Prince George's County Planning Department's Transportation Forecasting Model

Presentation to the TPB Travel Forecasting Subcommittee

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Applications – Work Program

- Traffic forecasts for County CIP Projects,
- Area Master and Sector Plans,
- Corridor analysis,
- Trip distribution percentages for traffic impact studies

TransForM Model Development Program

- **25 years of Model Development [1988 - 2013]**

  SYSTEM II DOS based + Graphical User Interface

  TransForM 1.0 to 1.4 Windows-based Interface + ArcGIS; in use since 2003

- **PRESENT [2011 - 2018]**

  TransForM 1.4 Operational, in use through June 2015

  TransForM 1.5 In development. Operational June 2015

- **FUTURE [2018 / 2020]**

  TransForM 2.0 /3.0

TransForM 1.4 – Highlights

- TransForM (Transportation Forecasting Model) 1.4, runs on TransCAD software platform.
  - Calibrated to year 2000
  - In 2012, partially validated to year 2010
- Same geographical area as MWCOG's model.
  - MWCOG's 2,191-zone system expanded to 2,523 zone system with added zones in Prince George's County.
- More highway and transit network detail within Prince George's County.

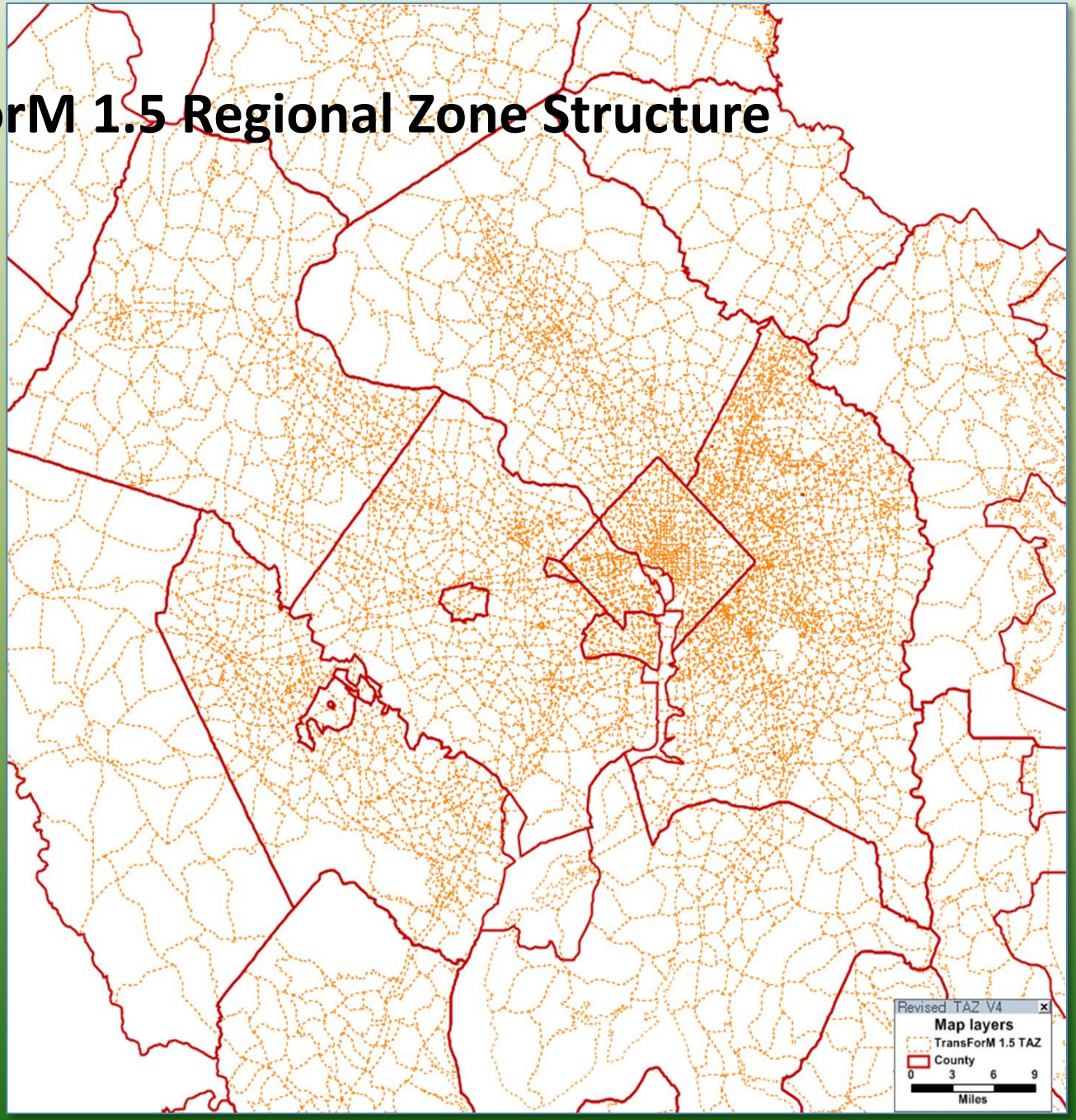
Enhancing TransForM 1.4 - Reasons

- Add greater zone and network detail.
- Improved standards for using zone area types and highway link area types.
- Incorporate functional classes that mirror County road standards.
- Improve the major model components.
- Incorporate the newest available data from the Census, MWCOG, and WMATA surveys as well as other new public databases.

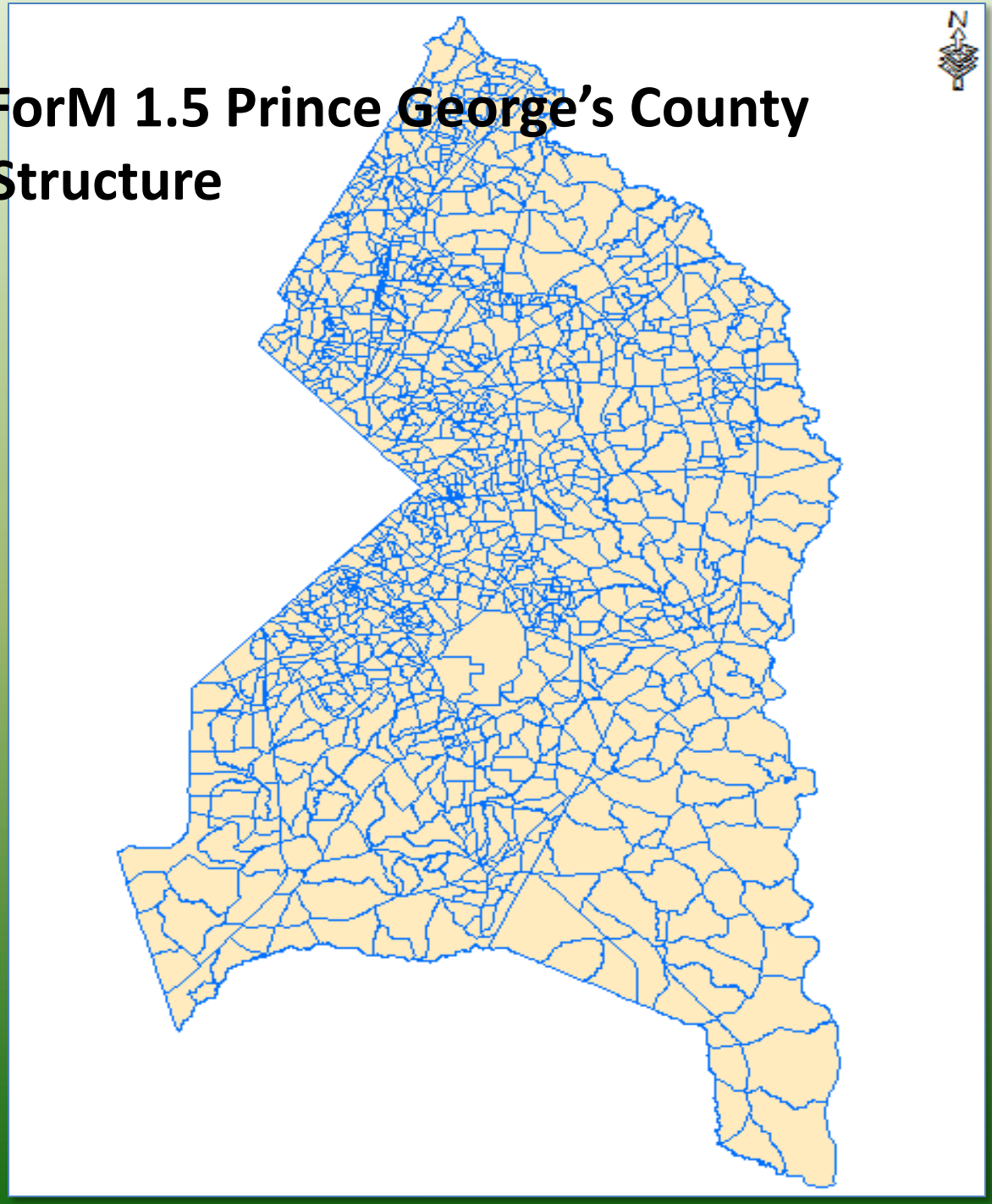
TransForM 1.5 – Networks and Zones

- Conflated detailed networks, years 2010, 2025 and 2040.
- Ten highway facility types (plus zone connectors and transit links).
- TransForM 1.5 zone structure:
  - 1285 zones within Prince George's County
  - overall 4,366 regional TAZs and 47 externals.
- COG's 2.3 Model zone structure:
  - 635 zones within Prince George's County
  - Overall 3,722 regional TAZs.

