

## **AGENDA ITEM A:** **WELCOME & INTRODUCTIONS**

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Michael Chiume

## **AGENDA ITEM B:** **PROJECT STATUS / SCHEDULE**

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Bob Donnelly

## Project Status / Schedule

- Overall, about 80% complete
  - Major data updates – SED, Counts, Tolls, etc. completed
  - **NYBPM 2010 Update – Final Version Stage 2.0 in Progress**
    - SED forecasts – revised future year allocation for NYC (100%)
    - Stage 2 BPM Update Base Year Highway network conflation and attribute integration for (100%) \*
    - Transit (EHR) transit network & assignment calibration (35%) – *PB and AECOM active now that Tier 1.2 TAZs are fixed*
    - Second pass at TAZ system: Census 2010 tract-based – major expansion in number of zones in NY (Tier 1.2) (98%)
    - External Out-of-Region analysis and forecasting methods (90%) \*\*
    - Improved Truck and CV models (85%) \*\*
  - Overall project completion date was extended to mid-March 2014.
  - Total Project GANTT Chart not updated, but a detailed flow chart of final stage model integration and project completion steps in development and will be shared with NYMTC end of this month.
- \* ***Focus of this meeting***

## **AGENDA ITEM C:**

### **TASK 13: OUT OF REGION ANALYSIS / EXTERNAL MODEL (TO 3-K)**

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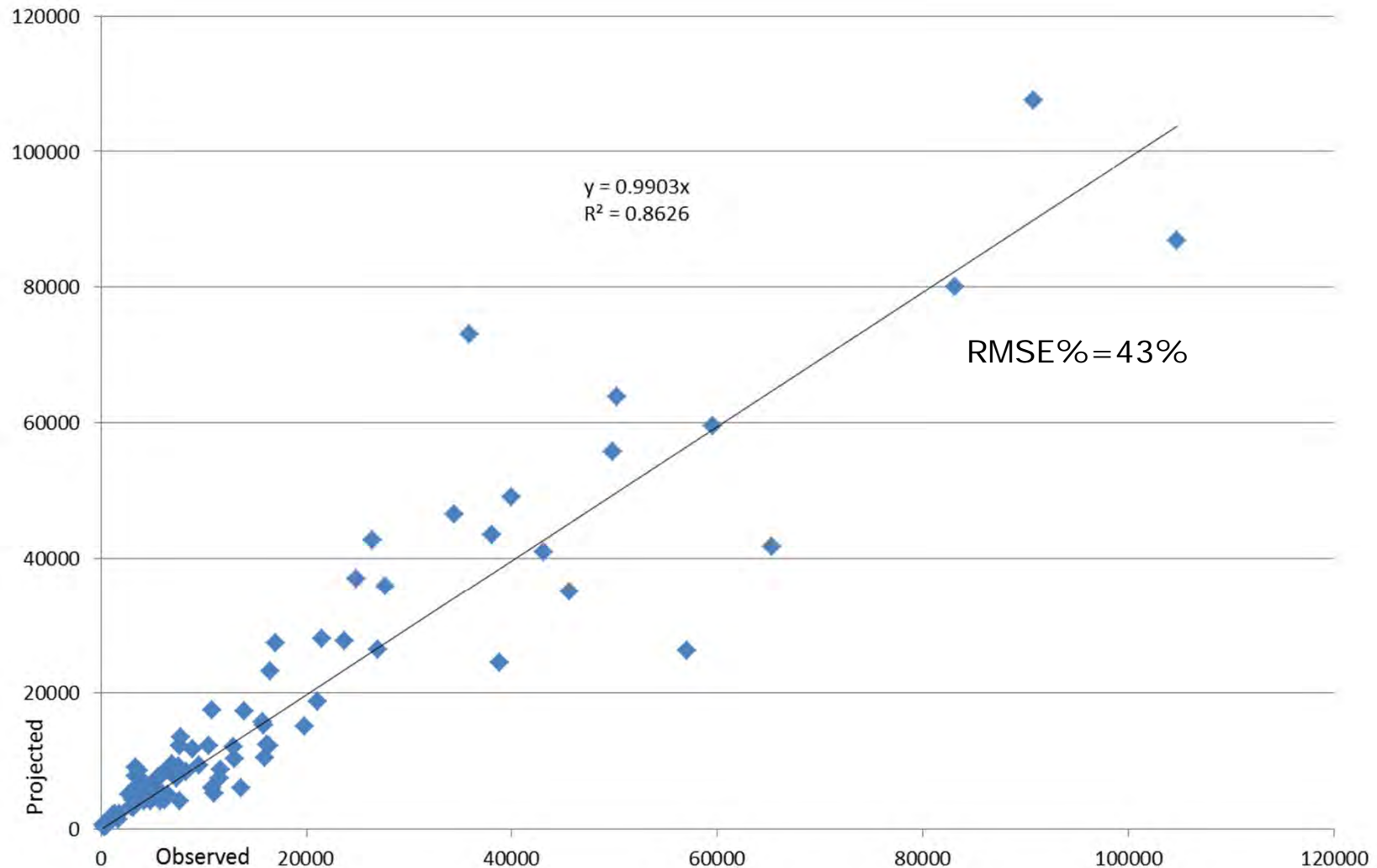
Pascal Volet

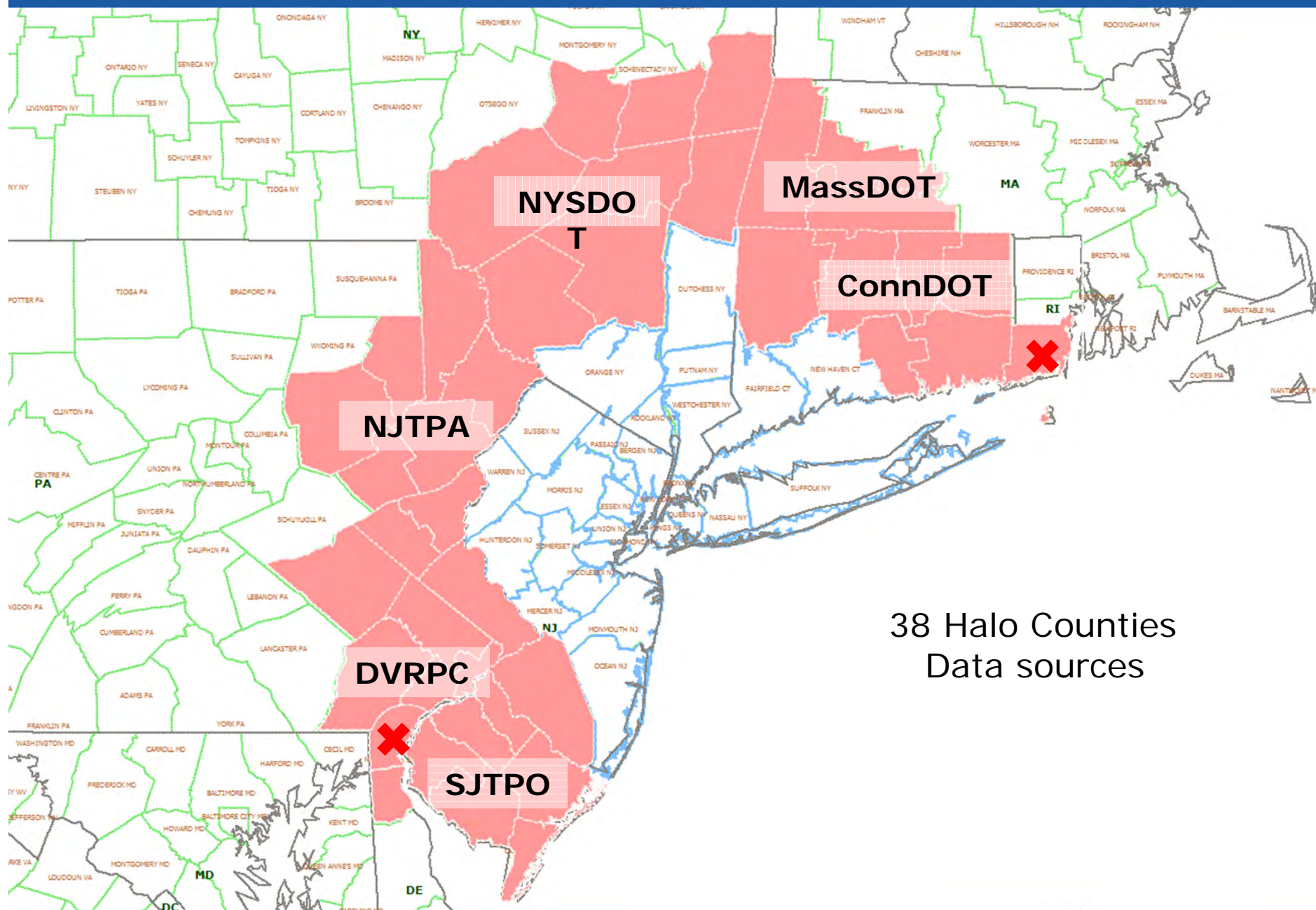
# Update External Trips Model

- Why Change?
  - To be able to link core models to out-of-region trips
  - Count based growth forecasts out-of-date 15 years later
  - Ability to forecast based on evolving pop/emp growth
- Data Requirements
  - Forecasts available from public sources (pop/emp)
  - National network already available from FAA study
  - BPM sub-network to remain frozen at 2G (2005 base)
  - Zone system compatible with 2010 tier 1.2

