Newark
 - Cleveland
 - Cincinnati/Dayton

Sequence of Discrete Choice Models

- Issues
 - “Chained” choice models in a logical but arbitrary order
 - Cumbersome mode-choice logsums (for spatial and temporal choices at upper levels)
- Future Directions
 - Parallel convoluted choice models



External Station Model

- Issues
 - 1995 cordon line counts for a much smaller area
 - No new cordon line survey planned ~~in foreseeable future~~ ever
- Future Directions
 - Near-term – Borrow the results from Ohio Statewide Model
 - External Station volumes
 - E-I/I-E/E-E trip tables
 - Possible update if results from upcoming research project prove fruitful

Freight Component

- Issues
 - QRFM Aggregate Freight Model
- Future Directions
 - Borrow/Implement the modules/results from Ohio Statewide Model
 - Use the results directly from ACOM (long-haul commodity shipment)
 - Implement DCOM in the MPO models (local goods delivery and service provision)

CBD Parking Model

- Issues
 - Not applied to all auto trips destined to CBD
 - Lack of a procedure to achieve a balance between parking demand and supply
 - “Random” CBD zones as alternatives for parking location choice model
 - Parking cost estimated based on parking availability
- Future Directions
 - Incorporate constrained parking equilibrium when parking supply is limited
 - Parking cost as an input

Spatial Resolution

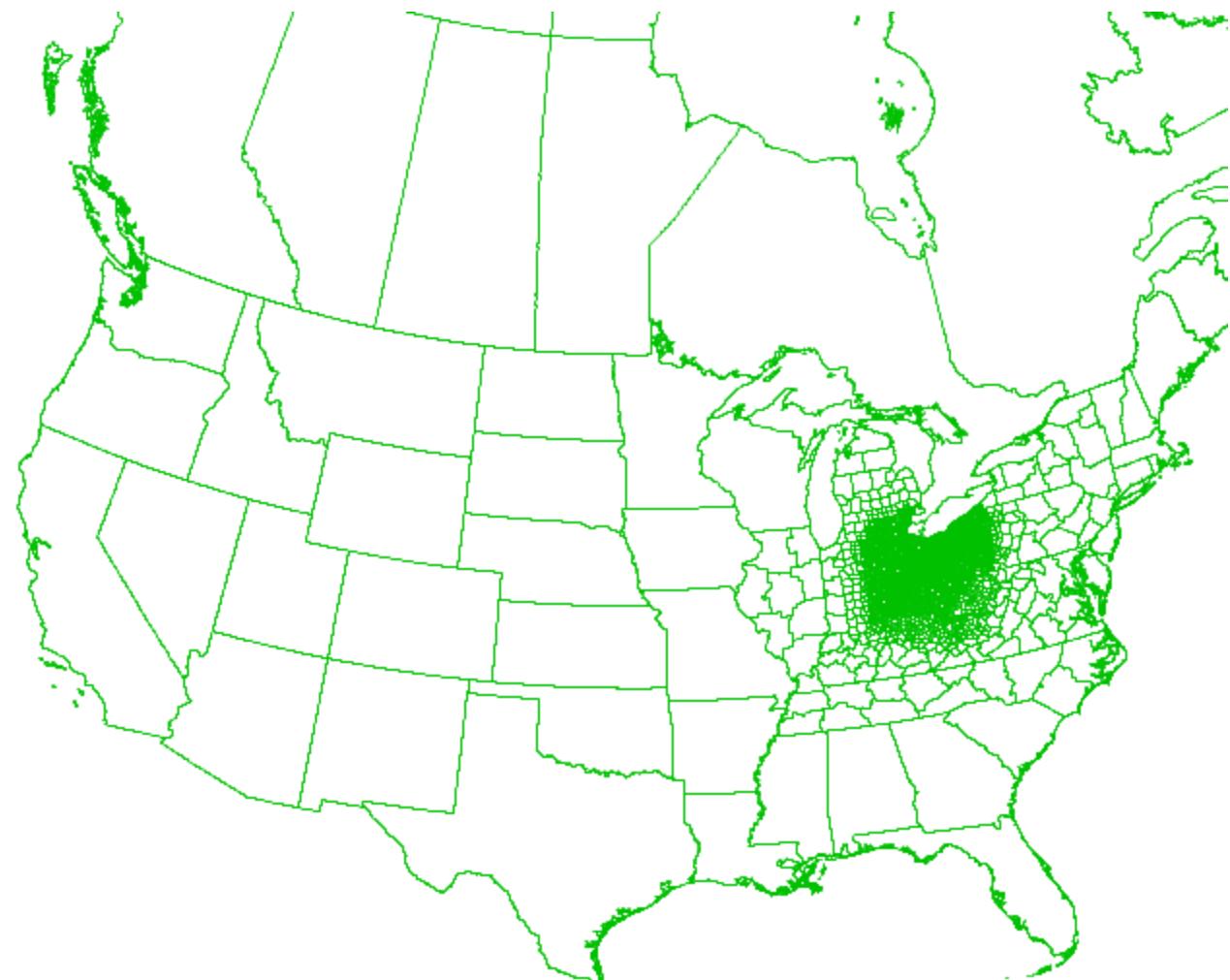
- Issues
 - 3 Transit Walk Access Segments for each TAZ (land use assumed to be centered around each centroid node)
 - Scarce zonal based travel demand loading points for traffic micro-simulation
 - Non-Motorized Trips
- Future Directions
 - Micro Analysis Zones (MAZs) nested within the standard TAZs
 - A detailed navigation network for calculating walk/bike distance