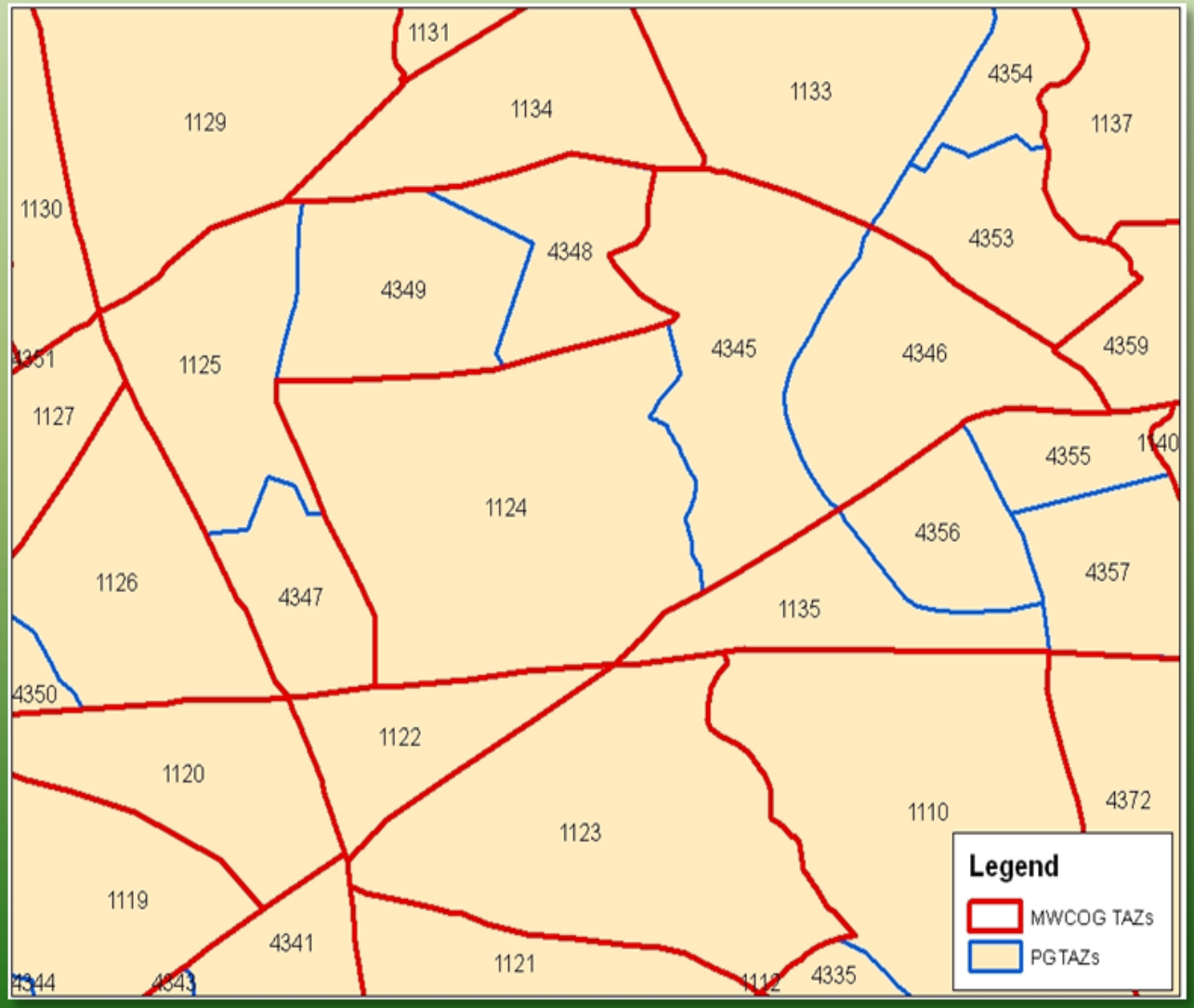
TransForM 1.5 Regional Zone Structure



TransForM 1.5 Prince George's County Zone Structure



MWCOG and TransForM Version 1.5 Zone Structure Within Prince George's County



TransForM 1.5 Area Types

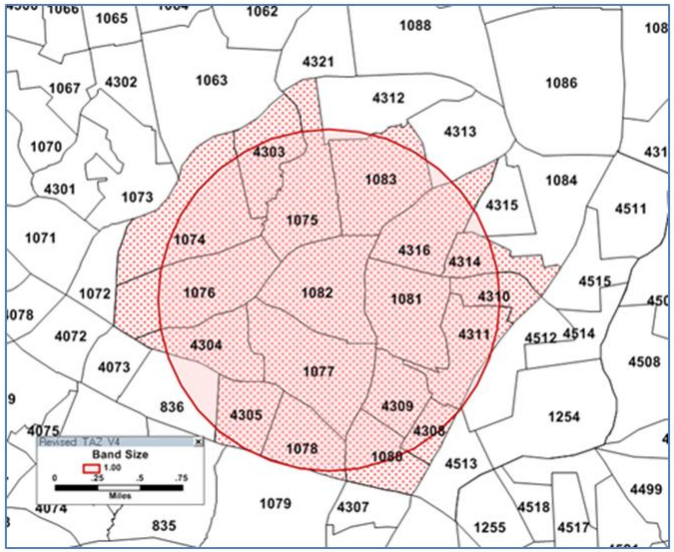
- **Zone area type:**
  - Went from 7 (TransForM 1.4) to 9 area types (TransForM 1.5)
  - Based on density index. DENSITYINDEX = POP_Den + 2.4 * EMP_Den
  - Population and employment densities are calculated for a one-mile radius of zone centroid.

- **Highway link area type**
  - In TransForM 1.4, zone area type is assigned to all the links in a given zone.
  - In TransForM 1.5, link area type is defined based on density index using a half-mile buffer for each link.