# Comparison of 2010 Counts to Original Forecast

External stations

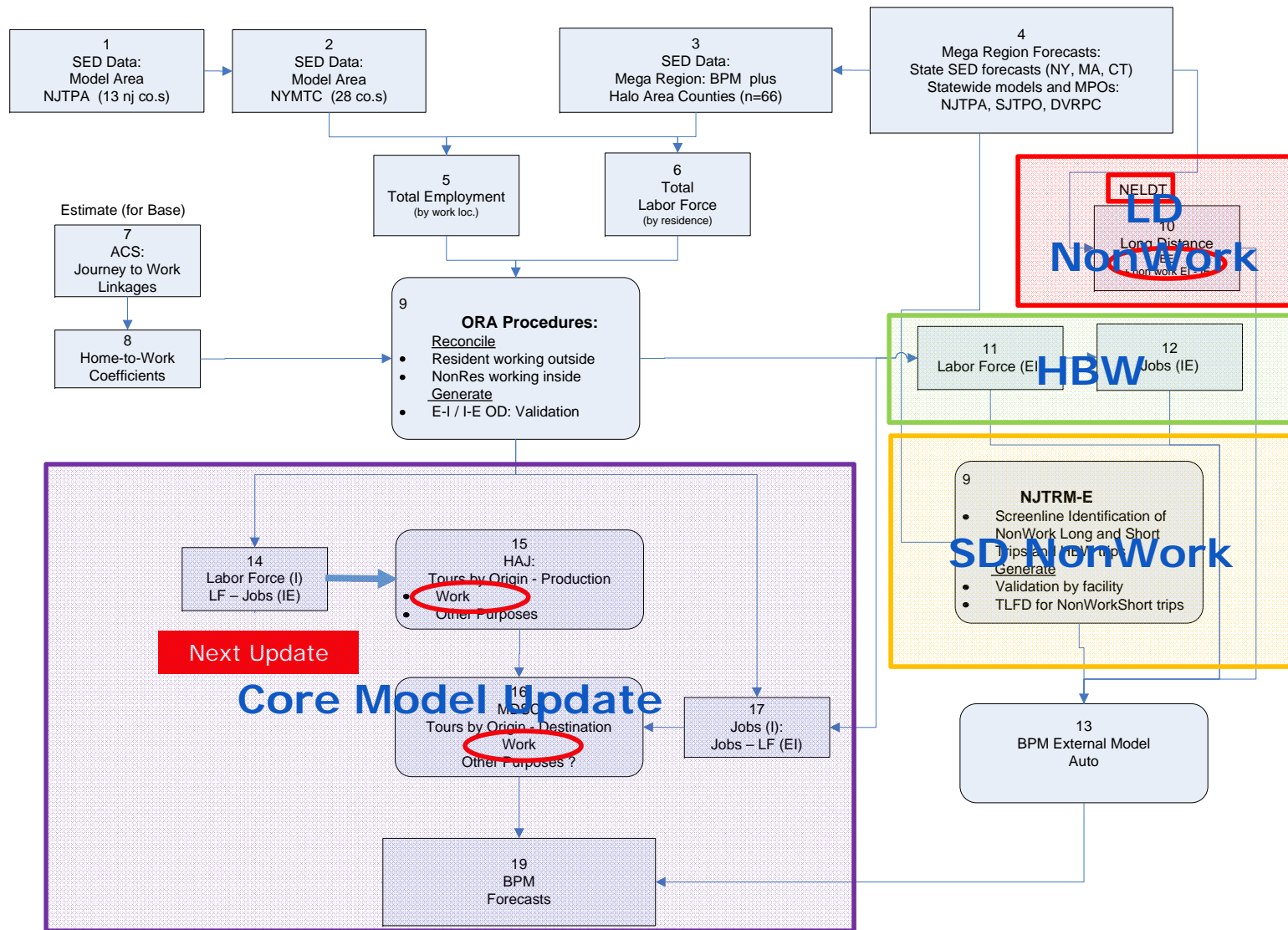




38 Halo Counties  
Data sources



## Task Order 3-K: Improved BPM Forecasting with Out of Region Analysis - Framework

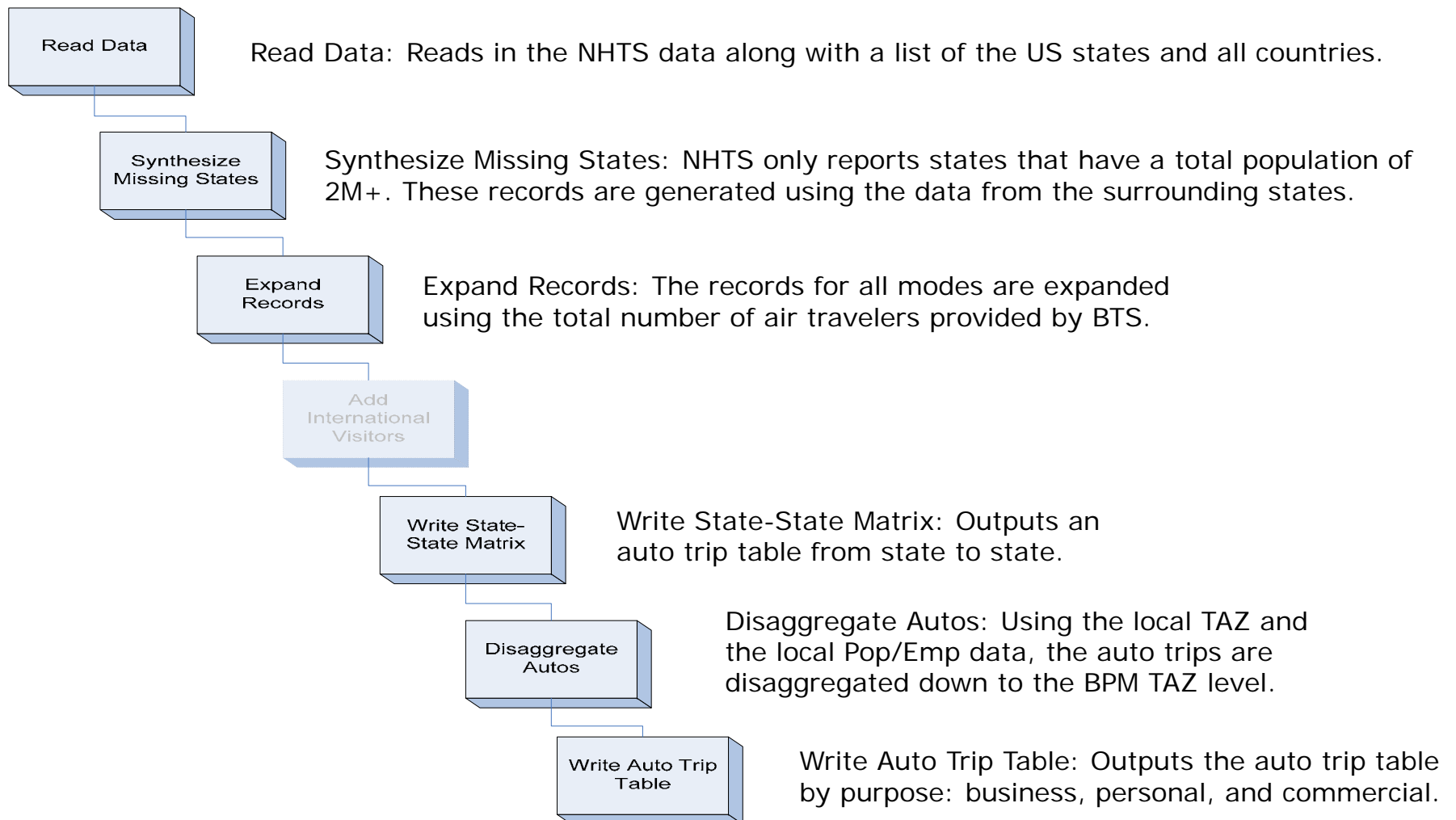




## Long Distance Trips - Approach

- Long-distance non-Work trips to use NELDT
  - National Evaluation of Long-Distance Trips (Java based)
  - Uses National Household Travel Survey (2001 NHTS) as input
  - Forecast based on overall population growth
- Uses 3 out of 4 NHTS purposes
  - Commute purpose left out
  - Outer purposes: business, personal, commercial
- National Model Network Needed for Assignments
  - Truck model and NELDT integrated in same network
  - BPM sub-area trip-tables extracted from national network
  - Core model traffic used as background for assignments

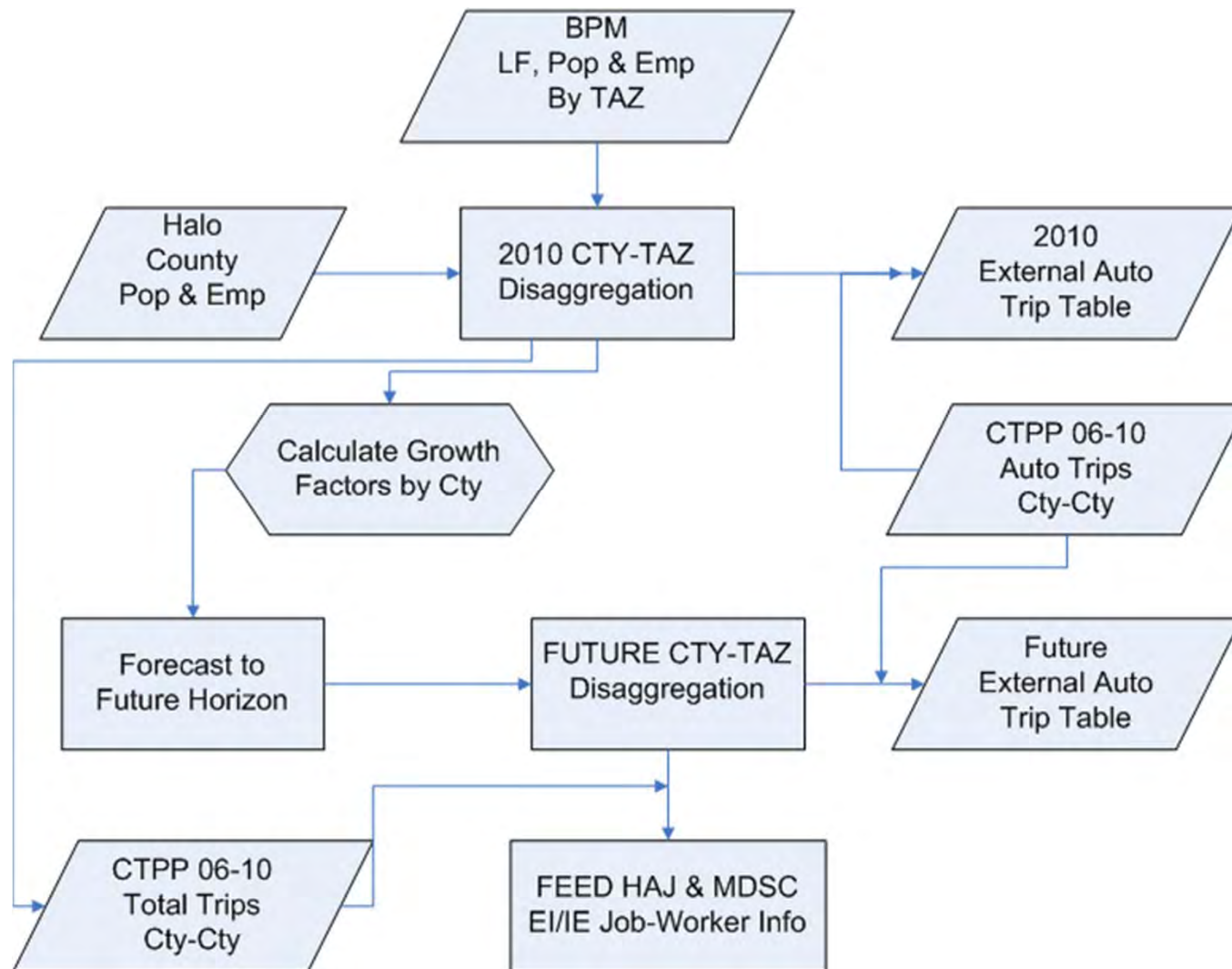
# NELDT Process



## HBW Trips - Approach

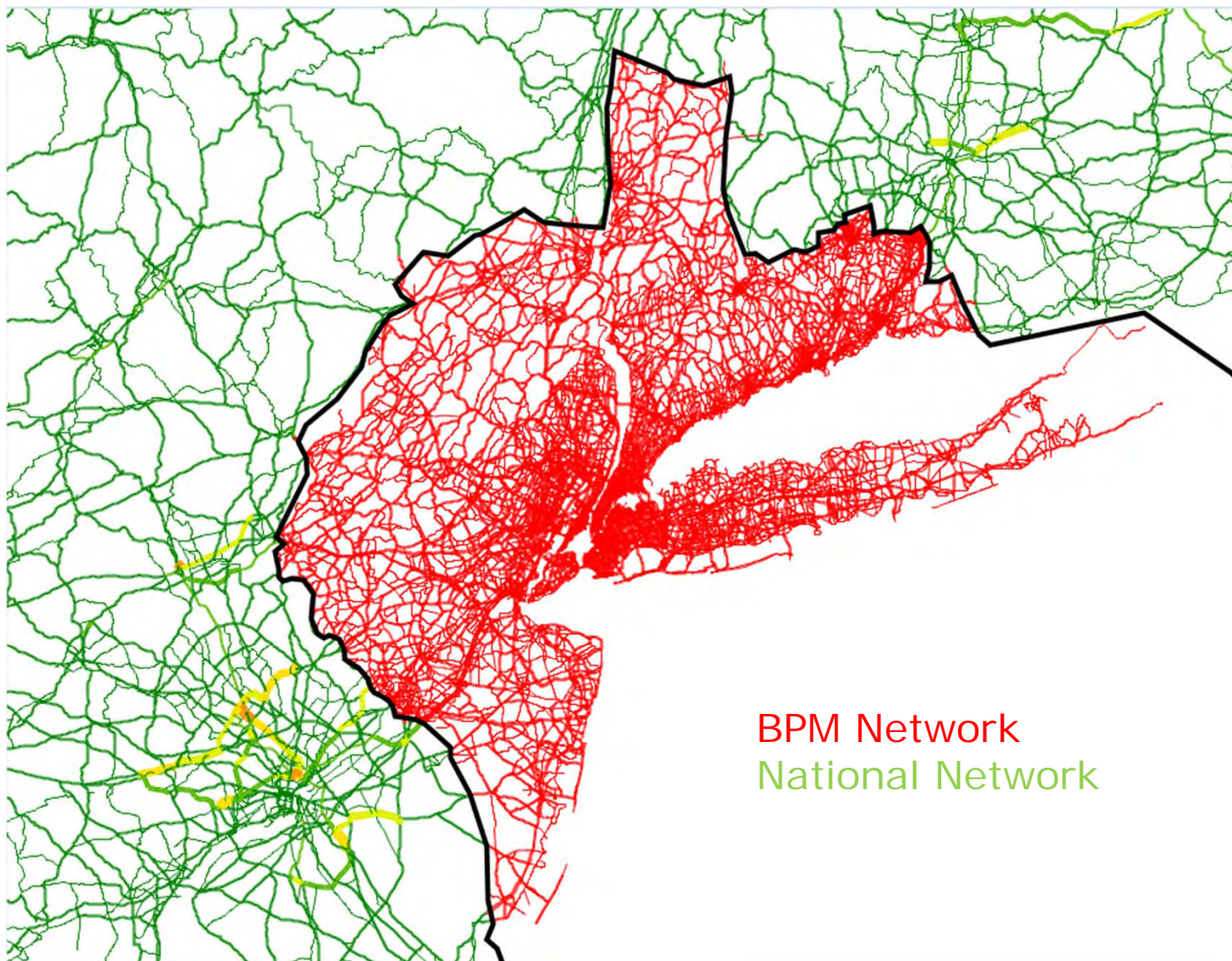
- 38 County Halo around BPM area
- Use of External Population & Employment Growth
  - Input received from NYSDOT, ConnDOT, MassDOT (statewide models)
  - Input received from DVRPC, SJTPO, NJTPA (MPO regional models)
- Fratar Model For All Work Trips (PANYNJ)
  - Based on CTPP 2006-2010 (auto) County-to-County Seed Matrix
  - Includes EI/IE and EE trips (both long and short distance)
  - Population and Employment (normalized) used as OD vectors
  - Forecasts based on both Pop. & Emp. growth by County
  - E-I & I-E labor force/jobs adjusted from core calcs using all-mode seed matrix instead of auto only.
  - BPM sub-area trip-tables extracted from national network

# HomeToWork Process





## TransCAD Subarea Network



## External trip adjustment

- Short distance (SD) nonWork trips not included
- Calibration by road type/purpose
  - Counts split using NJTRM-E screenline/SLK analysis
    - Adapted data to take into account overestimation of SD trips
  - Centroid connectors added to fit all adjacent County highway totals
- Disaggregation from Cty/Cty to Cty/TAZ or TAZ/Cty based on employment for HBW attractions and LD business trips and on population for other purpose or HBW productions

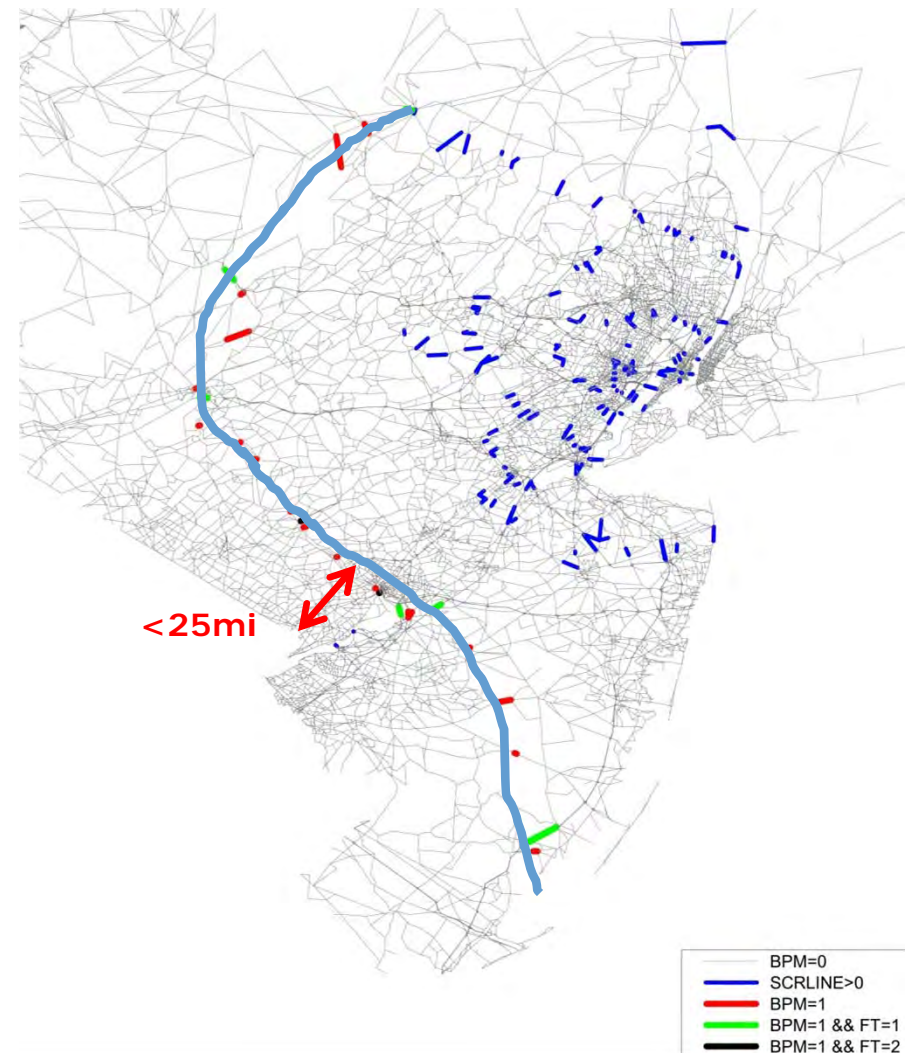
# NJTRM-E Screen Line/Select Link Results