Tolling/Pricing

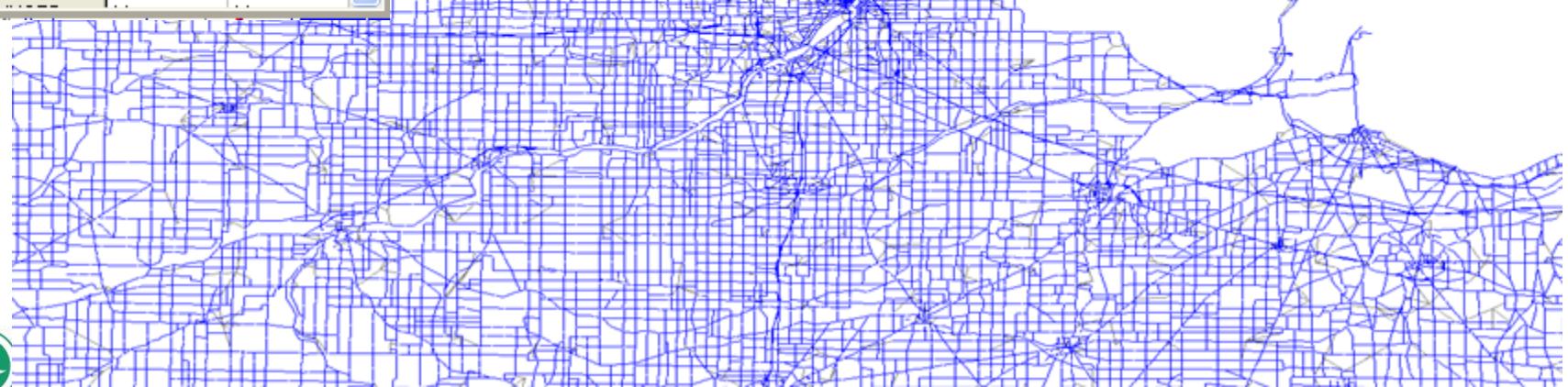
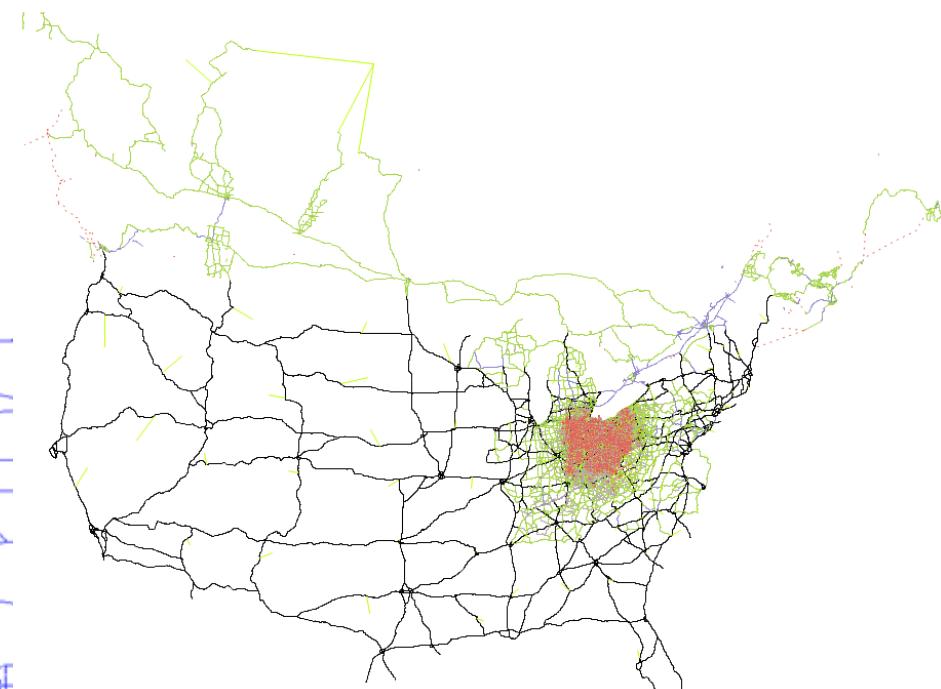
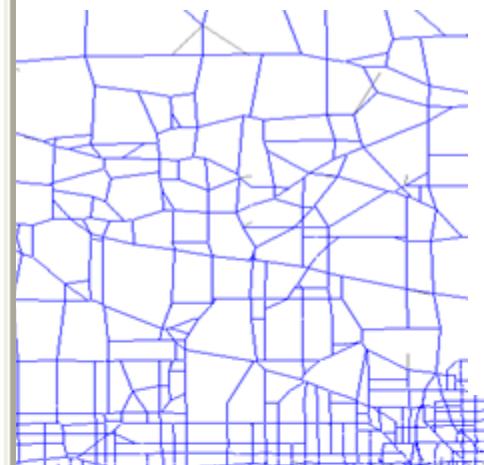
- Issues
 - Currently, only the Turnpike is tolled
 - In 2009, the Ohio General Assembly allowed for tolling of non-Turnpike facilities
- Future Directions
 - Adding person and tour specific values-of-time
 - Temporal disaggregation to 30 minutes for tour generation and 5 minutes for stop scheduling
 - Also accommodates multi-stop tour scheduling for Transims

