

NYMTC Truck Model Update

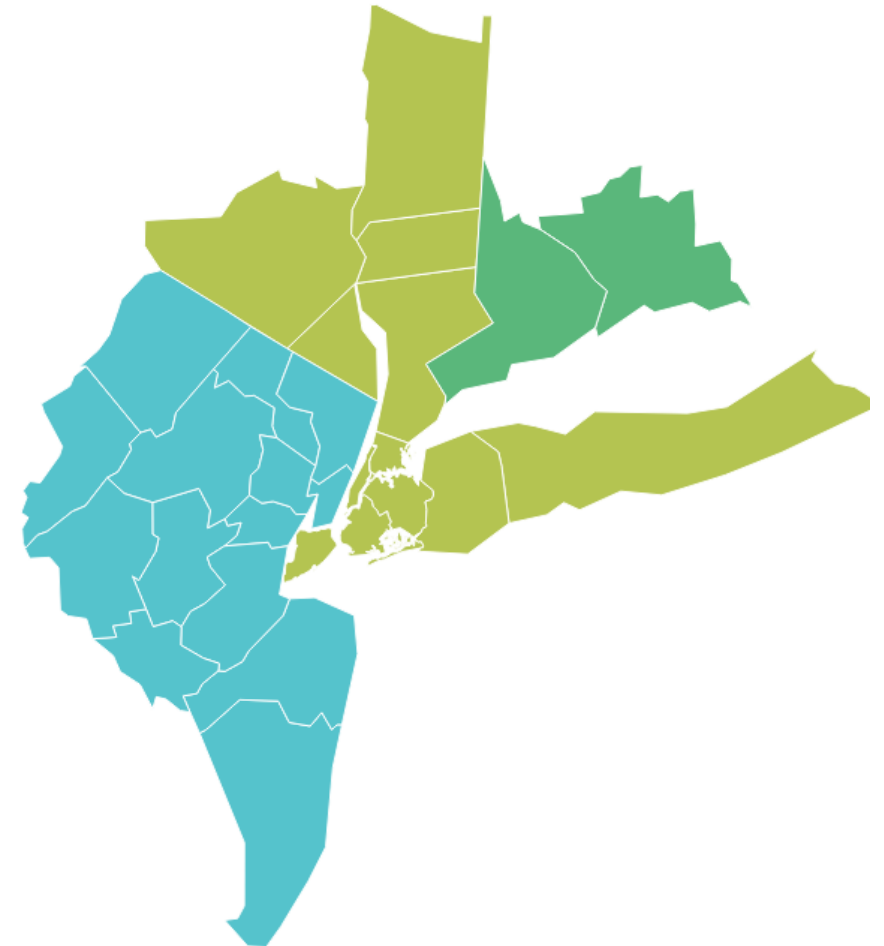
presented to
TPB Travel Forecasting Subcommittee

presented by
Brent Selby



Model Update Overview

- NYMTC Model Universe
 - » Passenger Models (ABM, External, & Visitor)
 - » Truck Model
- Truck Submodels:
 - » Long distance model – update
 - » Short distance model – new methodology
- LOCUS Truck GPS-based Big Data



New Truck Model Design

➤ Long Distance

- » *Previously:* Trips more than 50 miles OR external trip ends
- » Restrict to only trips with trip ends outside of region
- » Update with FAF5 (from FAF3)

➤ Short Distance

- » *Previously:* Applied QRFM rates by employment
- » *Previously:* Applied average trip distances from Chicago and North Carolina
- » Model all internal trips, without 50-mile limit
- » Base estimation on truck big data
 - Detailed, timely, local OD data
- » Destination choice model (in place of gravity model)

Previous Short Distance Estimation

➤ Trip Generation Steps

1. Apply QRFM trip generation rates by employment for each zone
2. Create initial OD by average distance
3. Add long distance model's trips to OD table
4. Scale OD table to prior model's total trips
5. Run ODME to adjust OD table to counts
6. Sum OD trips at origin zone & regress on employment to get trip gen rates

➤ Trip Distribution Steps

- » Calculate impedance

$$\text{Impedance} = \text{travel time} + \text{toll-cost}/\text{VOT} + \text{distance} \times \text{VOC}/\text{VOT} + \text{Truck Penalty} \times \text{distance}$$

- » Create distribution by gravity model
- » Calibrate to average distances from Chicago model

Comparing Approaches (Short Distance)