## NJTRM-E Results, raw

	Freeway	Other	Total
ShortNW	39%	66%	48%
LongNW	15%	2%	10%
HBW	47%	33%	42%

## Raw results adapted for SNW overestimation (-20%)

	Freeway	Other	Total
ShortNW	31%	52%	38%
LongNW	22%	15%	20%
HBW	47%	33%	42%





# External Cordon Results

## External Model, Observed Data

Total External Counts	1,396,362 auto trips
Home to Work share (47%)	654,089 auto trips
Long NonWork share (20%)	275,767 auto trips
Short NonWork share (33%)	466,506 auto trips

## External Model, assigned to national network

Home to Work Flows(47%)	654,059 auto trips
Long NonWork Flows(20%)	284,945 auto trips

# Proportions of EI/IE trips to E-E

Subarea matrix extraction

NonWork LD	265,000
HBW EI/IE	462,000
HBW E-E	98,000
NonWork SD	413,000
Total EI/IE	1,120,000
Total E-E	120,000
Total Crossings	1,360,000

In current Ext Model

1,084,000 EI/IE

37,000 E-E

1,111,000 Total Crossings

## Next steps

- Fine tune calibration by facility type and State border
- GISDK code to integrate Java programs
- Adapt HAJ, MDSC and PAP to HBW results
- Strategy for non Work Short Distance trips

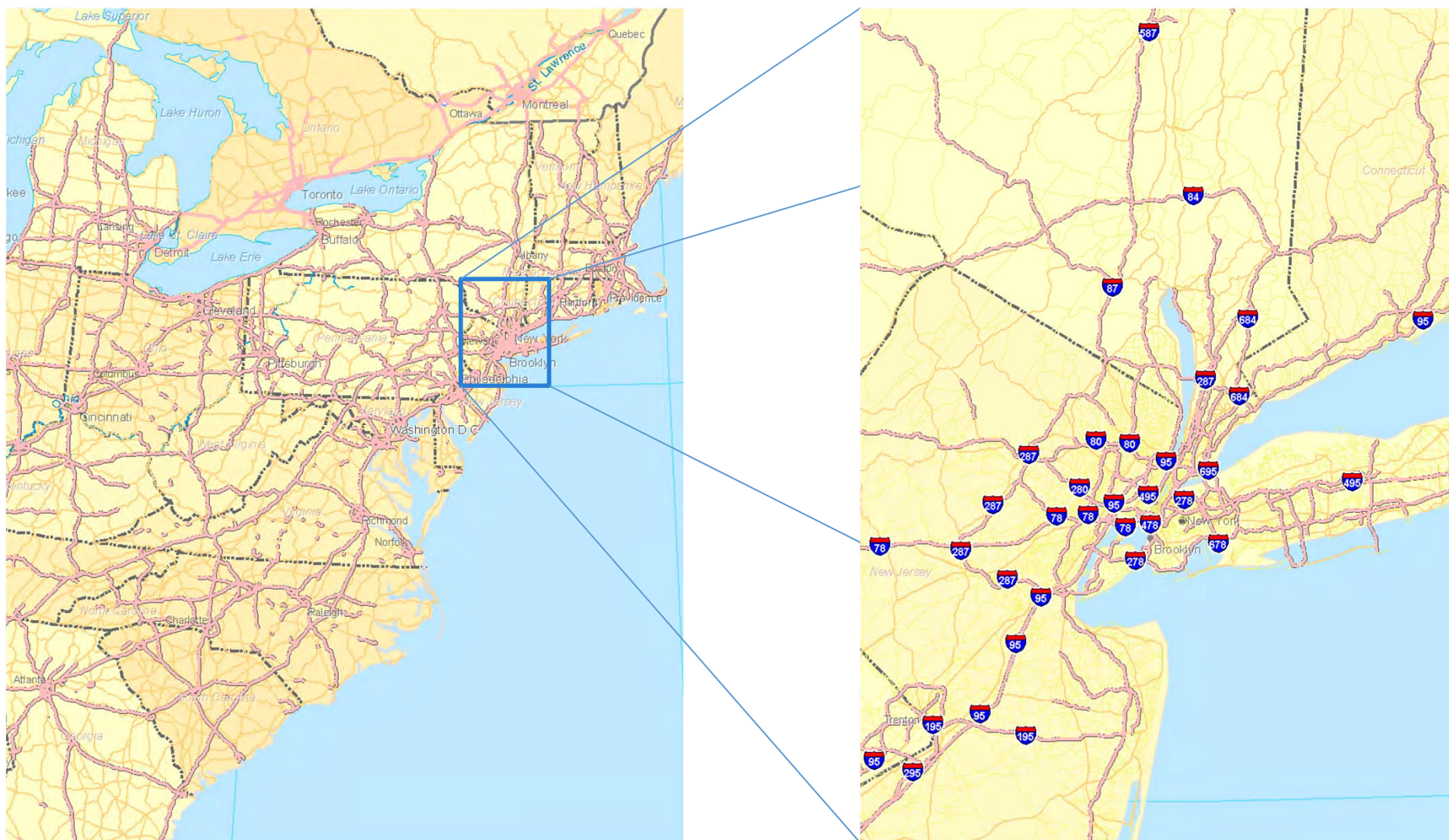
## **AGENDA ITEM D:**

### **TASK 14: MODEL REFINEMENTS: UPDATE TRUCK AND OTHER SMALL COMMERCIAL VEHICLES MODEL**

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Rolf Moeckel, Chrissy Bernardo

# Two-Layer Concept



# Short- & Long-Distance Freight flows

## **Short-Distance**

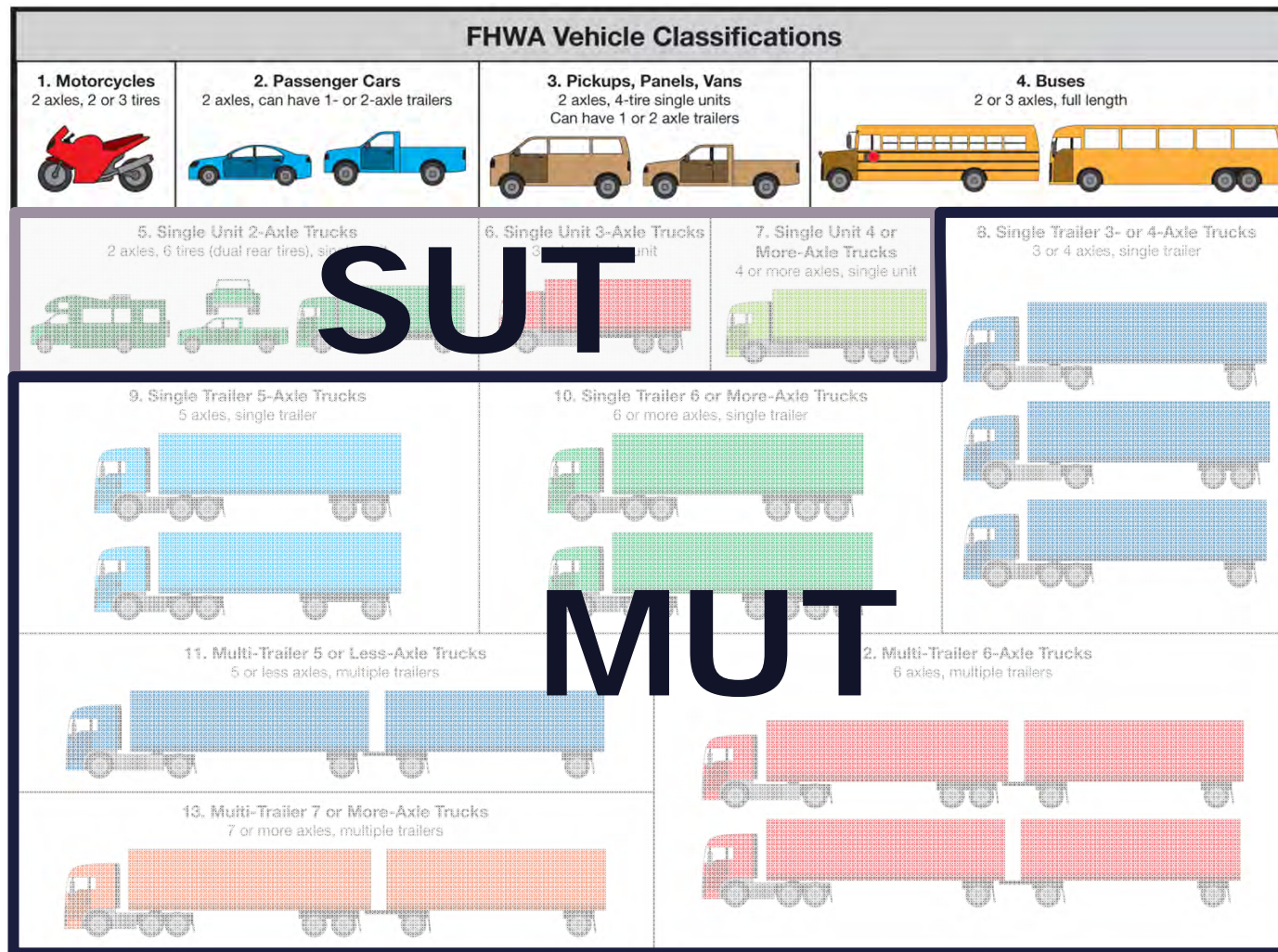
- Trips shorter than 50 miles
- Revised Quick Response Freight Manual (QRFM) approach

## **Long-Distance**

- Trips longer than 50 miles
- Based on commodity flow survey data (FAF<sup>3</sup>)
- Covers all trips nationwide

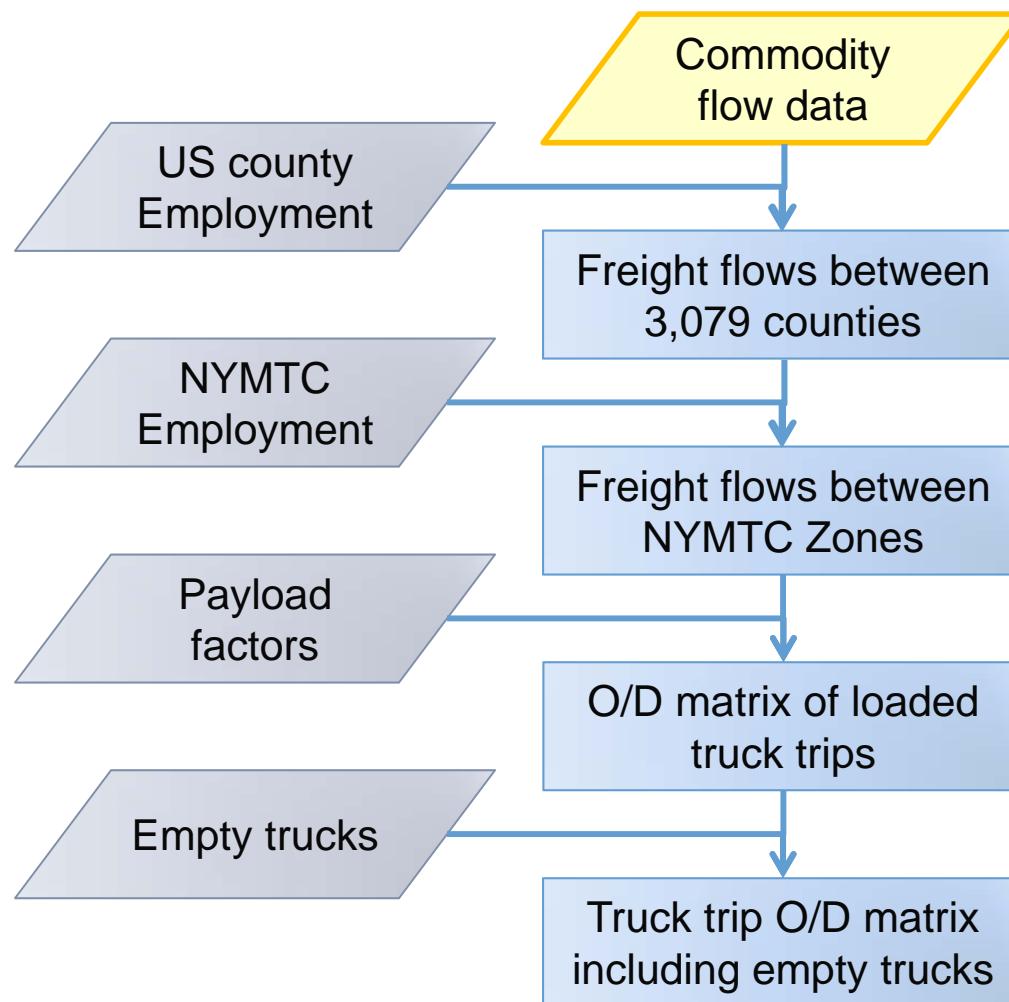


# FHWA Vehicle Classes





# Long-Distance Truck Model Design



# Flow Disaggregation (1)

$$flow_{county_i, county_j} = flow_{FAF_a, FAF_b} \cdot \frac{weight_{county_i, county_j}}{\sum_{county_k \in FAF_a} \left( \sum_{county_l \in FAF_b} weight_{county_k, county_l} \right)}$$