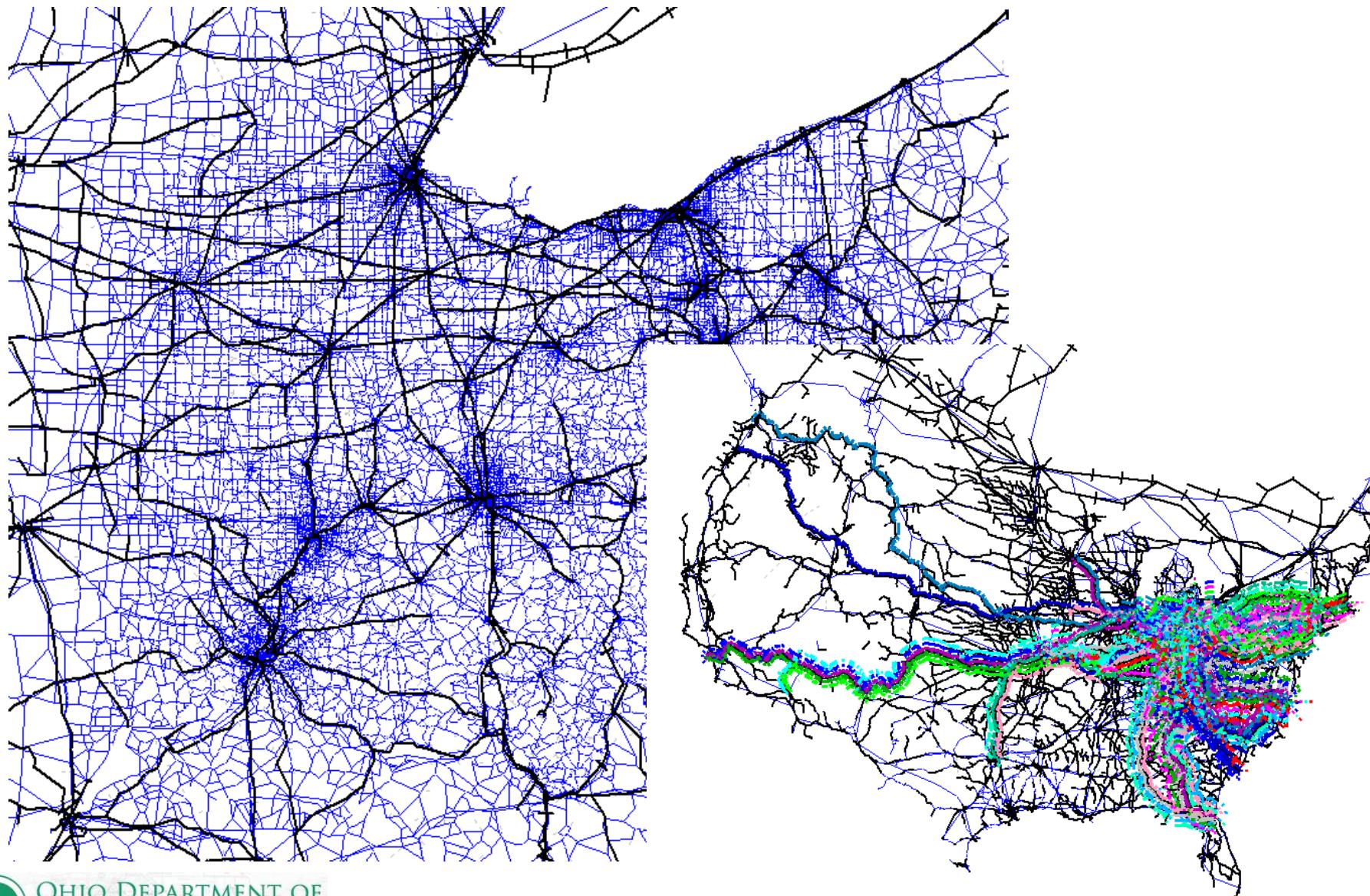
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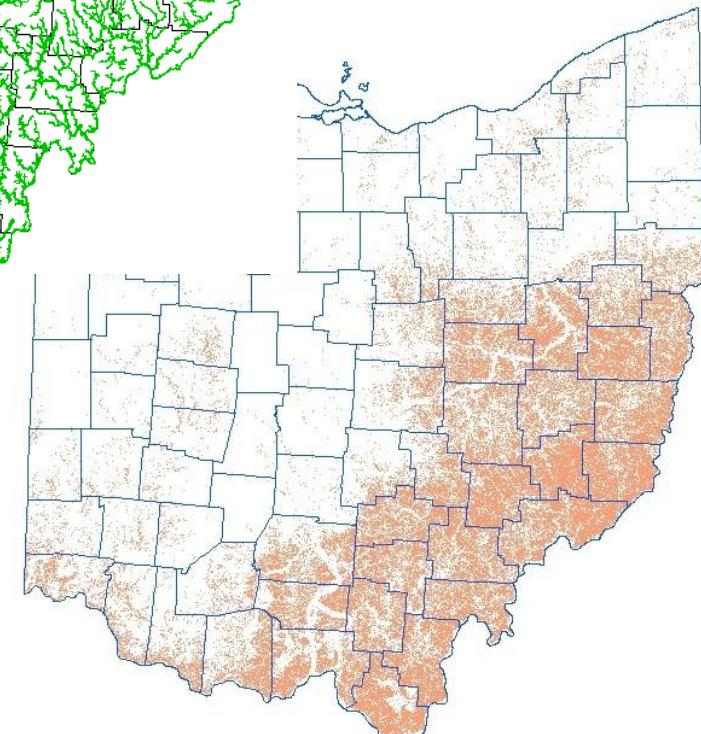
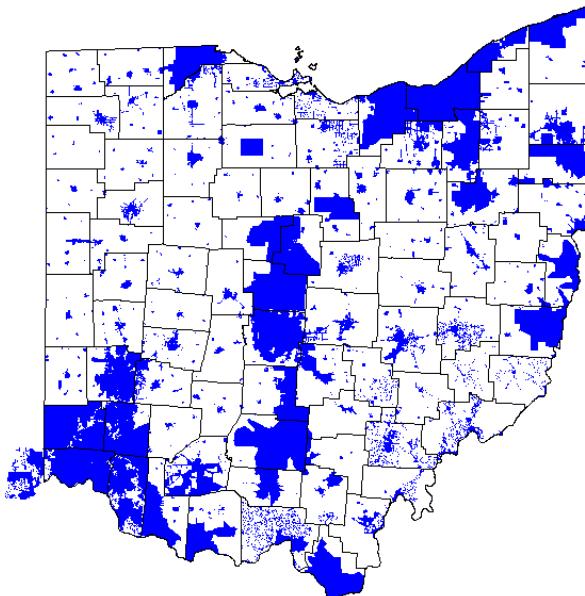
- 5116 Total Zones
- 3660 Ohio Zones
- 5002 Internal Zones