    - Link area type might be different than the zone area type for that link.

Table 8 – Area Type Definition in TransForM Version 1.5

Code	Area Type	Definition
1	Central Business District	Density > 200,000
2	Urban Business District	75,000 < Density < 200,000
3	Urban mixed Use	25,000 < Density < 75,000 and TOTEMP >= HHPOP
4	Urban Residential	75,000 < Density < 200,000 and TOTEMP < HHPOP
5	Suburban Business District	3,000 < Density < 25,000 and TOTEMP >= HHPOP
6	Suburban Residential	3,000 < Density < 25,000 and TOTEMP < HHPOP
7	Rural Business District	100 < Density < 3,000 and TOTEMP >= HHPOP
8	Rural residential	100 < Density < 3,000 and TOTEMP < HHPOP
9	Rural	Density <= 100

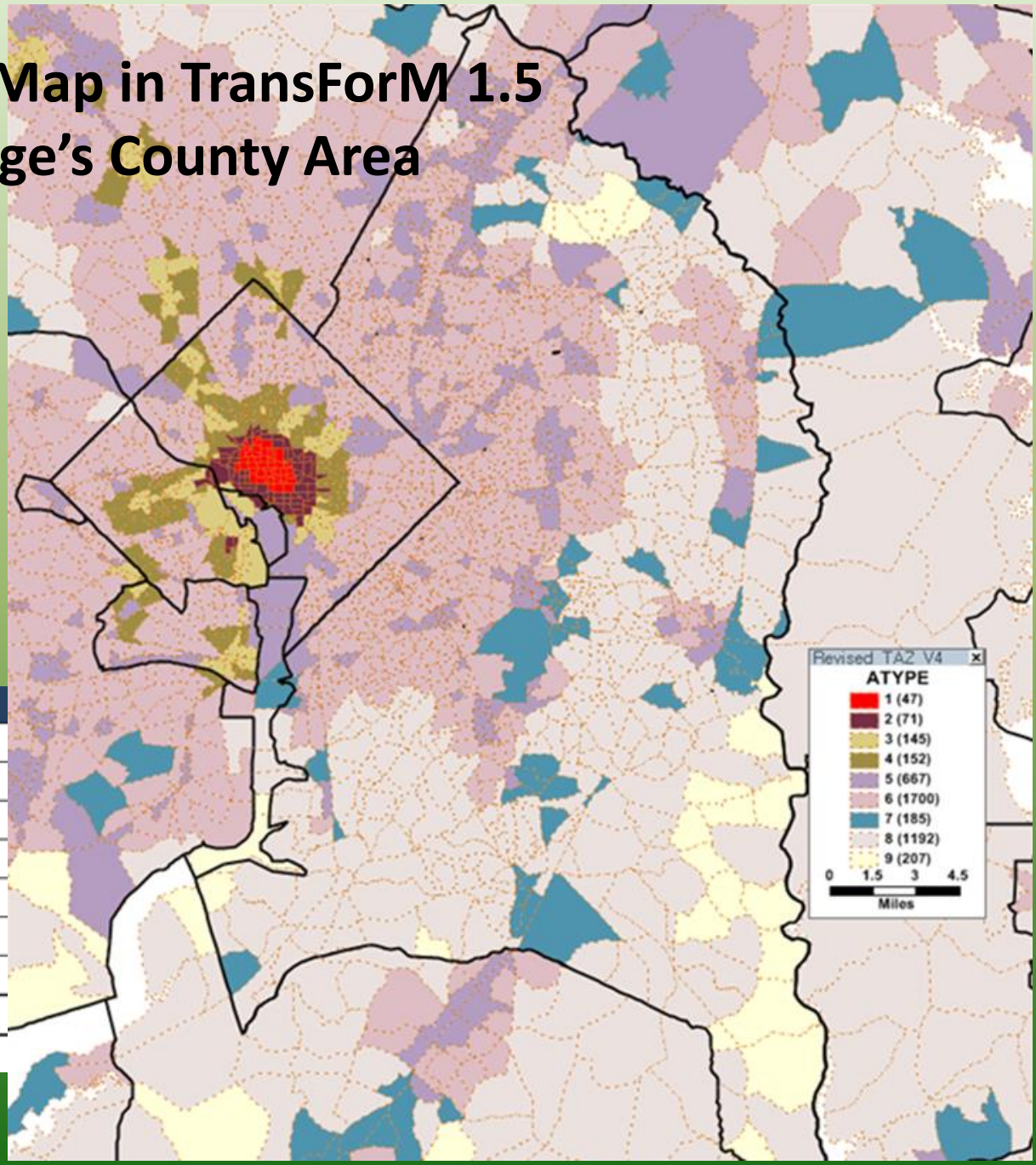
Figure 4 – Selected Zones within One Mile Distance of a Zone 1082 for Area Type Calculation