$$weight_{county_i, county_j} = empl_{county_i} \cdot empl_{county_j}$$

$county_i$  is located in  $FAF_a$

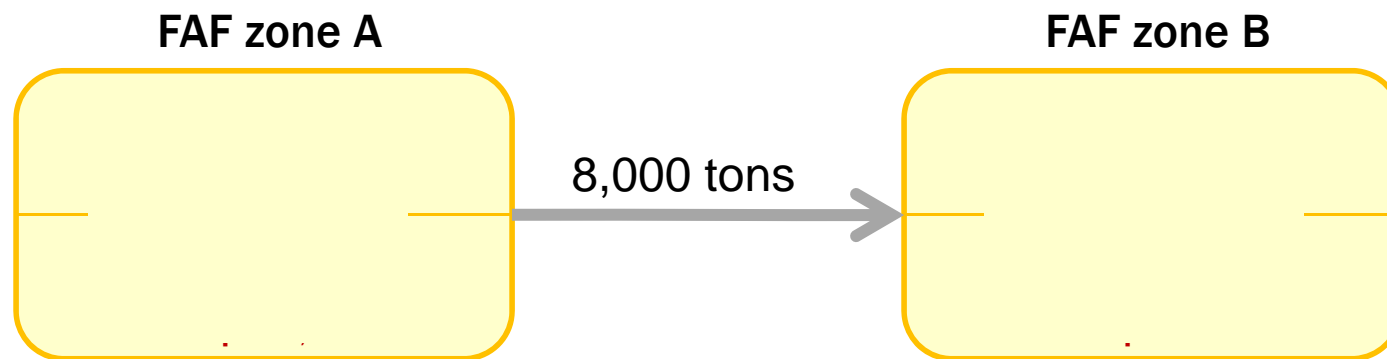
$county_j$  is located in  $FAF_b$

$county_k$  are all counties located in  $FAF_a$

$county_l$  are all counties located in  $FAF_b$

$empl_{county}$  is total employment in county i

## Flow Disaggregation (2)



Flow	Calculation	Weight	Share	Tons
i → k	1,000 * 5,000	5,000,000	30 %	2,424
j → k	2,000 * 5,000	10,000,000	61 %	2,848
i → l	1,000 * 500	500,000	3 %	242
j → l	2,000 * 500	1,000,000	6 %	485
Total		16,500,000	100 %	8,000

# Flow Disaggregation (make/use coefficients)

$$weight_{county_i, county_j, com_c} = \sum_{ind_m} (empl_{county_i, ind_m} \cdot mc_{ind_m, com_c}) \cdot \sum_{ind_m} (empl_{county_j, ind_m} \cdot uc_{ind_m, com_c})$$

$empl_{county_i, ind_m}$  employment in county i in sector m

$mc_{ind_m, com_c}$  make coefficient describing how many goods of commodity c are produced by industry m

$uc_{ind_m, com_c}$  use coefficient describing how many goods of commodity c are consumed by industry m

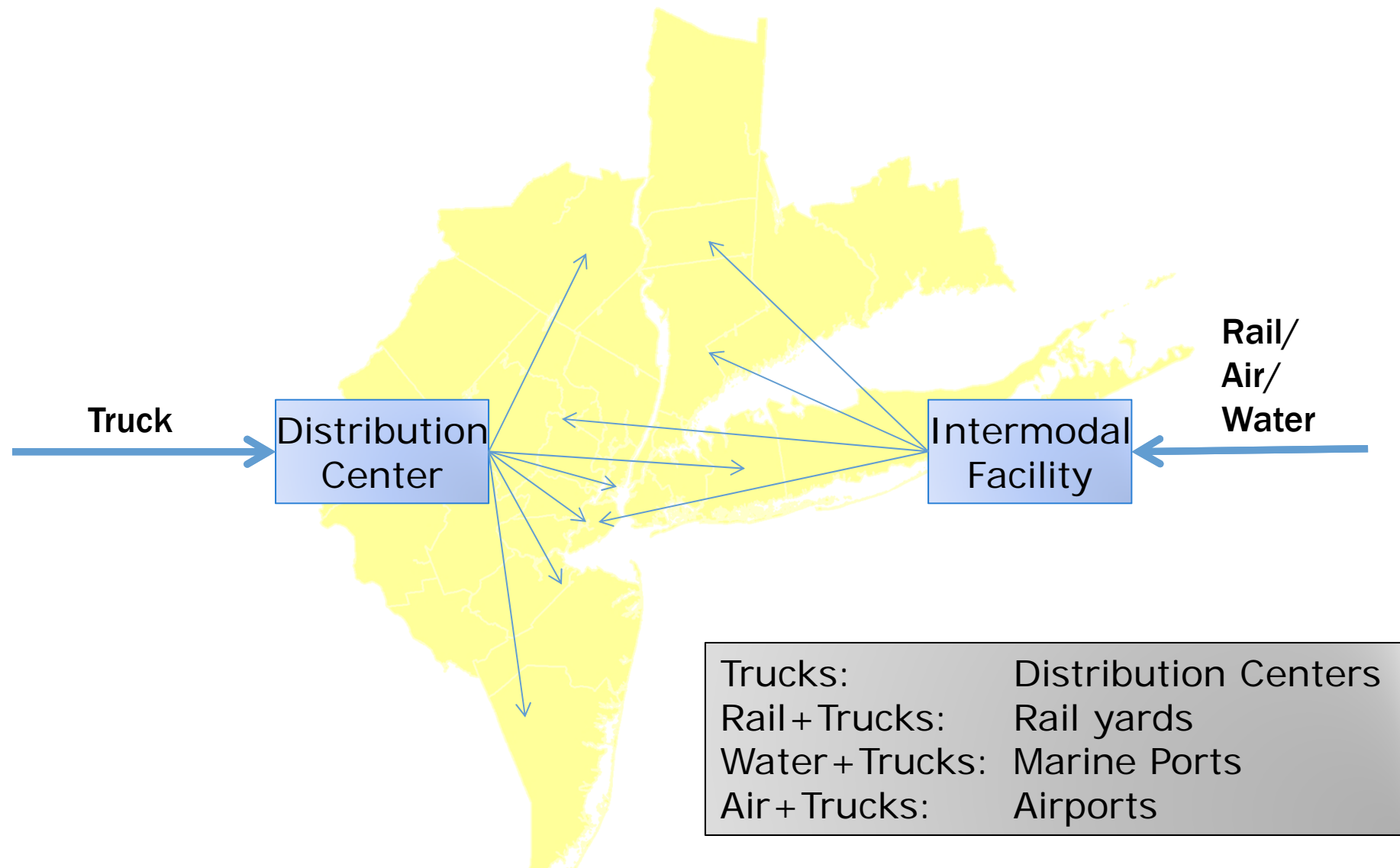
## Ton-to-Truck Conversion

- Truck type depends on trip distance
- Payload factors by truck type convert tons to trucks