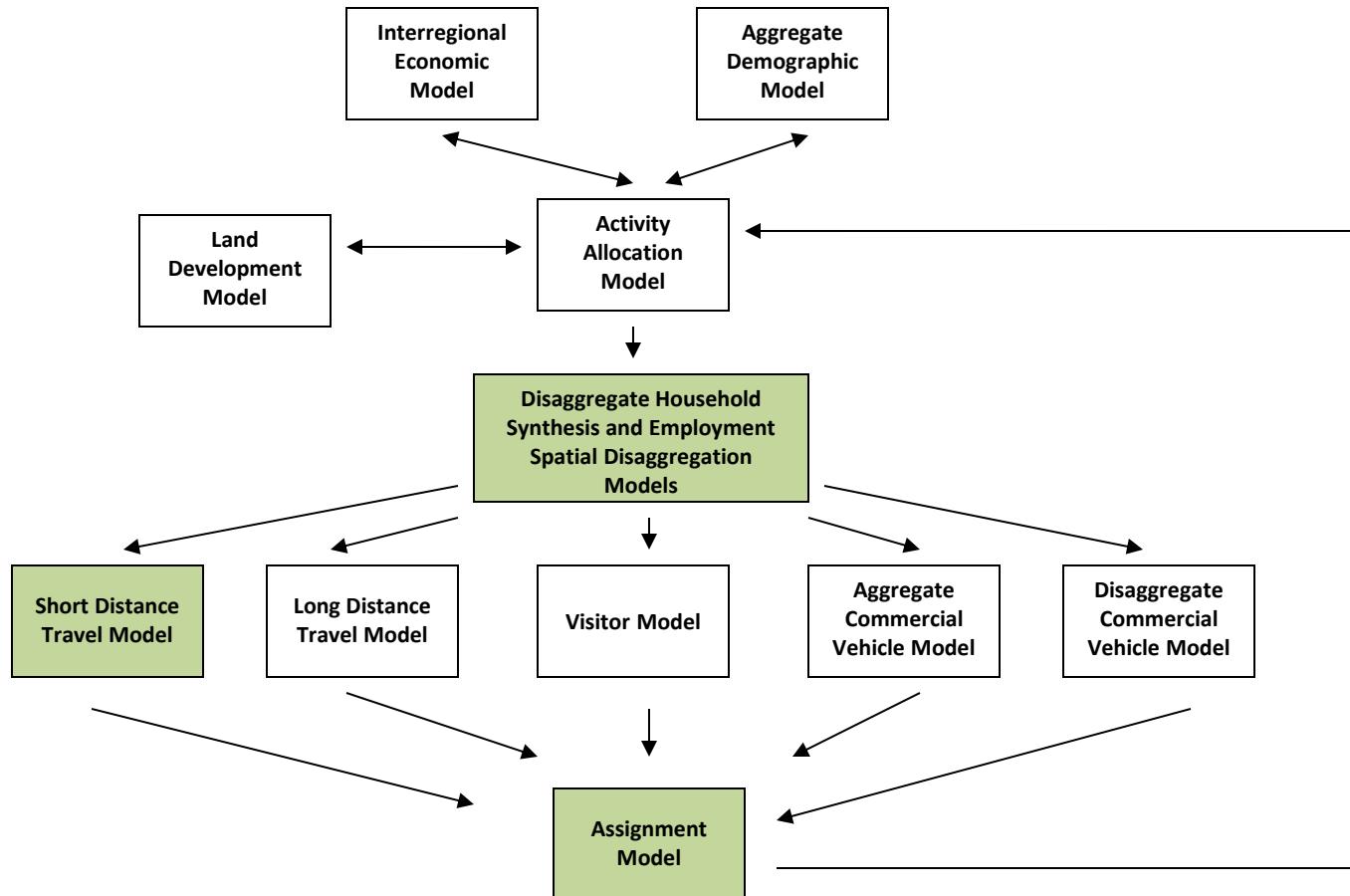
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AY/BY	1297836.8	1297758.2
A	150289	150290
B	150290	150289
DIST	0.51	0.51
POSTSPD	55	55
SPEEDMOD	0	0
FUNCLASS	40	40
AREATYPE	3	3
LANES	1	1
TWIDTH	9	9
TURNLANE	10	10
IXTYPE	0	3
MEDTURN	0	0
PARKING	0	0
TERRAIN	1	1
IXTHRU	1	1
PCTTRK	0	0
CAPADJ	0	0
CAR_TOLL	0	0
TRK_TOLL	0	0