DENSITY = (HHPOP + 2.4*TOTEMP)/AREA

Zone Area Type Map in TransForM 1.5
Prince George's County Area

Code	Area Type
1	Central Business District
2	Urban Business District
3	Urban mixed Use
4	Urban Residential
5	Suburban Business District
6	Suburban Residential
7	Rural Business District
8	Rural residential
9	Rural



TransForm 1.5 Facility Type

Facility Type Code	Facility Type Definition
0	Connector
1	Freeway
2	Expressway
3	Major Arterial
4	Minor Arterial
5	Major Collector
6	Collector
7	Local Street
8	Ramp
9	Frontage Road
10	Industrial Road
11	Non-Highway (train and train access)

Facility Look-Up Tables

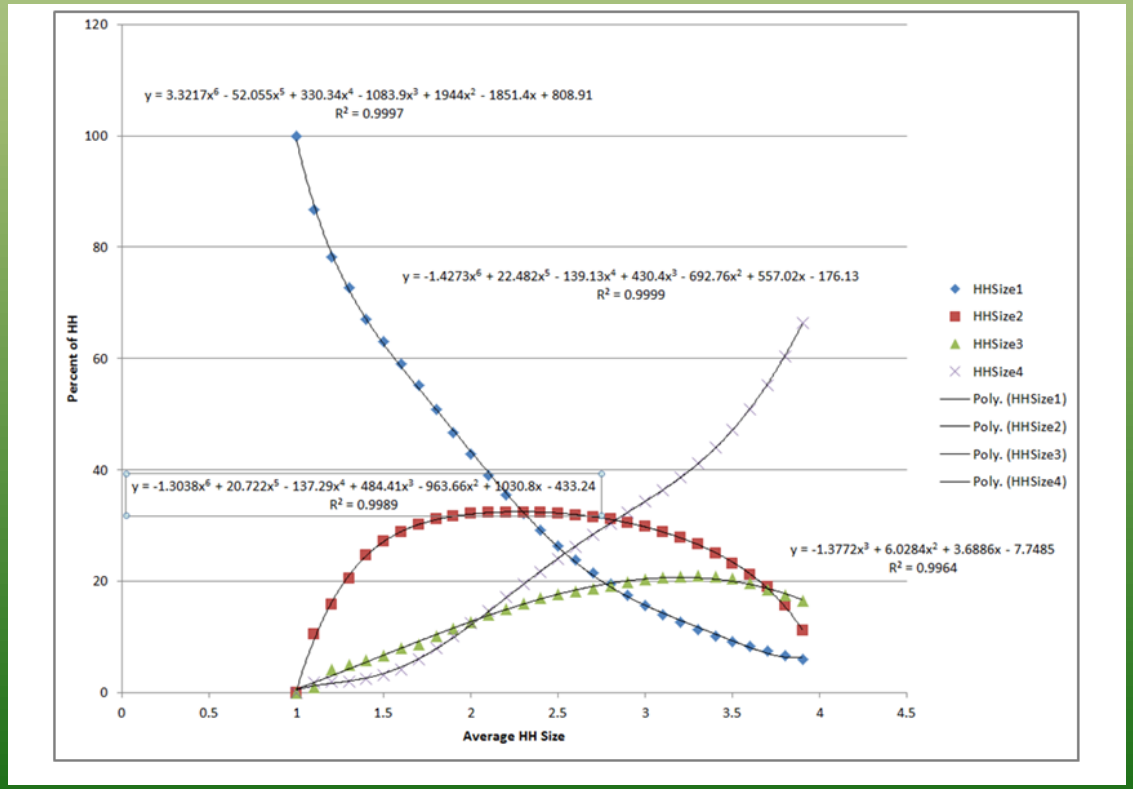
- Model uses speed and capacity look-up tables based on FTYPE (facility type) and ATYPE (link area type).
  - Speeds and capacities for facility types vary according to highway link area type
  - Overrides of free flow speed and capacity factors are available to the user.
- Model uses lookup table that defines volume-delay functions for different facility types.
- Based on Bureau of Public Roads (BPR) volume-delay functions.

