Baltimore Metropolitan Council

An Innovative Approach to Truck Modeling

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Introduction

- Why improve Truck Modeling capability?
  - Air Quality/Modeling Interest
    - Baltimore is a severe non-attainment area for Air Quality
    - Concern over accuracy of old Truck model
  - Freight Planning Interest
    - To better model areas around the Port of Baltimore
    - To better model Truck Traffic along major truck routes
    - To better account for future Truck Traffic growth

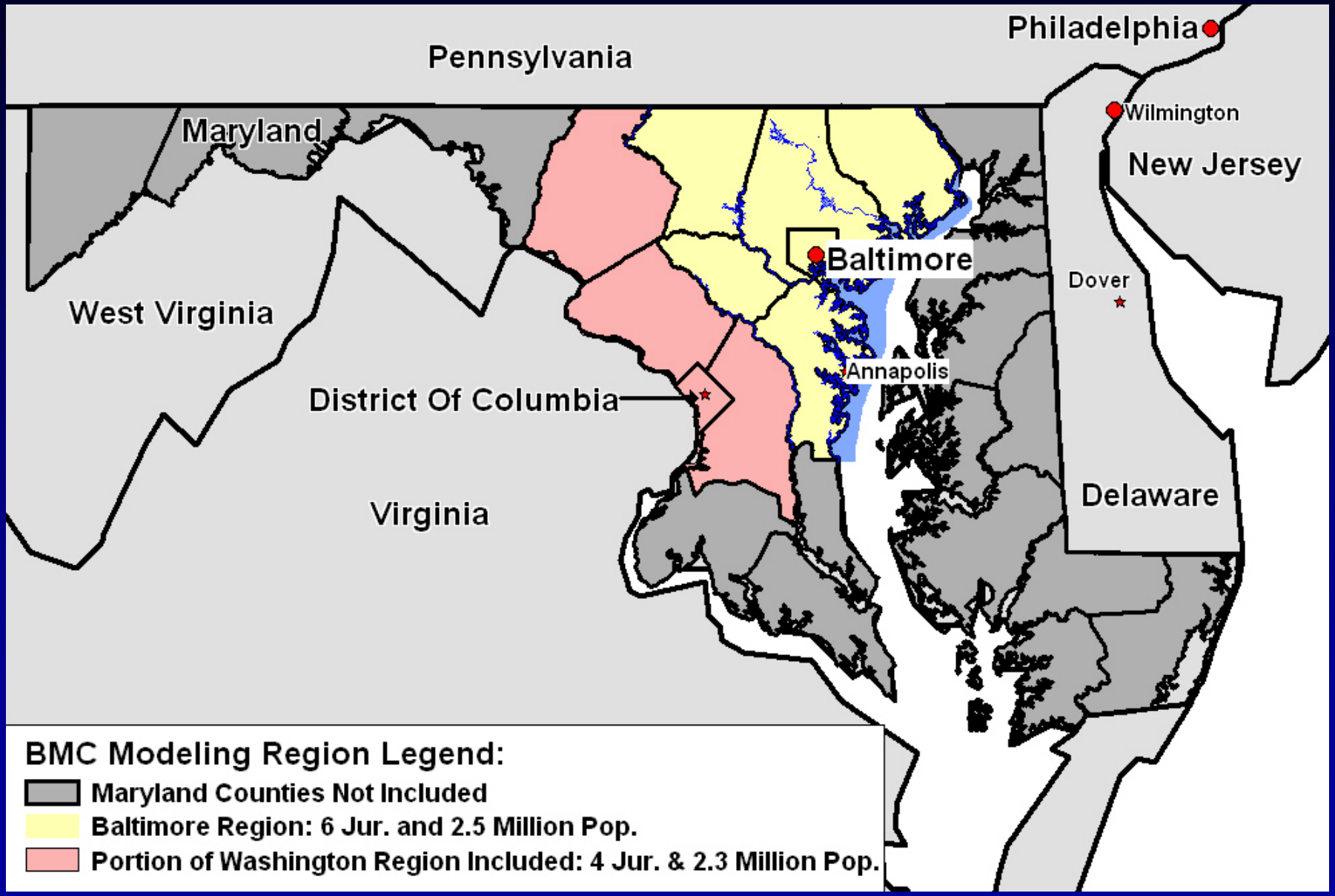
Introduction

- Partners involved in Project
  - Air Quality/Modeling Interest
    - BMC Modeling/Technical Staff
    - MPO Technical Committee
  - Freight Planning Interest
    - BMC Freight Planning Staff
    - MPO Freight Committee
    - Port of Baltimore Staff
    - Neighboring MPO Staff