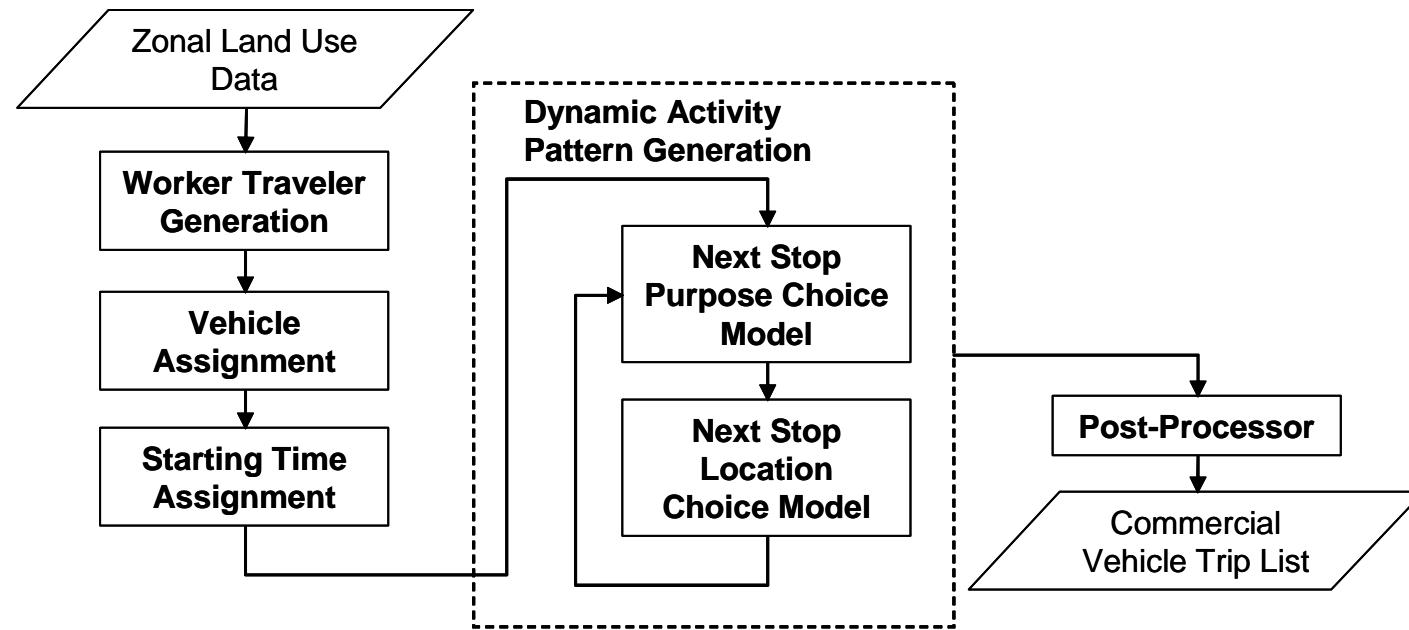




- Land Use
- School Quality
- Population
- Employment (Monday afternoon)



Disaggregate Commercial Vehicle Model



- Employs a tour based microsimulation of employees
- Based on establishment surveys
- Analogous to HH based tour-based model but based at the place of work
- Does not include route delivery vehicles

Employment categorized as:

- Industrial
- Wholesale
- Retail
- Transportation
Handling
- Service

Trip purposes:

- Service
- Meeting
- Goods (delivery)
- Other (includes such things as stopping for lunch or fuel)