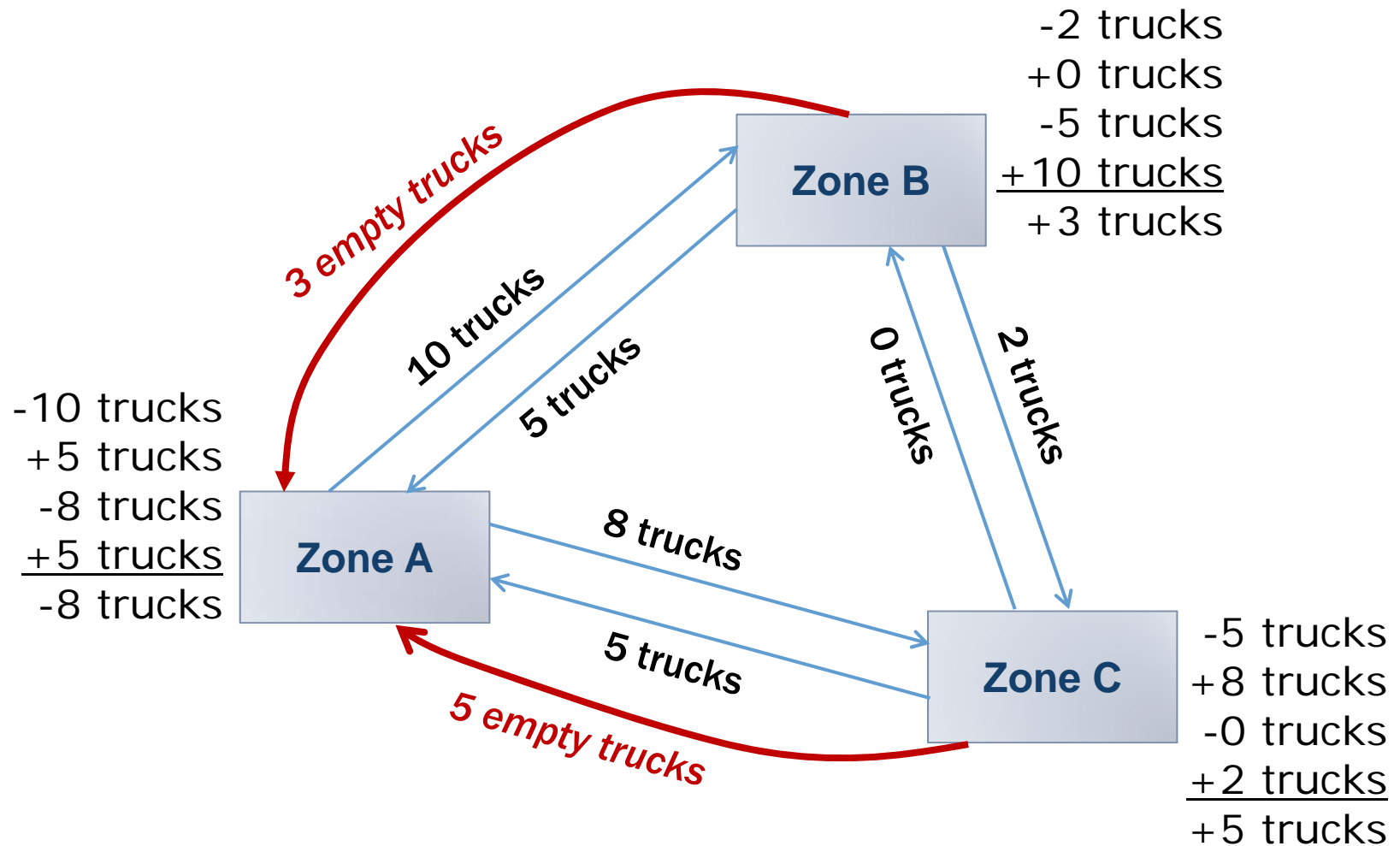
## Yearly-to-Weekday Truck Conversion

- Divide by 365.25
- Apply “weekday-to-average-day” factor of 2.1%

# Distribution Centers & Intermodal Facilities



# Empty Truck Trips



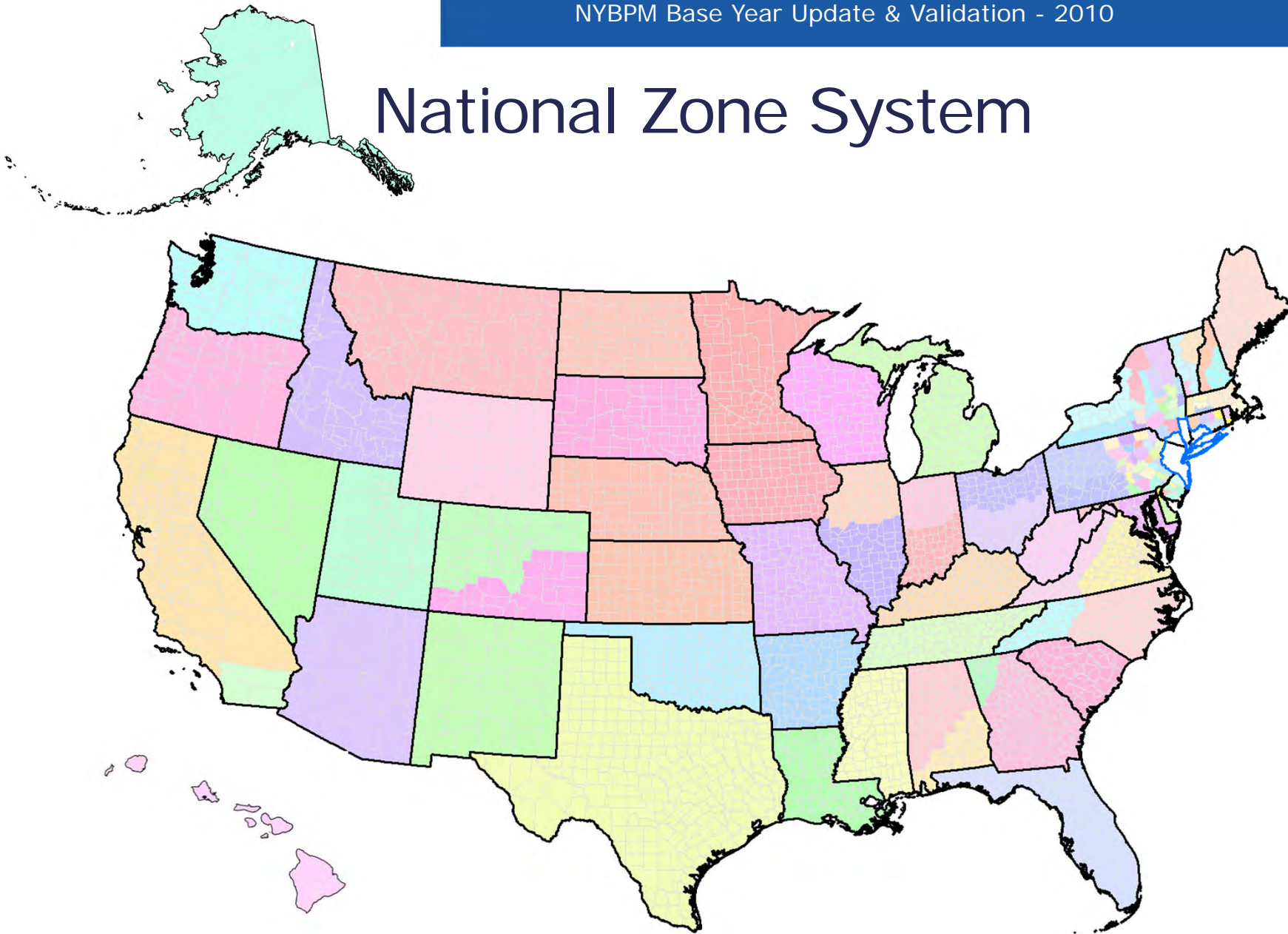


## ZONE SYSTEM

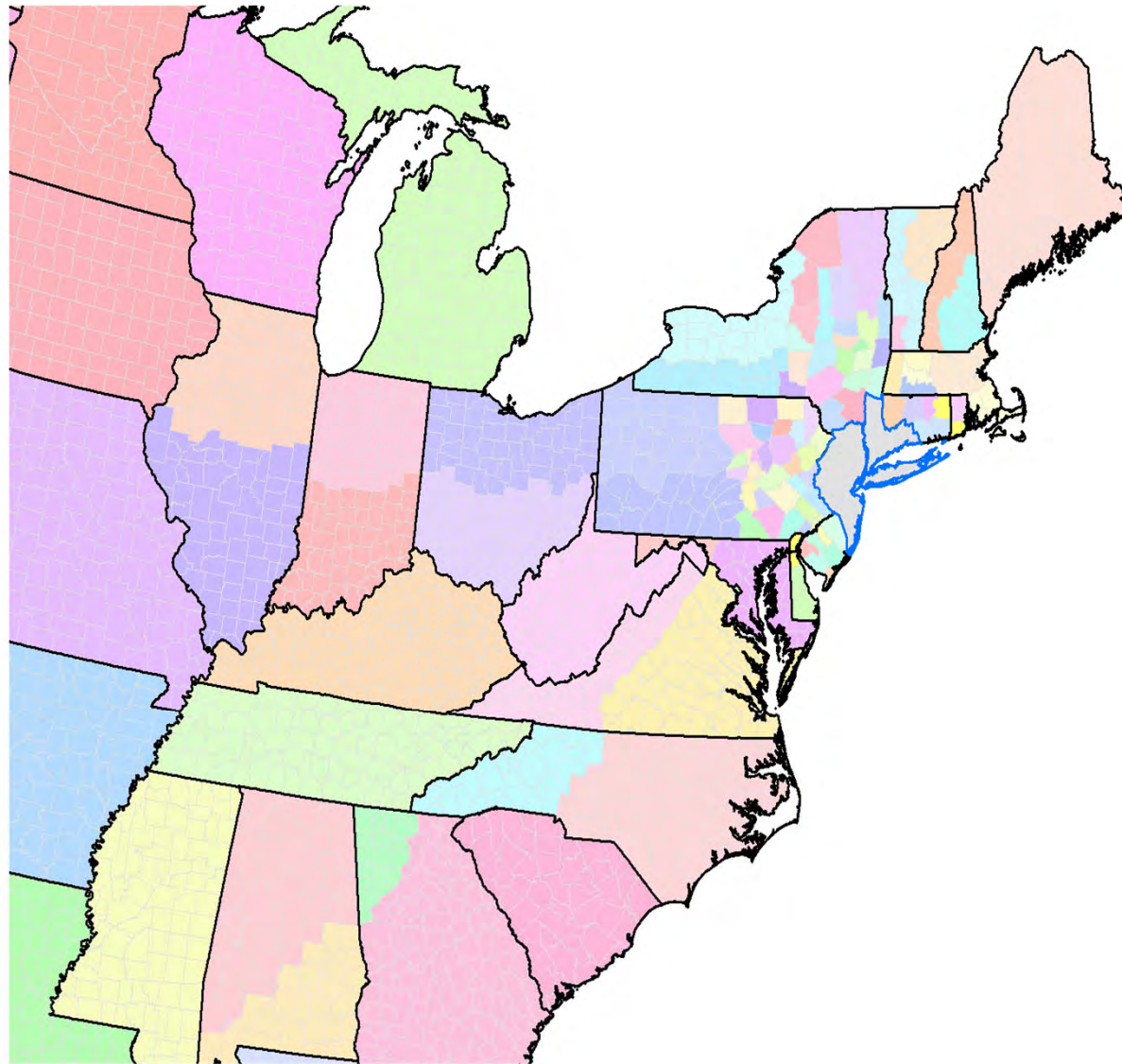
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Update Truck and Other Small Commercial Vehicles Model