➤ Prior approach

- » Rates and average distance borrowed from another time and place
- » ODME depends on the coverage and comparability of traffic counts
- » Used prior model total from years before
- » Simplistic distribution based on single impedance function for each weight

➤ New approach

- » Harnesses big data that was not available previously
- » Generation and distribution uses recent trip data from NY region
- » Destination choice model flexible enough to better match behavior
- » Less dependent on FAF

LOCUS Truck

- CS's commercial vehicle big data product based on fleet telematics data
- Includes light, medium, and heavy trucks
- Expanded Data
- Validated Data to account for biases
- Huge sample volume in NYMTC region
 - » 112,991 Average number of vehicles per month
 - » 115,503,965 Average number of miles driven per month
 - » 11,287,414 Average number of trips per month

Short Distance Model Structure



- Assigned trip table
 - » Truck weights – Light, Medium, Heavy
 - » Time of day
- Additional (pre-assignment) segmentation
 - » Vocation
 - » Industry

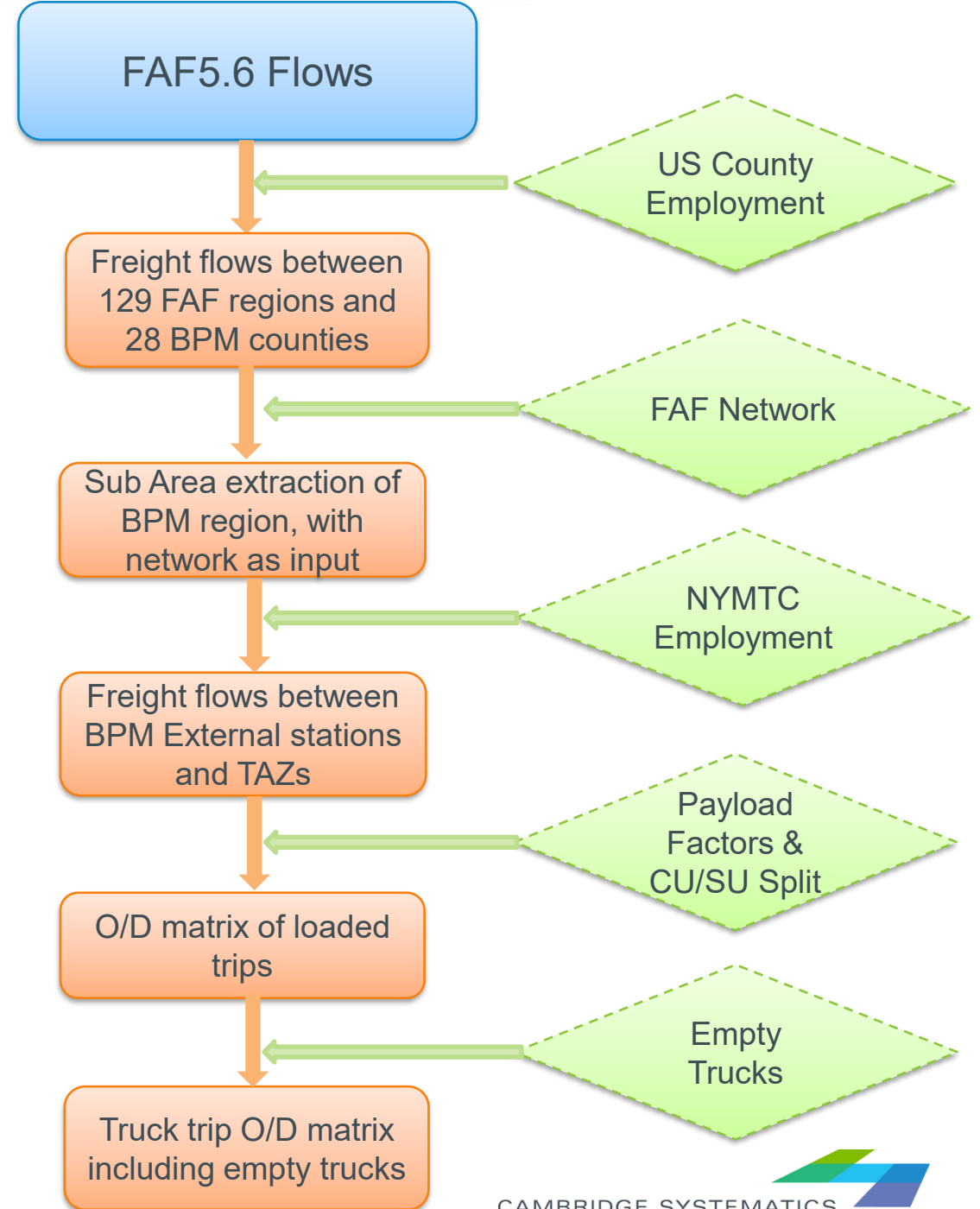
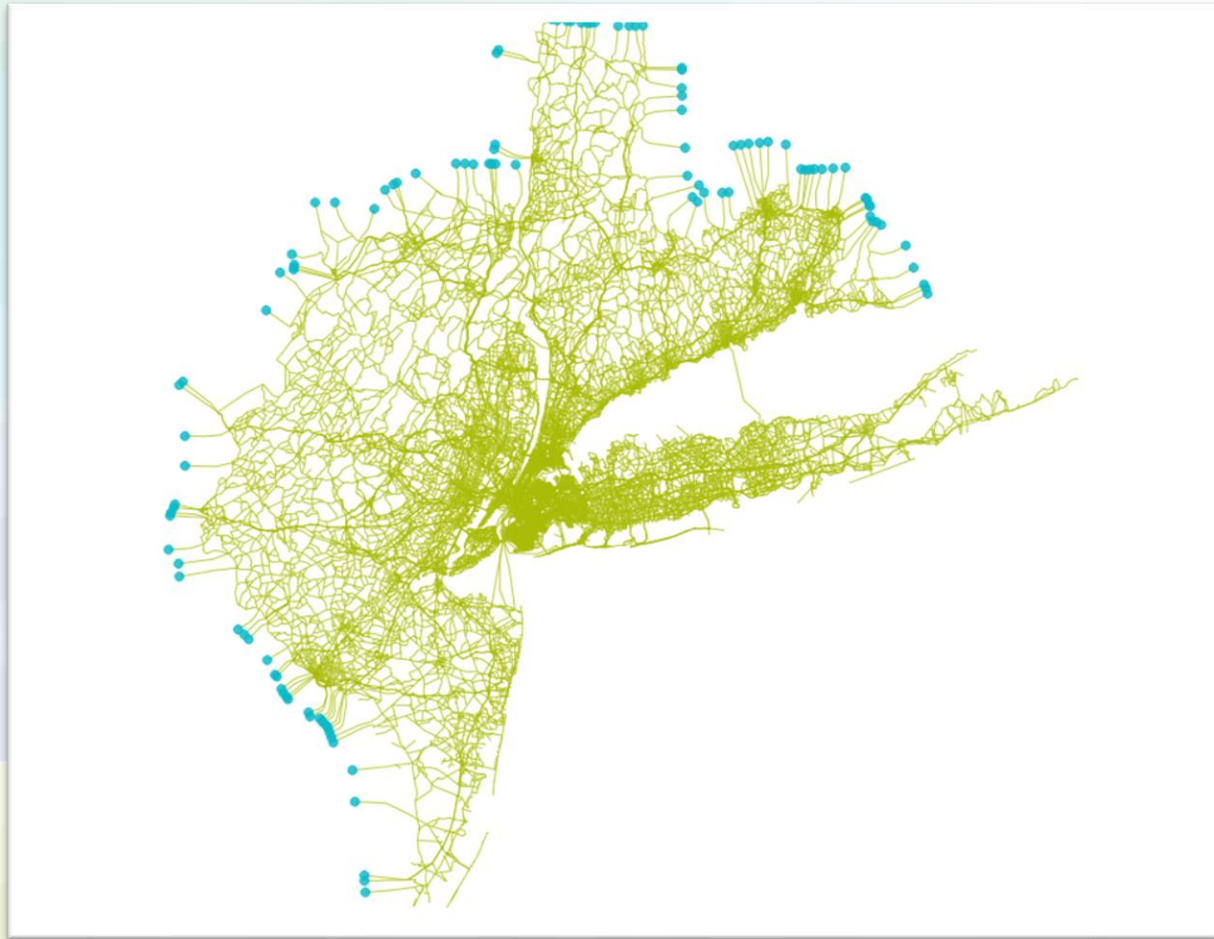
Updated Short Distance Model

- Trip Generation – estimate robust rates
 - » Sum truck trips from each zone by segmentation
 - Truck weight (light, medium, heavy)
 - Industry (of ownership)
 - Vocation (see right)
 - » Regress zonal trip total on employment and other local variables
 - Accessibility indices
 - Special generator (e.g., ports) variables