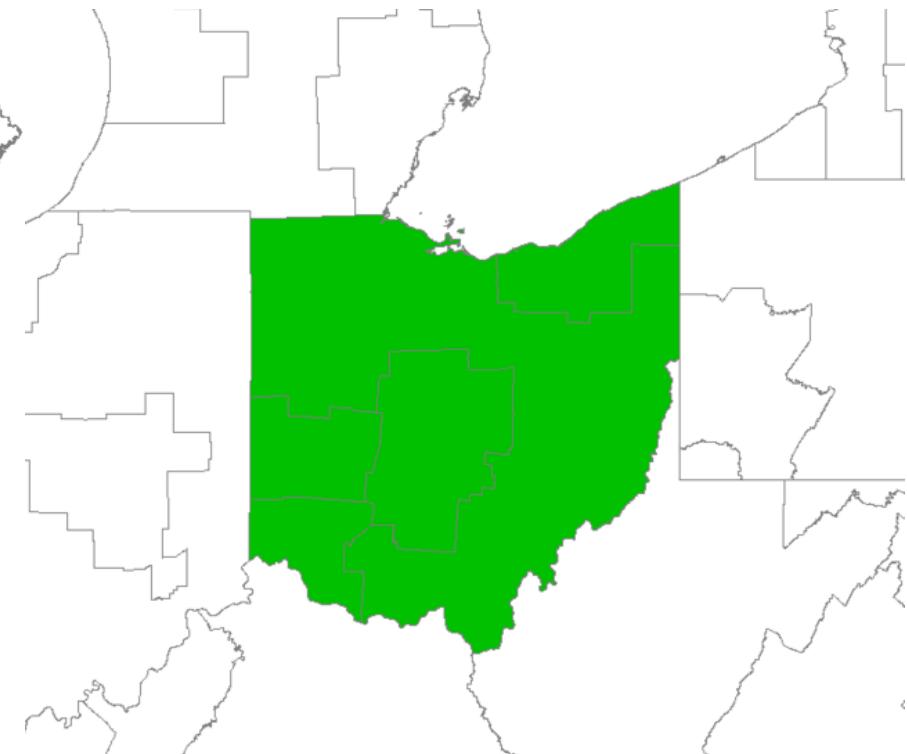
Aggregate Commercial Vehicle Model

- Recently updated to use FAF forecasts as its basis
- Combine FAF zones where TAZs are larger (e.g. western states)
- Disaggregate FAF zones where TAZs are smaller (e.g. halo/eastern states)
- Aggregate FAF flows in Ohio and use SEAM/SLUM to disaggregate to TAZs
 - Allows for freight flows to be sensitive to where the LU model says industries develop

123 Total



5 in Ohio



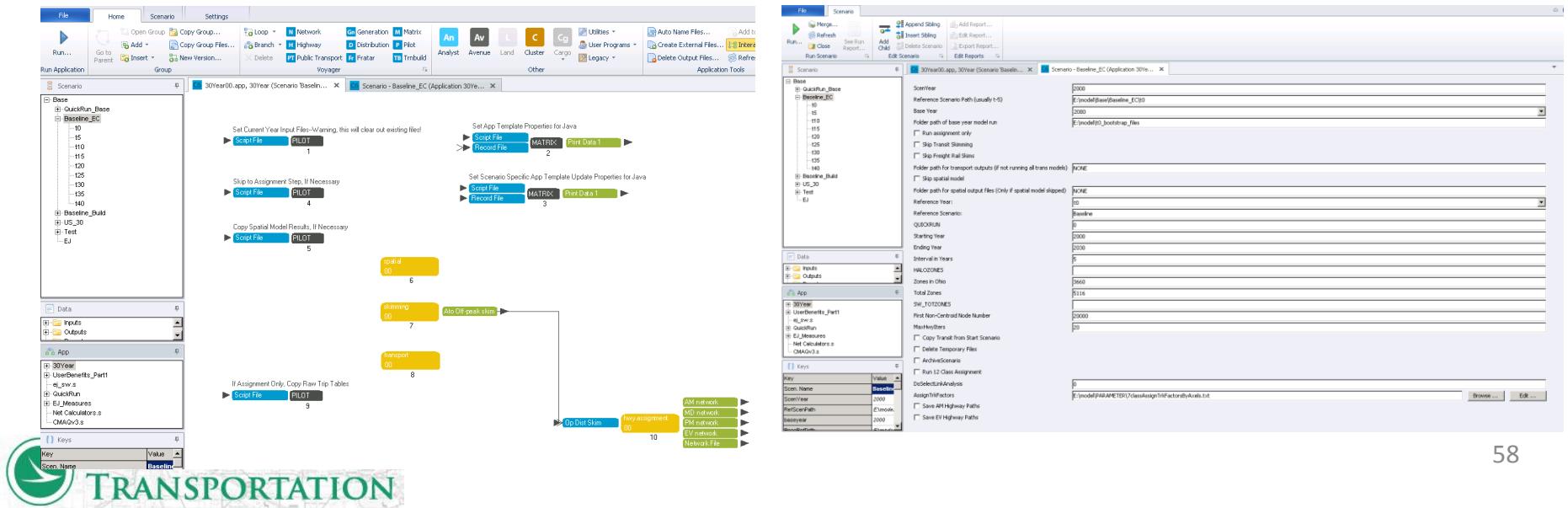
- Bulk rail freight is restricted to zones that have access to a railroad (within 1 mile)
- Containerized freight is sent to an incremental mode choice model that utilizes the base and build intermodal rail skims
- Truck tons are disaggregated by truck sizes and then by payload factors