Overview of BMC Model

- Traditional 4-Step Model
- 1,463 Modeling Region TAZs
  - Baltimore Region = 1,151 TAZs
  - Portion of Washington Region = 270 TAZs
  - External Stations = 42 TAZs
- 32,000+ Links
  - Baltimore Region = 21,000+
  - Portion of Washington Region = 11,000+
- Uses TP+/VIPER software

BMC Modeling Region



History of Truck Modeling at BMC

- (1959-62) Truck Survey conducted as part of Baltimore Metropolitan Area Transportation Study (BMATS)
- (1964-65) New Truck Models developed from BMATS survey
- (1995-96) – Unsuccessful Truck Survey
- (2002-03) New Truck models developed

Definitions: What is a Truck?

- Heavy Truck: 3+ axles

- Medium Truck: 2 axles, 6 tires
  "Box/Panel", e.g., UPS

- Commercial Vehicle:
  light/medium duty vehicles
  used for business

Methodology: Overview of Adaptable Assignment

- What is it?
  - Work backwards from count data to develop a model
- Why use it?
  - Traditional Truck Survey approach is generally too costly
  - Cheaper, easier, and faster
  - More accurate assignment results

Methodology: New Truck Models

- Old Truck model unsuitable as a starting point
- New Models for Heavy and Medium Trucks developed separately
- Phoenix Truck Model from FHWA Quick Freight Response Manual used as starting point
- Adjustments made using models from other areas

Methodology: Features Added

- Truck Special Generators
- Truck Prohibitions (Daily only)
- Truck Passenger Car Equivalents
  - For V/C calculation
  - Based on 2000 Highway Capacity Manual
  - Heavy Trucks = 2.0 cars, Medium Trucks = 1.5 cars
- Sensitivity for Land Use
  - Using Model's 4 Density Codes: CBD, Urban, Suburban, and Rural
- Sensitivity for Jurisdiction
- Improved method for estimating External Truck Trips

Methodology: New Truck Models

- New models based on employment: retail, industrial, and office and households
- Observed truck trip tables synthesized from 600+ counts
- Truck trip tables used to systematically improve truck models in an iterative process
- Delta Calibration adjustment table created to account for differences between observed and estimated trip tables