Trip Generation/Distribution

- Enhancements:
  - Conversion of NHB to NHBW/NHBO
  - All trip rates are calibrated on 2008 HH Travel Survey.
  - Use of regression equations to split zonal household data by HH size, HH income, and vehicle ownership. No more 4x4x4 matrices.
- Updated attraction rates.
- Updated trip lengths, adjusted friction factors, will add K-factors, if necessary.

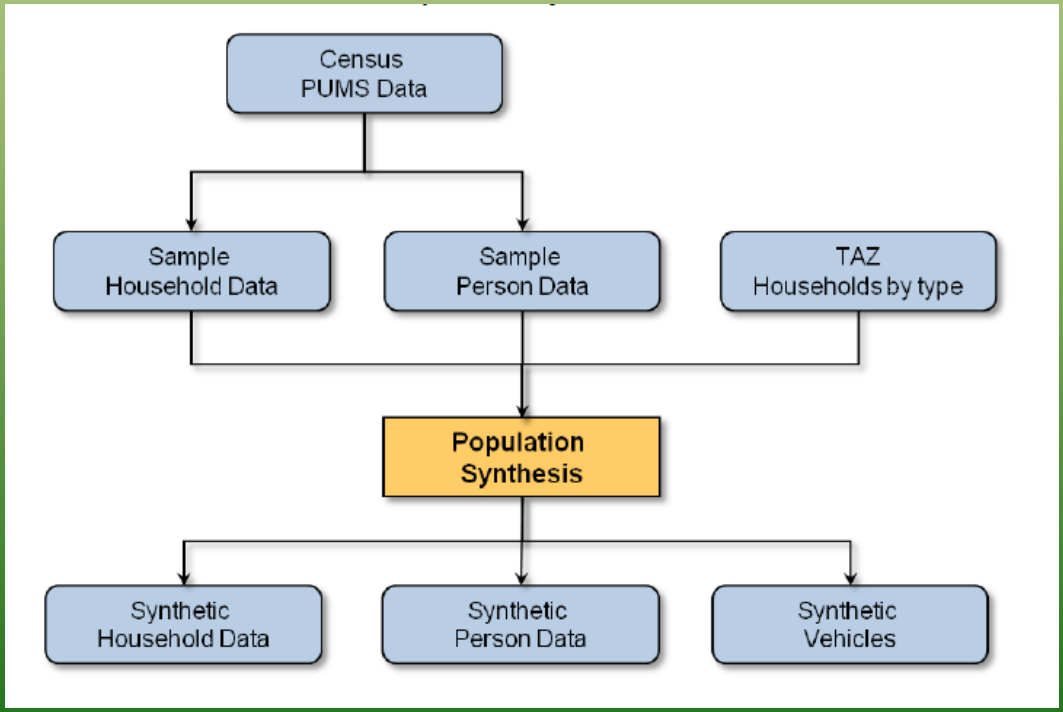
Change to Demographic Sub-Model

- TransForM 1.5 will replace use of output lookup tables (the 4x4x4 matrix).
- AECOM developed regression equations based on MWCOG lookup tables.



Population Synthesis Model

- Uses the American Community Survey (ACS) 5-year Public Use Microdata Sample (PUMS) disaggregate database.
- Creates new zonal person and household files for the trip generation model.