- MORPC Model Overview
- How Current MORPC Model Works
- Model Investigation Studies
- Issues and Future Directions
- Statewide Model Overview
- **Various Studies**
- Future Directions

- Yes, the model has been used for various studies.
 - Fracking (adding wells, well traffic, new toll road for well traffic, ...) (1 well = ~2500 trips)
 - Major/New Capacity Project Analysis
 - Turnpike Asset Evaluation (Tuesday Morning)
 - Freight Plan (Tuesday Afternoon)
 - Long Range Plan (Sunday Afternoon)
 - Design traffic forecasts ~250 projects/year (Tuesday Afternoon)

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-
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- Quick-run vs. full vs. focus model (Sunday afternoon)
 - Update ACOM to use FAF 3 (Tuesday afternoon)
 - Enhanced User Benefits and Cost Calculator (Sunday afternoon)
 - New User (friendly) Interface
 - Also being developed for 3C model



- Near Term
 - Replace ISAM with economic model outputs
 - Overhaul ACOM – Firm-based modeling
 - Incorporate population evolution
- Long Term
 - Convert SDT to CT-RAMP
 - Decide what to do with LU model
 - Restructure disaggregate models to save and reuse random error terms
 - DTA, SW junction modeling, 20,000 zone system

Crust

2 sticks butter, cut into pats

275g flour (~2 cups)

2 tsp. sugar

1 tsp. salt

3 Tbsp. ice water

Put first 4 ingredients into the bowl of a stand mixer. With the dough hook, run the mixer on medium-low speed until the butter is mostly cut into the flour. Add the ice water and continue mixing until the dough comes together into a ball. Separate into 2 disks, wrap in plastic wrap and refrigerate.



Filling

5-6 Ohio Goldrush Apples* – peeled, cored and thinly sliced

Scoop and a half of sugar (~2/3 cup)

Medium scoop of flour (~1/3 cup)

Fair amount of cinnamon (~1 Tbsp.)

Some nutmeg (~1 tsp.)

Some vanilla (~2 tsp.)

More pats of butter (2-3 Tbsp.)

Stir first 6 ingredients together, making sure that the apple slices separate and get coated in sugar/flour. Roll out one of the dough disks in a generous amount of flour and slide it into a pie pan. Add filling. Place butter pats around on top of the filling. Roll out the second dough disk and cut-out little apple shapes. Slide the top crust onto the pie, crimp the edges, bake at 425 degrees for 15 minutes. Reduce heat to 400 degrees and bake for another 30-40 minutes.

Whipped Cream

Whip (medium-high speed) whipping cream in a cold metal bowl.

While mixing add sugar and vanilla to taste.

Whip until stiff.

* Okay, so you can use other apples, but they won't be as good.

- What's the difference between weather forecasts and traffic forecasts?

- What things should I do if I come early to the Planning Apps Conference?
 - Ohio Wineries and Breweries
 - Ohio was America's top wine producing state from 1860 to prohibition
 - Cleveland Indians Game (all weekend)
 - Columbus Crew (Saturday afternoon)
- Staying late?
 - Cedar Point (15 roller coasters!)
 - Cincinnati Reds

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Question & Answer Period

Please use the Q/A Chat Pod to type and enter questions for the presenters