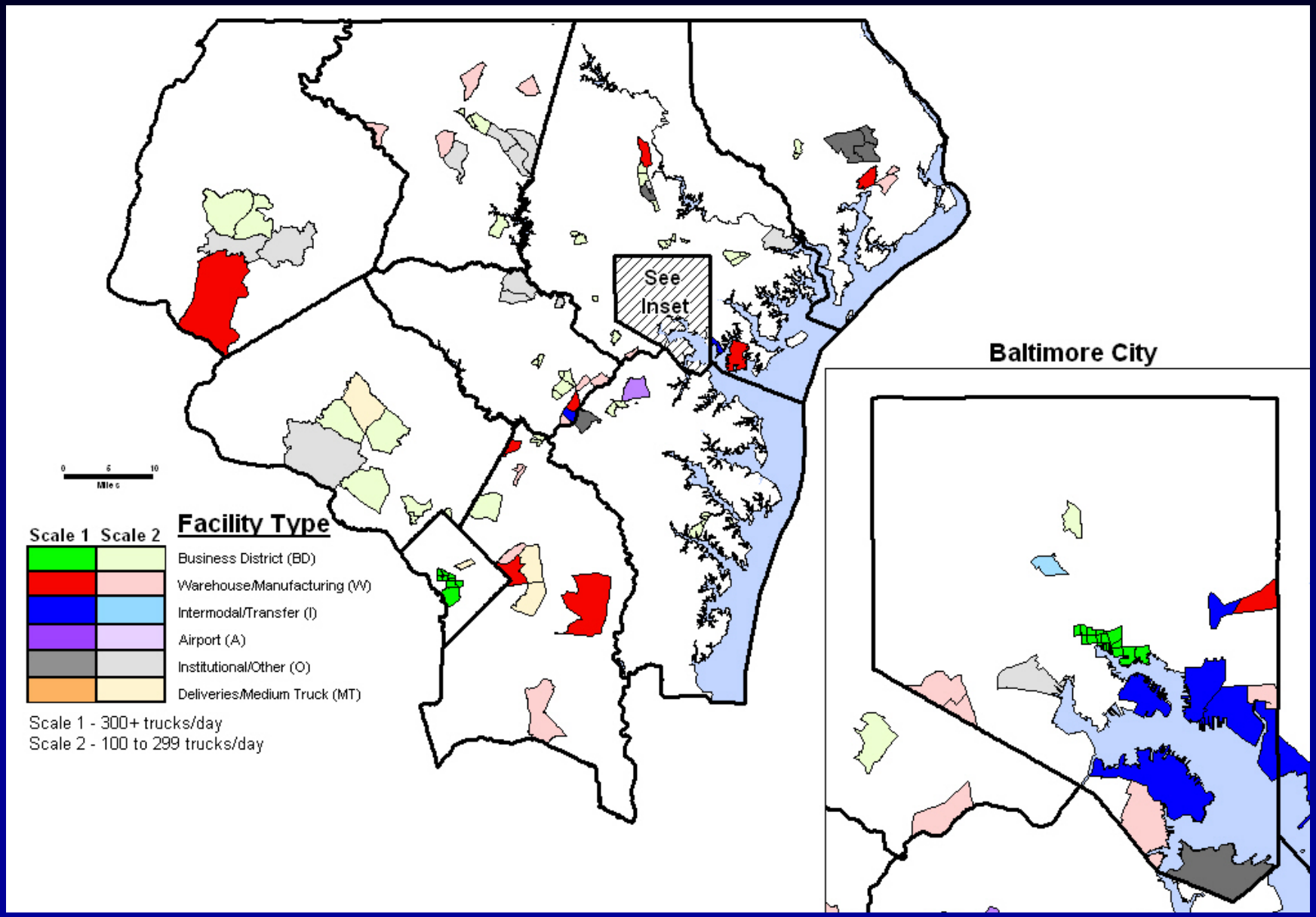
Truck Special Generators

- Created to address problem of under simulation in areas of high truck activity
  - Higher than average trips/employee
- 127 TAZs selected
- Selection process based on input from:
  - Modeling/Technical Representatives
  - Freight Planning Representatives
- New Truck Zone variable created for categorizing zones into different types of Truck Activity

Description of Truck Zone Categories

Truck TAZ Type	Scale (Trucks/Day)	
	Large	Small
Business District (BD): central business districts, major retail areas/large malls, colleges	Baltimore DC	Annapolis Columbia Towson
Warehouse/Manufacturing (W): warehouse, manufacturing, & processing facilities, industrial parks	300+	100-299
Intermodal/Transfer (I): facilities where freight transfers from truck to another mode	300+	100-299
Airport (A):	300+	100-299
Institutional/Other (O): quarries, landfills	300+	100-299
Delivery/Medium Truck (MT): facilities that process mail or primarily generate medium truck activity	300+	100-299

Map of Truck Special Generators



Results: New vs Old Models

- Big Differences as New Model has:
  - 71% Fewer Medium Trucks
  - 133% More Heavy Trucks
  - More Future Truck Growth
- New model traffic assignments are much more accurate

Differences: New vs Old Models

Measure	Heavy Truck	Medium Truck	Commercial Vehicle	Personal Car	All Vehicles
2000 Vehicle Trip %					
Old	0.9%	7.2%	N/A	91.9%	100.0%
New	2.1%	2.1%	7.0%	88.8%	100.0%
% Growth: 2000-2025					
Old	25.7%	19.6%	N/A	22.0%	21.9%
New	41.1%	22.1%	33.3%	22.6%	23.8%

Traffic Assignment: New vs Old Models

Facility Type	Heavy Truck Traffic Percentages			Medium Truck Traffic Percentages		
	Count	New Model	Old Model	Count	New Model	Old Model
Freeways	6.8	7.1	2.4	3.1	2.9	11.4
Arterials	3.9	4.0	1.2	2.6	2.5	8.2
Collectors	4.7	5.1	0.9	3.0	3.0	7.5
All Roads	**5.8**	**6.0**	**2.0**	**2.9**	**2.7**	**10.6**

Accuracy: New vs Old Models

% RMSE	Heavy Truck	Medium Truck	Commercial Vehicle	Personal Car	All Vehicles
Old Model	394%	138%	N/A	45%	43%
New Model	27%	24%	13%	36%	34%

Adaptable Assignment vs Traditional Survey Based Approach

Criteria	Adaptable Assignment	Traditional Survey Based Approach
Cost	$42,500	$500,000-$1,000,000 Est. $325,000 in 1995-1996
Time	1 year	2-3 year Est.
Primary Work Activity	Obtaining/Organizing reliable count data Selecting truck special generators	Truck Survey
Data Obstacles	Maintaining consistency in Local/State count data No average truck trip length to compare model results to	Obtaining adequate truck survey results for model development Inadequate survey data at External Stations

Conclusions

- Adaptable Assignment model development faster and cheaper than Traditional Survey based approach
- Adaptable Assignment approach showed significant improvement over old model in accuracy and logic
- Importance of including technical and policy staff and committees critical to success of project