# National Zone System

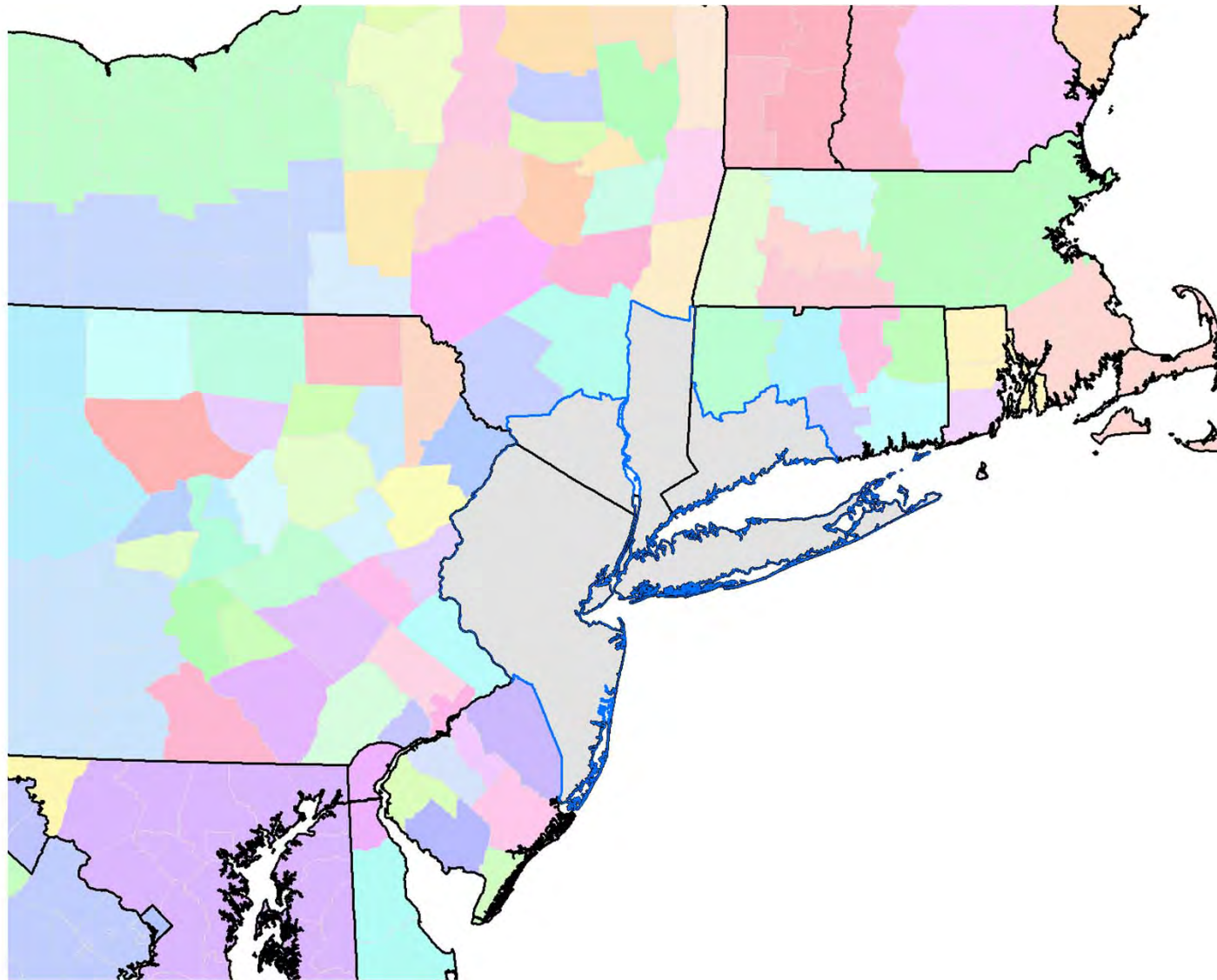


## National Zones: Northeast

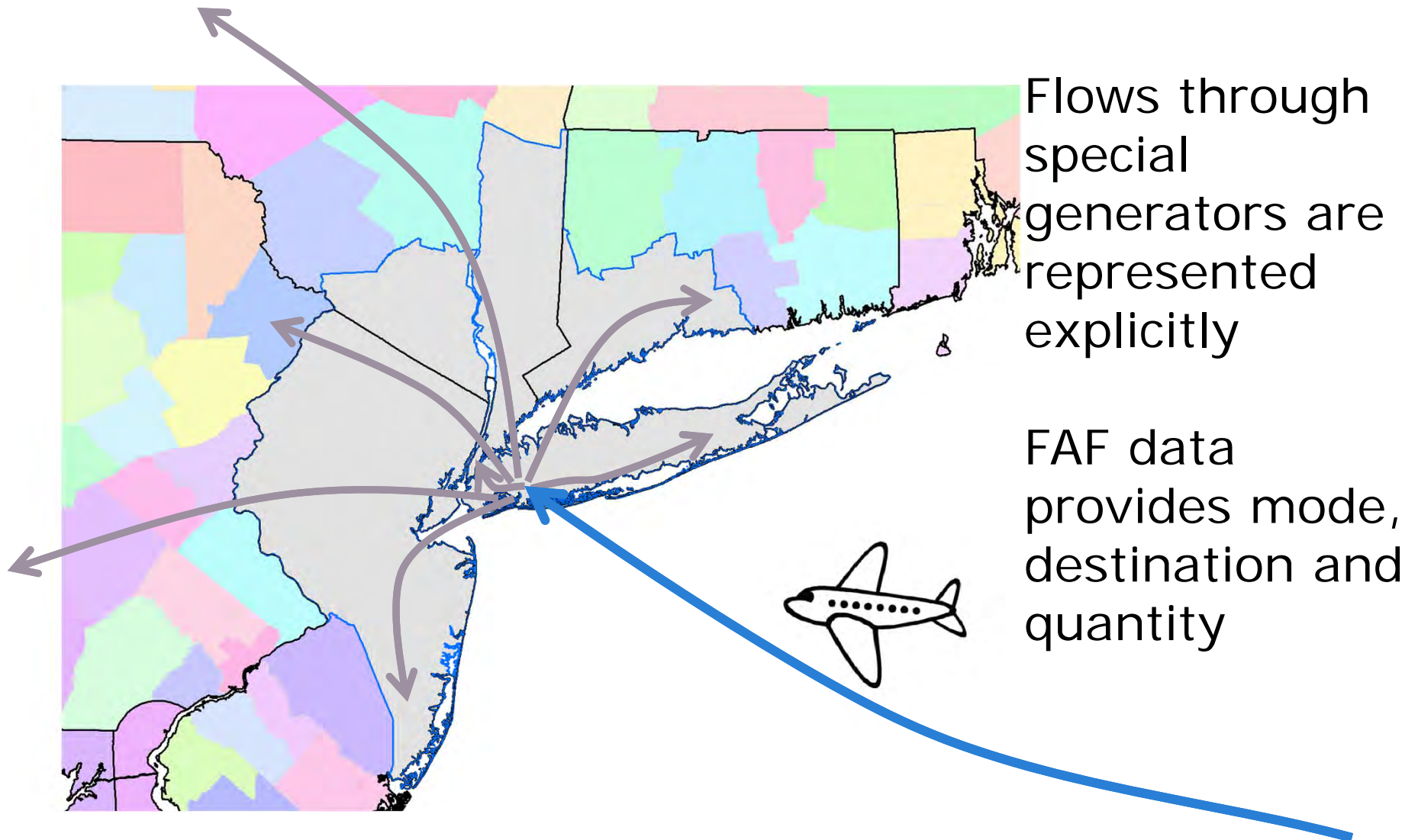




## National Zones: NY Region



# Special Generators



# Special Generators Represented

Color code: New added SG zones

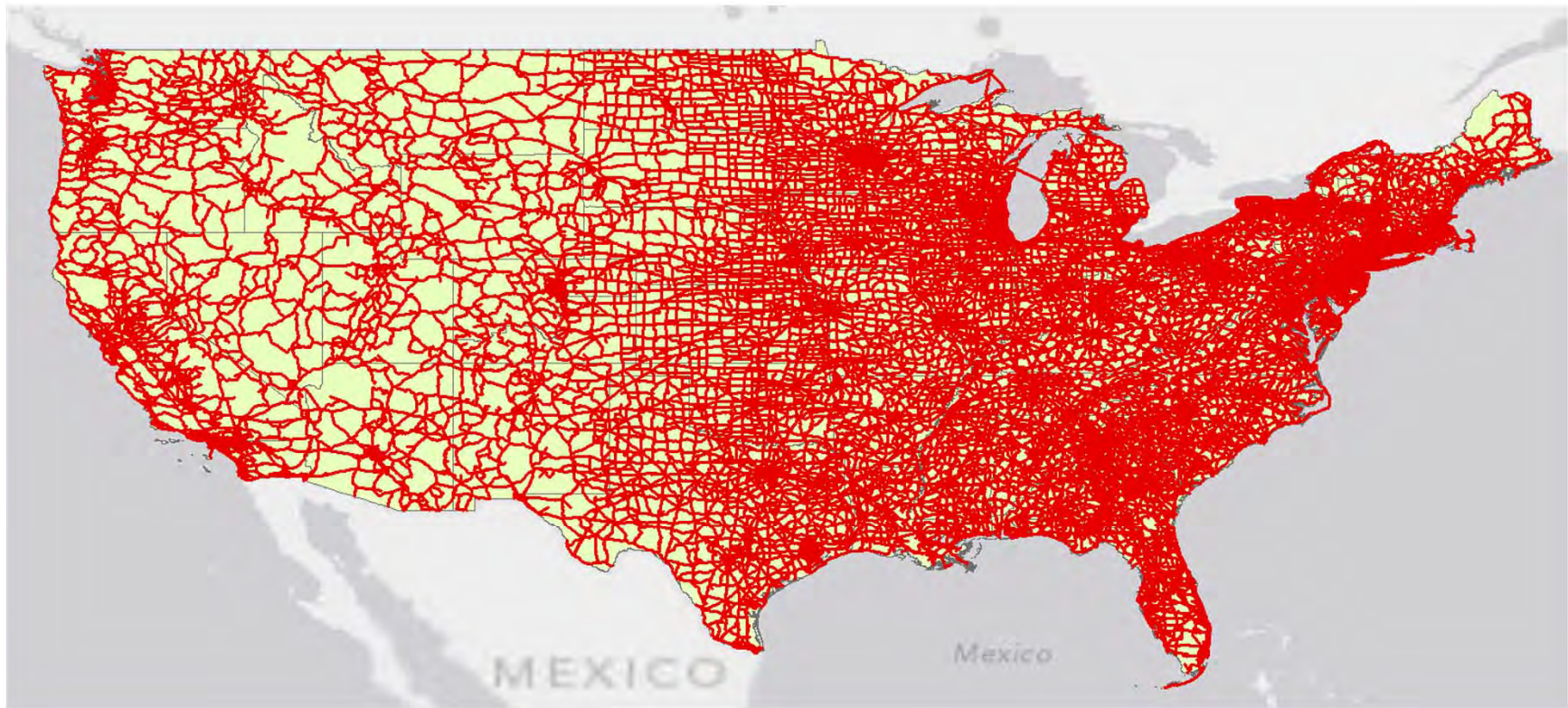
		Tier TAZ			Tier 1.2 TAZ			
SG Area	0	1	1.1	1.1 Zone ID	Special Generator Name	1.2	1.2 Zone ID	Zone processing
AIRPORTS								
JFK	x	x	x	605	JFK General			
		x	x	3590	JFK Cargo Terminal	x	6151	Split - Add
			x	3814	JFK Arriving/Departing Passengers	x	6152	Separate
LGA	x	x	x	407	LGA General			
			x	3815	LGA Arriving/Departing Passengers	x	6153	Separate
EWR	x	x	x	3000	Newark General			
		x	x	3588	Newark Airport North Cargo Terminal	x	6154	Split - Add
		x	x	3589	Newark Airport South Cargo Terminal	x	6155	Split - Add
			x	3816	Newark Arriving/Departing Passengers	x	6156	Separate
SWF		x	x	3591	SWF General			
			x	3817	SWF Arriving/Departing Passengers	x	6157	Separate

## TRUCK TERMINALS

x	x	x	2816	Port Jersey Trucks	x	6158	Split - Add
x	x	x	2817	MOTBY - Military Ocean Terminal at Bayonne	x	6159	Split - Add
	x	x	3587	Howland Hook (New York Container Terminal)	x	6160	Split - Add
	x	x	3592	South Brooklyn Marine Terminal	x	6161	Split - Add
	x	x	3593	Red Hook Container Terminal	x	6162	Split - Add
	x	x	3667	Port Newark Container Terminal	x	6163	Split - Add
	x	x	3750	Port Elizabeth Marine Terminal	x	6164	Split - Add

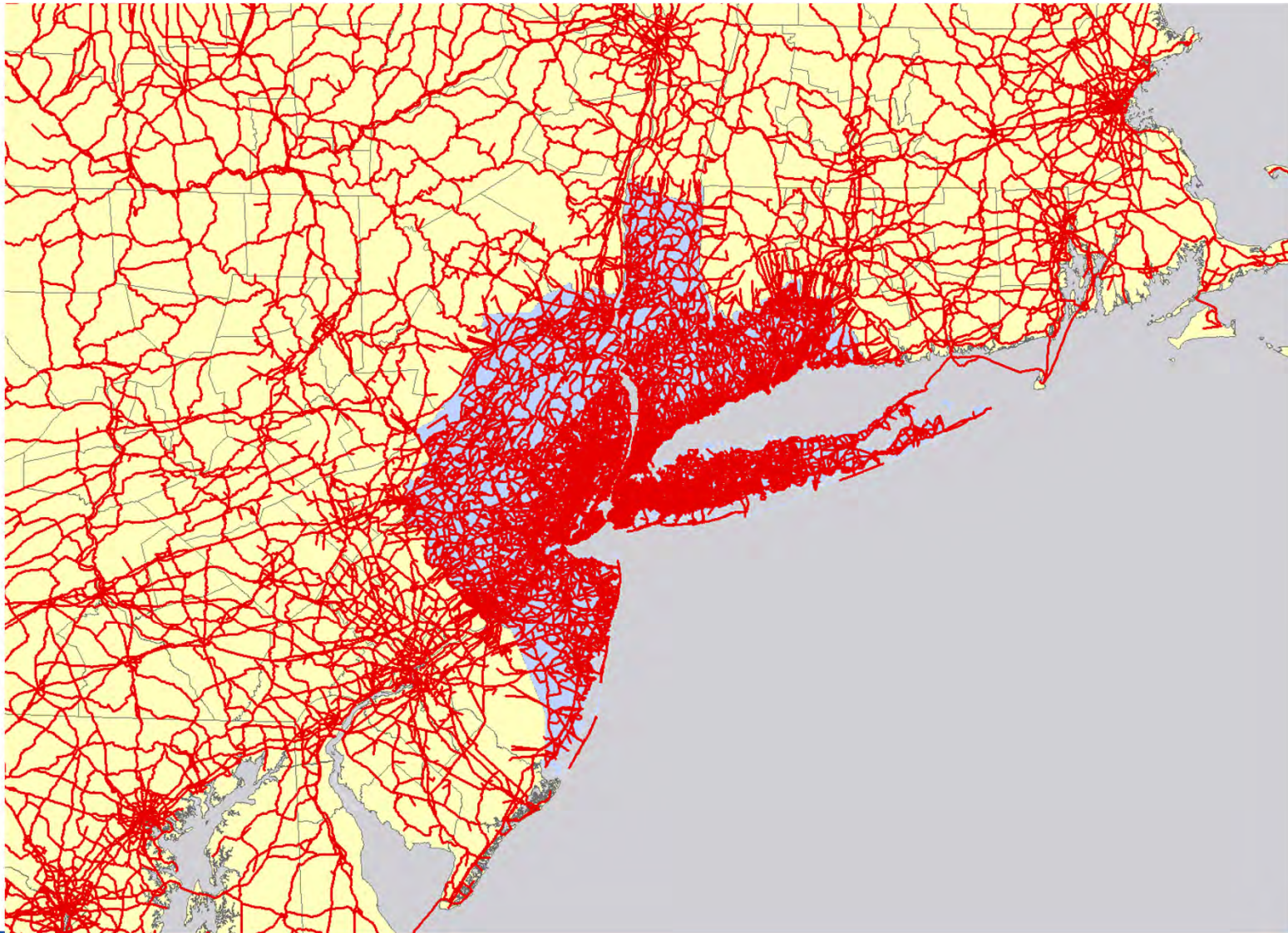


# Merged networks





# Merged Networks in New York Region

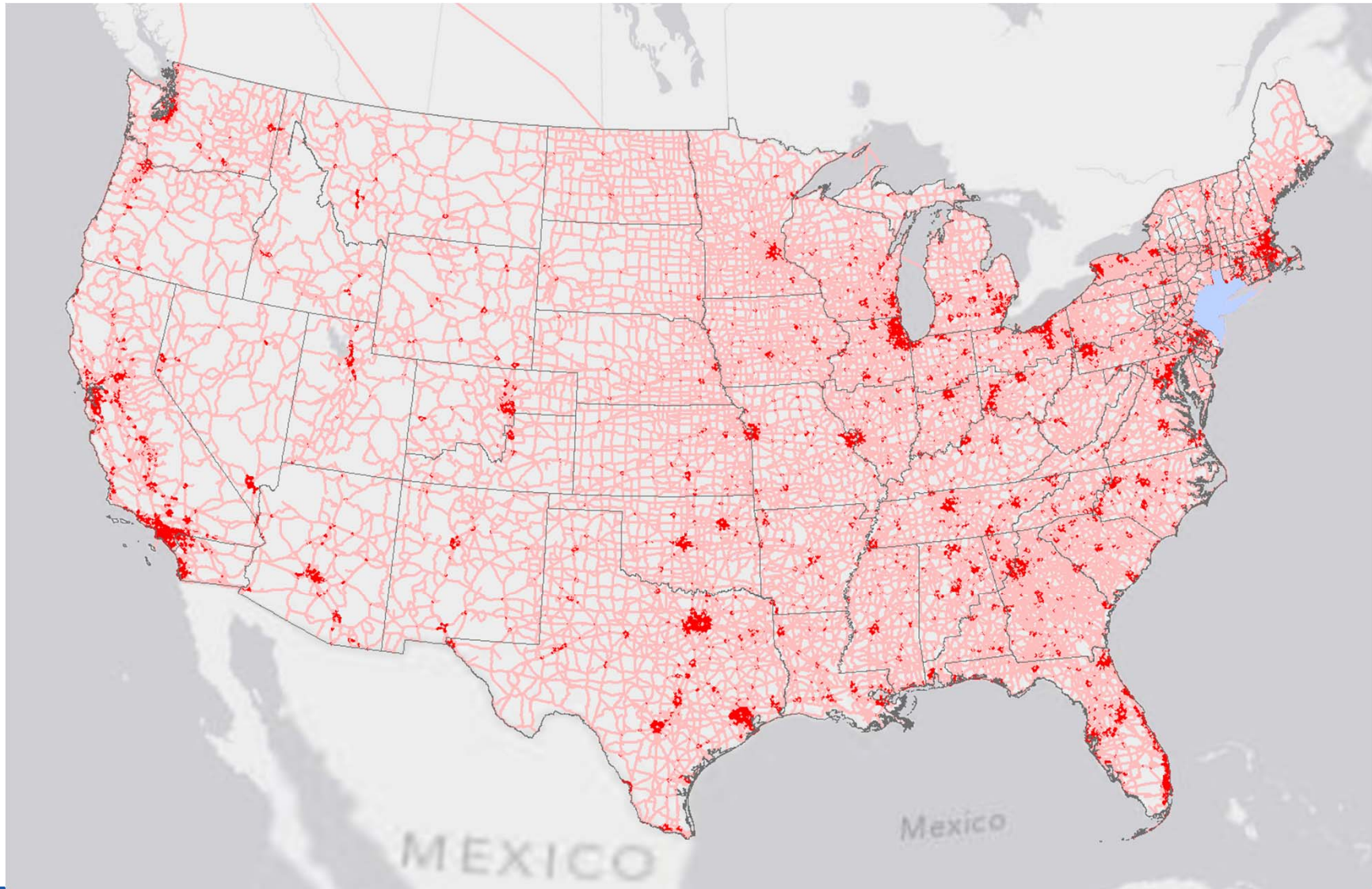


# Functional Classes in National Network

01 Rural Interstate	11 Urban Interstate
02 Rural Principal Arterial	12 Urban Freeway/Expr.way
06 Rural Minor Arterial	14 Urban Principal Arterial
07 Rural Major Collector	16 Urban Minor Arterial
08 Rural Minor Collector	17 Urban Collector
09 Rural Local	19 Urban Local



# Urban vs. Rural Facility Types



## Definition of Capacity by Functional Class

- Interstate capacity: 2,400 vehicles per hour per lane (vphpl)
- Other links: 1,700 vehicles per hour per lane
- Daily capacity is assumed to be 10-times the hourly capacity

# Background Volume

## *Within BPM Study Area*

- Local autos
- Local trucks
- External autos

## *Outside BPM Study Area*

- Synthesized background volume

# Background Volume

## *Rural Areas*

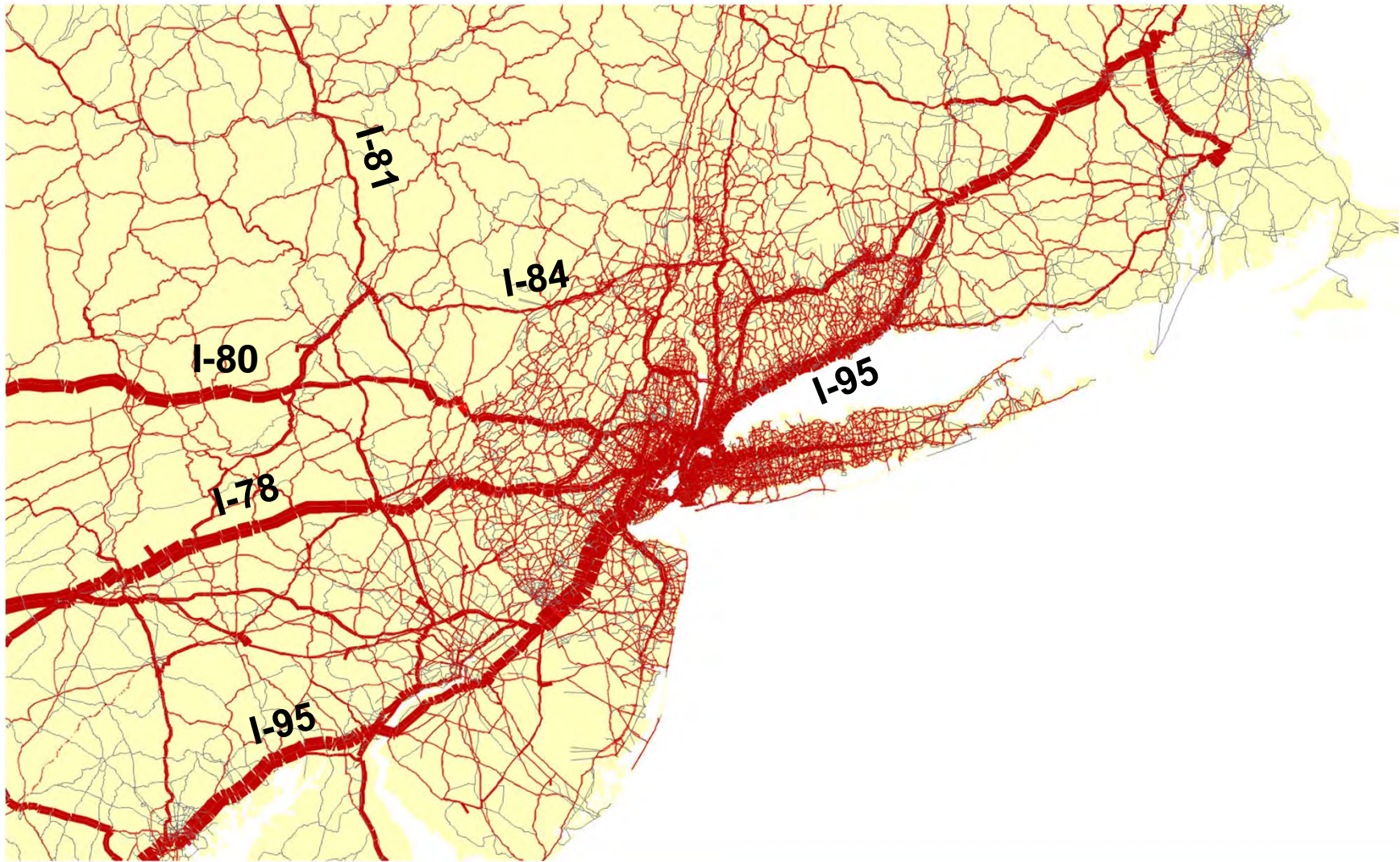
- Level of Service C
- Volume-to-capacity ratio of autos and local trucks: 0.6