Trip Production Rates

- Person trip rates for HBW, HBS, HBO, NHBW, NHBO
  - Vary depending on trip maker's residence for HBW, HBS, and HBO
  - Vary depending on trip origin for NHBW and NHBO
  - Vary according to HH workers, vehicle availability, and HH size
- Used 2008 HTS survey for year 2008 to estimate the person trip rates.

Trip Attraction Rates

- Uses employment characteristics of the zones to estimate the attracted trips to each zone.
- Values updated based on HTS 2008 and on MWCOG 2.3 model.
- Trip attraction model estimates motorized and non-motorized trips for HBW trips and motorized for all other trip purposes.
- Truck trip rates in the model are identical to the ones in TransForM 1.4 which is based on the MWCOG model.

Mode Choice

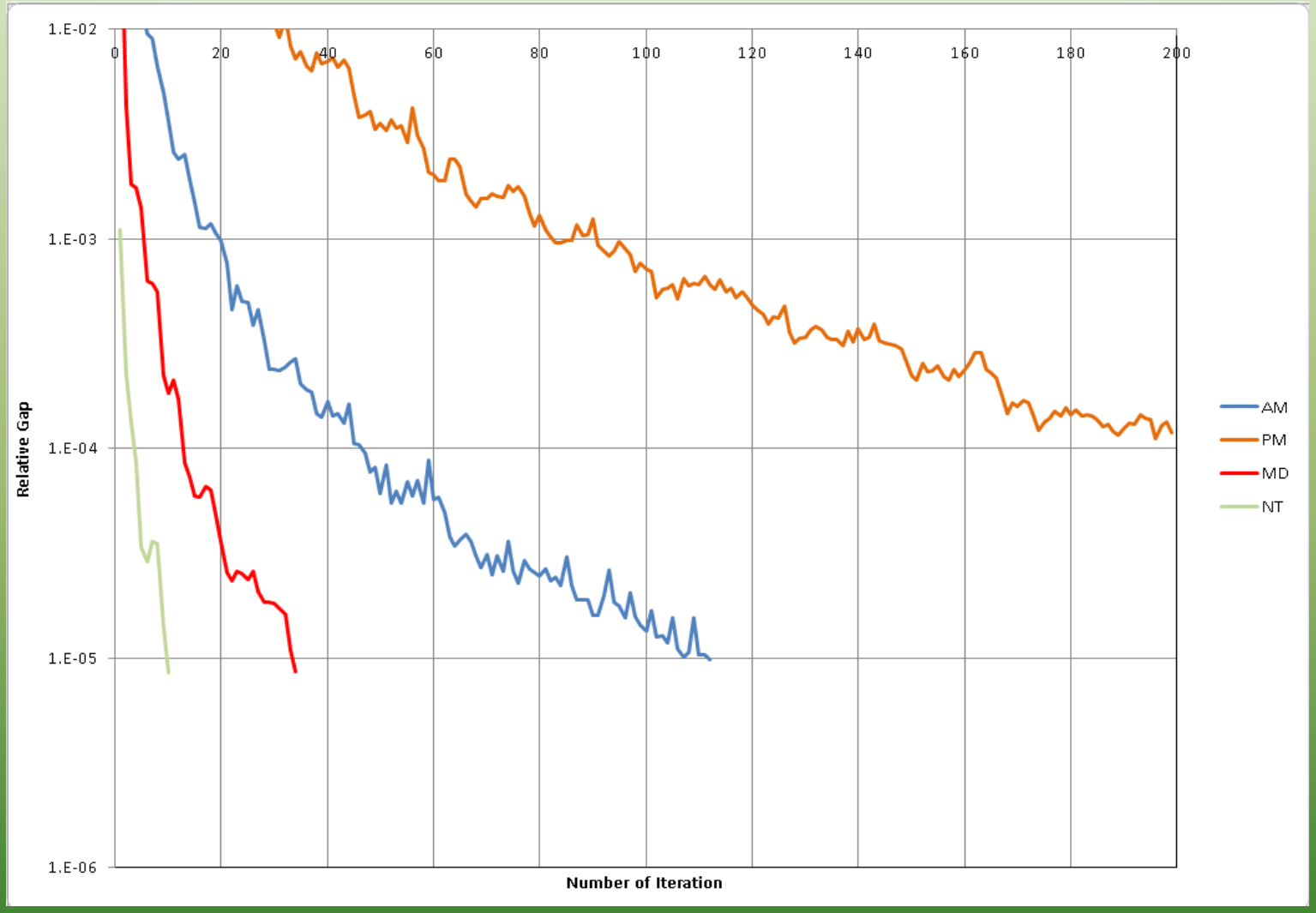
- Enhancement: Use of TRANSIMS open source Mode Choice Program using the WMATA model (a nested logit model).
- Incorporation of new data: WMATA/COG/HH Survey.
- Calibration based on targets by mode, trip purpose, HH vehicle availability, etc.
- Targets created from recent on-board transit surveys.
- Will include a new set of mode choice constants

Assignment - Time-of-Day Changes

- Updated - New percentages - trips in four time periods based on 2008 HH travel survey by trip purpose, AM, PM, Mid-day, Night
- Updated time of day factors.
- Updated highway link capacity for each modeling period.
- Updated and calibrated diurnal distribution factors.