- Trip Distribution – estimate destination choice model
 - » Process truck trips into estimation data set & model zones
 - » Estimate coefficients for relevant variables
 - Travel time/distance
 - Accessibility indices
 - Bridge/border crossings
 - Other local information relating to origin and destination

Vocation Type	Examples
Door-to-Door	<ul style="list-style-type: none">• Last mile delivery vehicle• Waste collection vehicle
Hub and Spoke	<ul style="list-style-type: none">• On-demand delivery services or delivery vehicle• Auto-part delivery vehicle
Local	<ul style="list-style-type: none">• HVAC vehicle• Beverage distribution vehicle
Regional	<ul style="list-style-type: none">• Building supplies vehicle• Fuel carrier
Long-Distance	<ul style="list-style-type: none">• Long haul freight vehicle• Rental or company vehicle

Long Distance Model



Traffic Counts

➤ Count types

- » Continuous vs 48 hour
- » Classification vs Non-Classification
- » WIMs and Tolls

➤ Sources

- » 3 states
- » NYMTC
- » Port Authority
- » Bridge tolls

➤ Processing and Validation

- » Assigning to links

New Jersey Department of Transportation

Short-term Hourly Traffic Volume for 06/05/2017 to 06/07/2017

Site names: 1-6-120.US 206-114.48,00000206__
 County: SUSSEX
 Funct Class: Rural Principal Arterial - Other
 Location: APPROX 0.33 MILE NORTH OF NJ 15

Seasonal Factor Grp: rg2_3R
 Daily Factor Grp: rg2_3R
 Axle Factor Grp: rg2_3R
 Growth Factor Grp: rg2_3R

	Sun, Jun 4, 2017			Mon, Jun 5, 2017			Tue, Jun 6, 2017			Wed, Jun 7, 2017			Thu, Jun 8, 2017			
	Road	N	S	Road	N	S	Road	N	S	Road	N	S	Road	N	S	Road
00:00							92	54	38	109	73	36				
01:00							54	29	25	56	34	22				
02:00							43	18	27	44	16	28				
03:00							106	21	85	102	21	81				
04:00							322	21	301	333	25	308				
05:00							688	66	622	688	72	616				
06:00							935	124	811	978	129	849				
07:00							1,182	391	791	1,162	390	772				
08:00							1,106	453	653	1,097	396	701				
09:00							930	327	603	848	338	510				
10:00							848	336	513	916	367	549				
11:00				866	365	501	869	382	487							
12:00				936	401	535	903	424	479							
13:00				921	455	466	899	457	442							
14:00				998	569	429	995	607	388							
15:00				1,148	707	441	1,197	743	454							
16:00				1,275	793	482	1,307	798	509							
17:00				1,296	865	431	1,314	885	429							
18:00				949	626	323	925	607	318							
19:00				648	433	215	653	442	211							
20:00				449	291	156	493	332	161							
21:00				383	256	127	405	297	108							
22:00				220	156	64	216	147	69							
23:00				142	107	35	128	99	29							
Total				10,231	6,024	4,207	16,611	8,058	8,553	6,333	1,861	4,472				
AM Peak Vol							1,182	453	811							
AM Peak Fct							1	1	1							
AM Peak Hr							7:00	8:00	8:00							
PM Peak Vol				1,296	865	535	1,314	885	509							
PM Peak Fct				1	1	1	1	1	1							
PM Peak Hr				17:00	17:00	12:00	17:00	17:00	16:00							
Seasonal Fct				.945	.945	.945	.945	.945	.945	.945	.945	.945				
Daily Fct				1.037	1.037	1.037	1.018	1.018	.997	.997	.997	.997				
Axle Fct				.452	.452	.452	.452	.452	.452	.452	.452	.452				
Pulse Fct				2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000				

Model Validation

- Model flows vs counts
 - » Aggregate – by region, roadway type
 - » Geographic – individual locations mapped
 - » Medium, Heavy, & Medium+Heavy
 - » Light – combined with passenger
- Adjustments
 - » Trip generation
 - » Regional factors
 - » Roadway restrictions
 - » Miscoded/erroneous counts

Conclusion

- Updated NYMTC Truck Model
 - » Short distance (internal) model redesigned
 - » Long distance (external) model updated data
 - » Updated network coding
 - » ABM updated in separate project
- Applied Big Data from truck GPS units
- Compiled and applied count data
- Validated full model with ABM