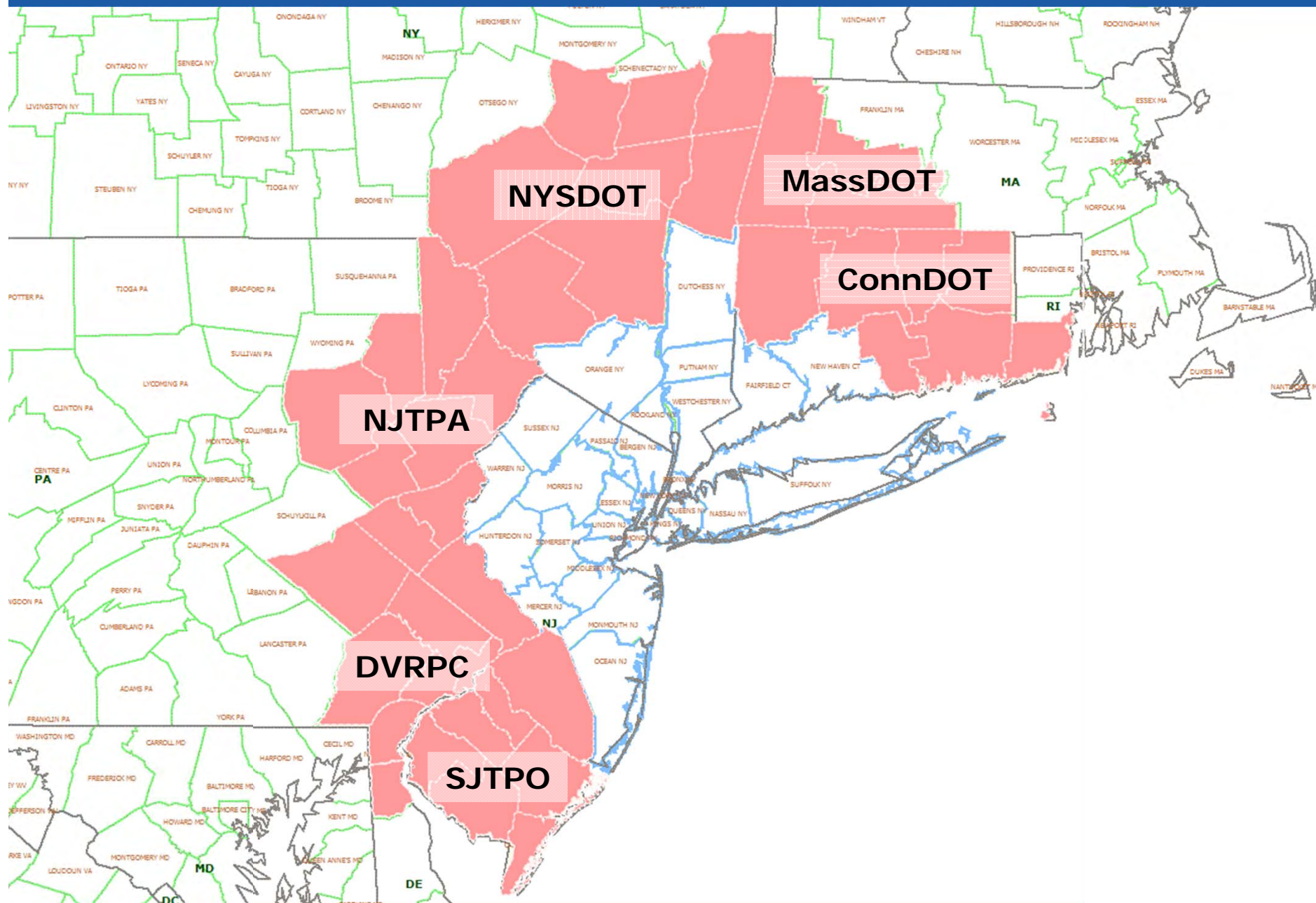
## *Urban Areas*

- Level of Service D to E
- Volume-to-capacity ratio of autos and local trucks: 0.9



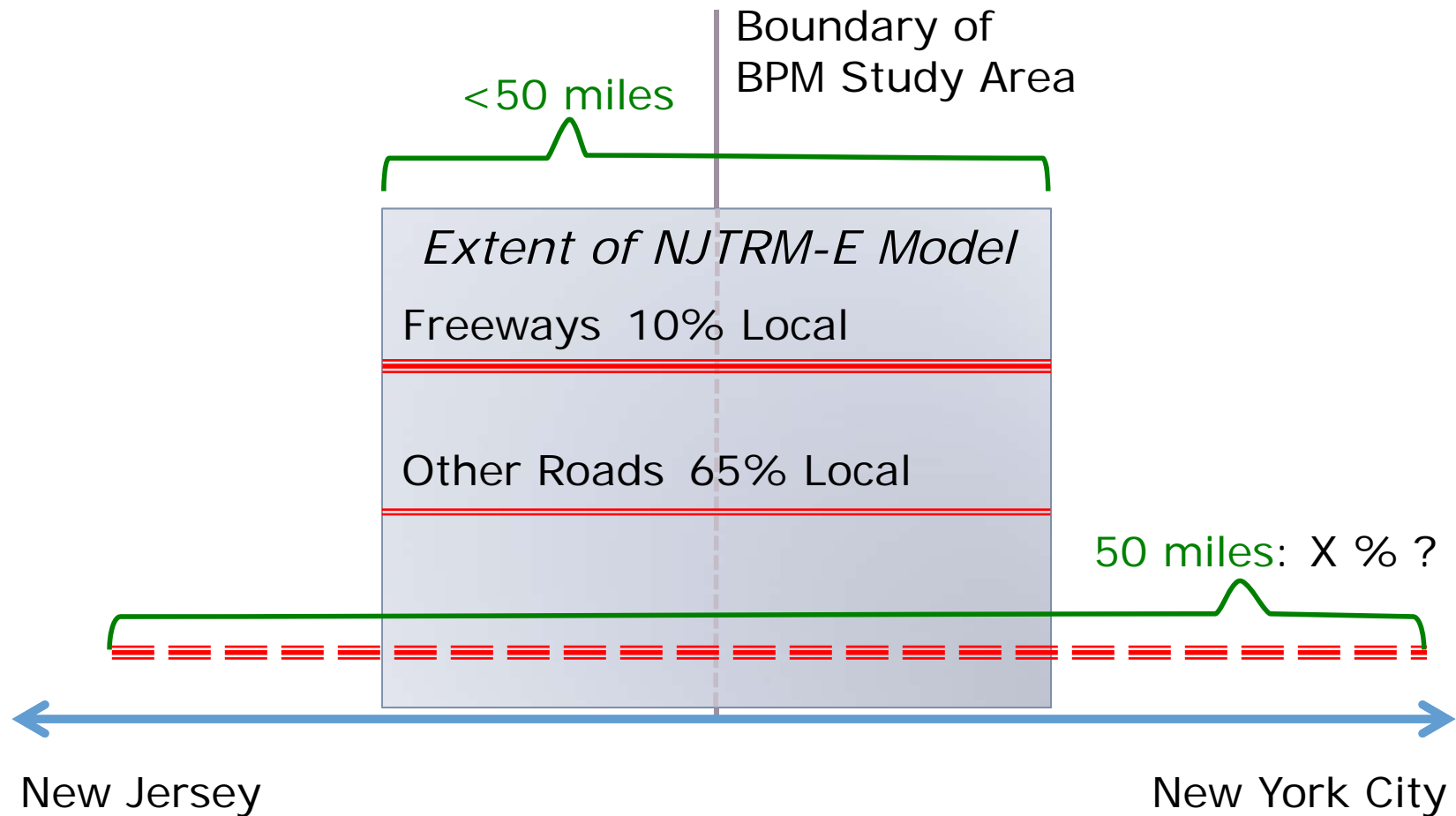
# Assignment of Long-Distance Trucks







# Calibration Challenge



# Commercial Vehicle Model Overview

## 1. Starting Point:

- QRFM Factors, adapted to NYMTC sub-areas (original model) → starting seed O/D matrix

## 2. Perform Origin-Destination Matrix Estimation (ODME) to adjust trip tables based on 2010 counts

## 3. Regress trip productions on zonal data:

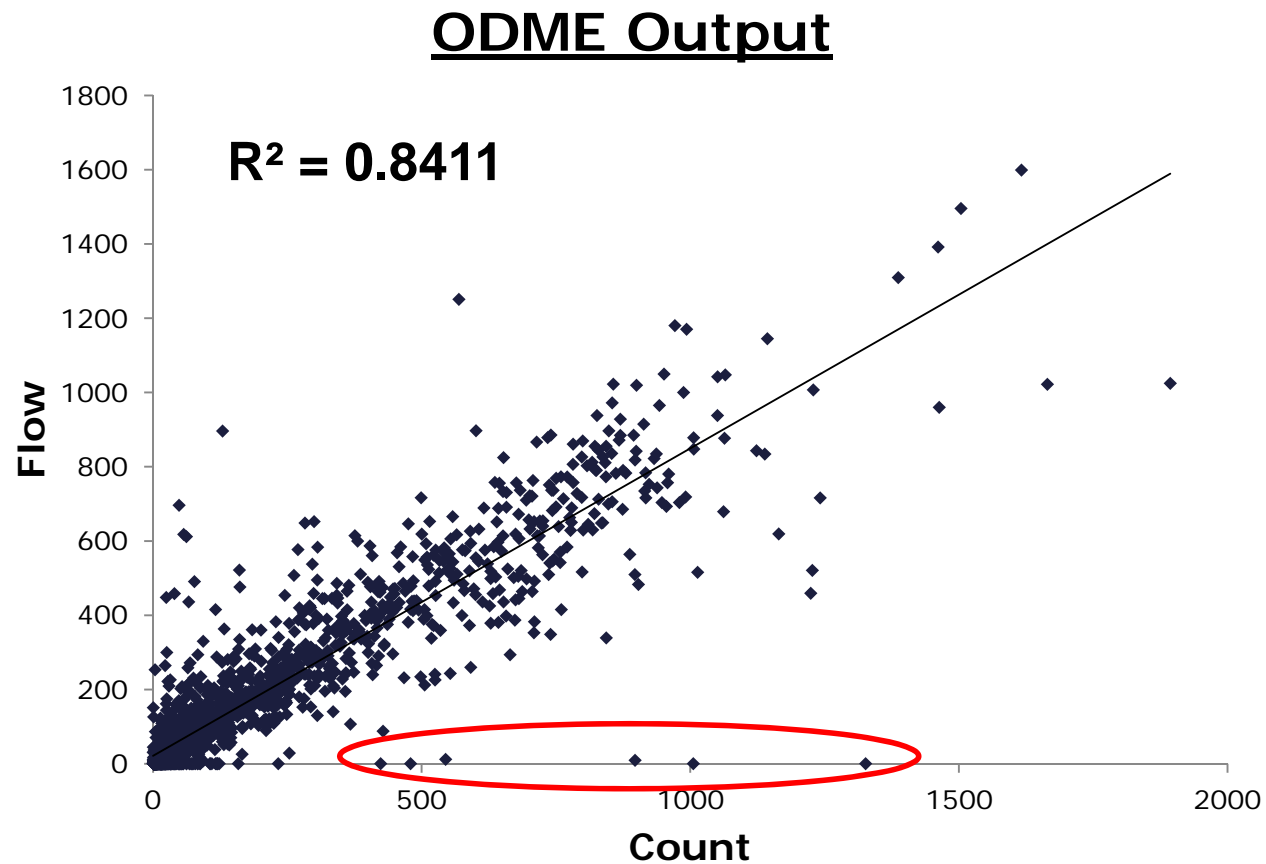
- SED:
  - Population, HH Income, Emp Wages, Population / Employment Density, Employment by Industry, etc.
- Additional Zonal Attributes

## In Progress: ODME

- Adjusts O/D Matrix based on count volumes
- CV Counts:
  - Estimated by proportion of total count volume where unavailable, segmented by:
    - FCLASS grouping
    - Manhattan vs. other NYC vs. Outer NY counties

# Preliminary ODME Results

- MD Period:



# Preliminary ODME Results

- MD Period:

Total Count Volume	356,073
Total Flow Volume (on count links)	345,395
RMSE	97.6
Percent RMSE	5.2%