Traffic Assignment

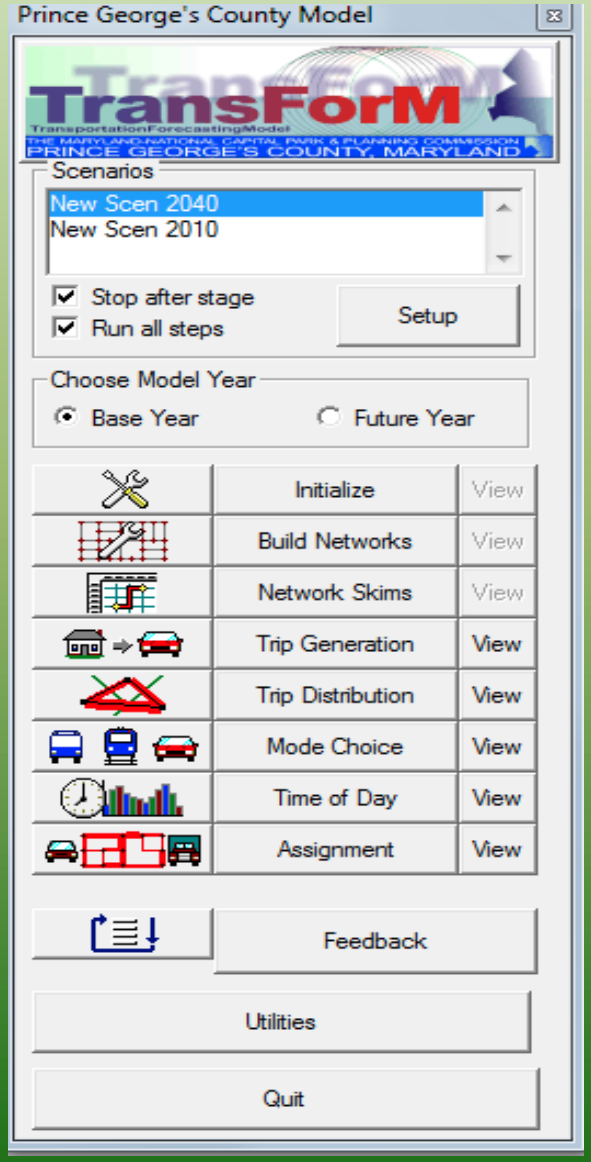
- Results based on 250+ iterations, VMT gap 0.00001, and four feedback loops, using an origin user equilibrium assignment (OUE)
- Enhanced scripts - multi-class trip assignments by purpose and vehicle occupancy.
- Checked link speeds, ramps, made adjustments to link attributes when needed – FF speed/capacity.
- Enhanced transit path builder based on new transit surveys – compared ridership/boardings – validated.



Running Times ➔ NT: 00:38:38 MD: 01:56:13 AM: 06:13:14 PM: 10: 53:40

TransForm 1.5 – Select Link/Taecom/Torpe

- Select Link Analysis
  - Link to link; Zone to zone;
  - by mode type [SOV, HOV2, HOV3];
  - by trip purpose
- Input - Output modules
  - TAECOM - TransForM Analyze, Edit, and COMpare
  - TORPE - TransForM Output Report ProcEssor



Model Execution

- TRANSCAD 6.0 software, 64-bit operating system.
- Dell Precision T5600 computer.
- 12 cores – 32 GB RAM, 836 GB
- Intel ® Xeon ®CPU E5-2630 - 2.32GHz
- Four step model run – 4 feedback loops - 250+ iterations or gap of 0.00001 or -10^{-5}
  - Run time 22.5 hours cold start (entire 4-step process)
  - Run time 8.5 hours warm start (re-running a prior result with minor network changes)

TransForM Model – next steps

- **TransForm 2.0 – Hybrid TransCAD-TRANSIMS**
- **TransForm 3.0 – Full Activity Based Tour-Oriented Model**


TransForM
TransportationForecastingModel
THE MARYLAND-NATIONAL CAPITAL PARK & PLANNING COMMISSION
PRINCE GEORGE'S COUNTY, MARYLAND

Questions ?