- **Next Steps:**

- Run procedure for AM, PM, NT periods
- Validate ODME results
- → Estimate Regression

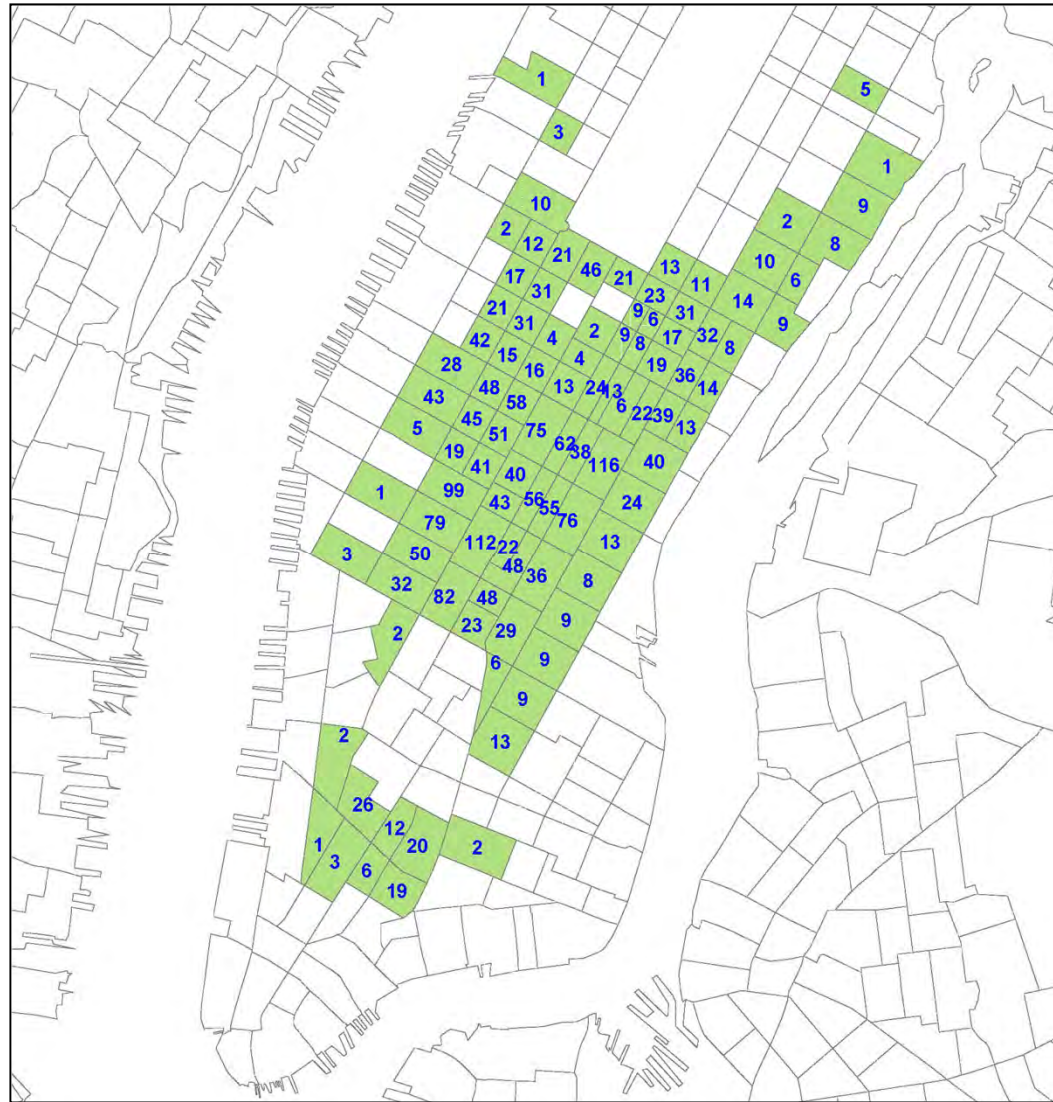
## Additional Data

- Commercial Vehicle Parking Sign data
  - From NYCDOT
  - Midtown + Downtown Manhattan
  - Tag signs to TAZ layer (100 TAZs)





# Commercial Vehicle Parking Data



## Next Steps

- Estimate step-wise linear regression of trip productions on zonal data
  - More realistic forecasts (based on SED forecasts)
  - Responsive to changes in model inputs

**AGENDA ITEM E:**  
STAGE 1 (2010N) / CONFLATED BASE  
NETWORK (2010T-7) - TESTING FOR  
MODELING

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Chrissy Bernardo, Yuri Teleshevsky

## Recap of Networks Involved in Task 6:

- **2010N** – Current working BPM 2010 Stage 1 Network
  - Evolved network with current calibration – prior updates
  - Incorporates TH-TDFM improvements and NJPTA net in NJ
  - Platform for future / alt network coding
  - Other linkages – screenline, bus preloads,
- **2005T** – Source network for Caliper conflation
- **2010T** – Result of Caliper work in Task
  - Conflation of full 28 county region
  - Merged attributes from 2010N
  - Added important links missing from 2005 source

## Recap of Networks Involved in Task 6:

- **2010T-2** – Result NYTMC's review and refinement (PSA2-11-25)
  - QA/QC review
    - manual topological conflation w/r to external base maps
    - Correction of attributes – key: direction of flow lanes, fclass
  - Restructuring improvements
    - Rationalized topological and flow direction in network dataview
    - Added some turn prohibitions to prevent “illegal” flows in divided arterials coded as bi-directional links
- **2010T-3** – First Assignable conflated version
  - Testing and further reconciliation with 2010
    - Turn prohibitions
    - NETPREP – to build time of day networks (AM, PM, MD, NT)
    - Assignment tests – fixed 2010 trip table, compare to Stage 1 calibration results

## Recap of Networks Involved in Task 6:

- **2010T-4** – Basic Attribute Checks for Links with no Matching\_ID to correspond to 2010N
  - Verify/edit FCLASS, number of lanes
  - Minor additional manual conflation
- **2010T-5 / 2010B-S2.0** (transmitted 10/30/2013) – Basic Attribute Checks for all Links
  - 2010T-4 Edits
  - Verify/edit FCLASS, number of lanes for Links *with* a Matching\_ID corresponding to 2010N
  - AUTOTOLL & TRUKTOLL updated to latest 2010 values



## Recap of Networks Involved in Task 6:

- **2010T-6** – 2010 Update Attributes Added
  - TOD and vehicle class tolls added to network
  - Links that represent multiple streets identified
- **2010T-7 / 2010B-S2.1** (transmitted 11/18/2013) – Connected to new Tier 1.2 TAZ system
  - Centroid Connectors built to Tier 1.2 (4629) zone system, using only original 2010N loading points for comparability and consistency with calibrated model
  - Additional Lincoln Tunnel lane edits to reflect reversible center tube lane and Express Bus Lane

## Recap of Networks Involved in Task 6:

Transmitted Name	Working Version Name	Date Developed	Description
<b>2010T</b>	2010T-1	3/13/2013	Original from Caliper
	2010T-2	9/4/2013	Manually Conflated (PSA2-11-25)
	2010T-3	9/24/2013	Edited for NETPREP and Assignment
	2010T-4	10/23/2013	Links with NO matching ID to 2010N checked for primary attributes
<b>2010B-S2.0</b>	2010T-5	10/30/2013	Links WITH matching ID to 2010N checked for attributes
	2010T-6	10/31/2013	TOD Tolls added Multiple Roadways identifiers added
<b>2010B-S2.1</b>	2010T-7	11/18/2013	Centroid Connectors built to TAZ Tier 1.2 Lincoln Tunnel edits

## New Centroid Connections

- Connect new Tier 1.2 TAZ centroids to conflated network
- Original 2010N loading points retained
- TransCAD built-in connector-building procedure used
  - Setting restrictions (i.e. crossing water, max distance, etc.)
  - Finds closest loading points within a maximum distance, segmented by county
  - Manual checks and edits

## Test Assignment Run: 2010B-S2.1

- Compare with same trip tables assigned to 2010N, converted from Tier 1.1 (3824) to Tier 1.2 (4629) TAZ system
- Validation on aggregate scale, at major highway crossings:
  - Conflated network
  - Network attributes
  - New Centroid Connectors

# Assignment: Validation Results

Free and Tolled Facility Summary						% Diff from Counts		
		Counts	2010N	2010B-S2.0	2010B-S2.1	2010N	2010B-S2.0	2010B-S2.1
East River Crossings - NYC & MTA	WB	242,661	265,883	245,213	241,619	10%	-8%	0%
	EB	244,640	271,242	278,530	272,686	11%	3%	11%
	<b>Total</b>	<b>487,301</b>	<b>537,125</b>	<b>523,743</b>	<b>514,305</b>	<b>10%</b>	<b>-2%</b>	<b>6%</b>
** Free Bridges **								
East River Crossings - MTA	WB	111,923	77,504	99,979	98,383	-31%	29%	-12%
	EB	98,274	68,236	74,466	71,814	-31%	9%	-27%
	<b>Total</b>	<b>210,197</b>	<b>145,739</b>	<b>174,445</b>	<b>170,198</b>	<b>-31%</b>	<b>20%</b>	<b>-19%</b>
** Tolled Bridges & Tunnels **								
Verrazano Narrows Bridge - MTA	WB	106,787	89,306	87,723	88,297	-16%	-2%	-17%
	EB	98,022	104,204	104,297	106,784	6%	0%	9%
	<b>Total</b>	<b>204,809</b>	<b>193,510</b>	<b>192,020</b>	<b>195,081</b>	<b>-6%</b>	<b>-1%</b>	<b>-5%</b>
** Tolled Bridge**								
East River Crossings - NYC & MTA	WB	461,371	432,693	432,916	428,299	-6%	0%	-7%
	EB	440,936	443,681	457,293	451,285	1%	3%	2%
	<b>Total</b>	<b>902,307</b>	<b>876,374</b>	<b>890,208</b>	<b>879,584</b>	<b>-3%</b>	<b>2%</b>	<b>-3%</b>
** All Bridges & Tunnels **								

# Assignment: Validation Results

Major Crossing Cordon Summary						% Diff From Counts		
		Counts	2010N	2010B-S2.0	2010B-S2.1	2010N	2010B-S2.0	2010B-S2.1
<b>Bronx- Manhattan Crossings</b>  ** Free Bridges **	Bronx-Bound	278,744	249,776	269,814	271,857	-10%	8%	-2%
	Manhattan-Bound	270,830	274,079	293,235	296,094	1%	7%	9%
	<b>Total</b>	<b>549,574</b>	<b>523,855</b>	<b>563,049</b>	<b>567,951</b>	<b>-5%</b>	<b>7%</b>	<b>3%</b>
<b>Henry Hudson Bridge - MTA</b>  **Tolled Bridge **	North-Bound	32,574	30,615	16,098	15,416	-6%	-47%	-53%
	South-Bound	37,064	23,628	10,360	9,460	-36%	-56%	-74%
	<b>Total</b>	<b>69,638</b>	<b>54,243</b>	<b>26,459</b>	<b>24,877</b>	<b>-22%</b>	<b>-51%</b>	<b>-64%</b>
<b>Bronx- Manhattan Crossings</b>  ** All Bridges **	Bronx-Bound	311,318	280,391	285,913	287,274	-10%	2%	-8%
	Manhattan-Bound	307,894	297,707	303,595	305,554	-3%	2%	-1%
	<b>Total</b>	<b>619,212</b>	<b>578,098</b>	<b>589,508</b>	<b>592,828</b>	<b>-7%</b>	<b>2%</b>	<b>-4%</b>



# Assignment: Validation Results

Major Crossing Cordon Summary						% Diff from Counts		
		Counts	2010N	2010B-S2.0	2010B-S2.1	2010N	2010B-S2.0	2010B-S2.1
Bronx- Queens Crossings - MTA  **Tolled Bridges **	NB	148,183	174,046	172,304	173,517	17%	-1%	17%
	SB	158,431	157,899	158,681	160,380	0%	0%	1%
	<b>Total</b>	<b>306,614</b>	<b>331,945</b>	<b>330,985</b>	<b>333,897</b>	<b>8%</b>	<b>0%</b>	<b>9%</b>
Mid-Hudson Bridges  ** Tolled Bridges**	WB	107,648	114,522	102,267	105,156	6%	-11%	-2%
	EB	115,904	117,198	118,324	119,568	1%	1%	3%
	<b>Total</b>	<b>223,552</b>	<b>231,720</b>	<b>220,591</b>	<b>224,724</b>	<b>4%</b>	<b>-5%</b>	<b>1%</b>
Hudson River Crossings - PANYNJ  ** Tolled Bridges & Tunnels **	WB	257,486	262,616	259,609	261,787	2%	-1%	2%
	EB	247,690	237,411	228,707	228,955	-4%	-4%	-8%
	<b>Total</b>	<b>505,176</b>	<b>500,026</b>	<b>488,316</b>	<b>490,741</b>	<b>-1%</b>	<b>-2%</b>	<b>-3%</b>
Staten Island Bridges - PANYNJ  ** Tolled Bridges**	WB	79,081	83,383	82,705	82,943	5%	-1%	5%
	EB	90,442	96,298	98,827	99,317	6%	3%	10%
	<b>Total</b>	<b>169,523</b>	<b>179,682</b>	<b>181,531</b>	<b>182,260</b>	<b>6%</b>	<b>1%</b>	<b>8%</b>

## Next Steps

- Overall: 2010B-S2.1 Assignment results look good, reasonably close to or better than 2010N
- Current results reflect the basis for BPM 2010 calibration moving forward
- Freeze 2010B-S2.1 as base network for BPM 2010 Update
- Future / Additional edits and corrections to network will be built as Projects
  - NYMTC and PANYNJ comments and modifications
  - Additional edits by PB
  - Network Calibration work

## Related Work

- Update all existing PROJ & CHG files – Leo Tsang and Sandeep Puppala
  - Adapt for new network geometry and additional fields
  - Possible procedure update to handle additional fields?
- Ongoing Roadway Attribute Update Project (51237G) – Feng Lu and Sandra Forte
  - Continue attribute update work through PROJ / CHG system, built on top of “frozen” base 2010B-S2.1
  - Final delivery January 2014