

DEVELOPMENT OF EXTERNAL TRUCK TRIPS FOR MPOS



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Overview

- Benefits of external truck trips for MPOs
- External Truck Model Design
 - Freight data summary
 - National Truck Model
 - Sub-Area analysis
 - Disaggregation to MPO TAZs
 - Model calibration
 - Model results
- Current uses
- Questions?

BENEFITS OF EXTERNAL TRUCK TRIPS

Modeling External Trucks

Benefits

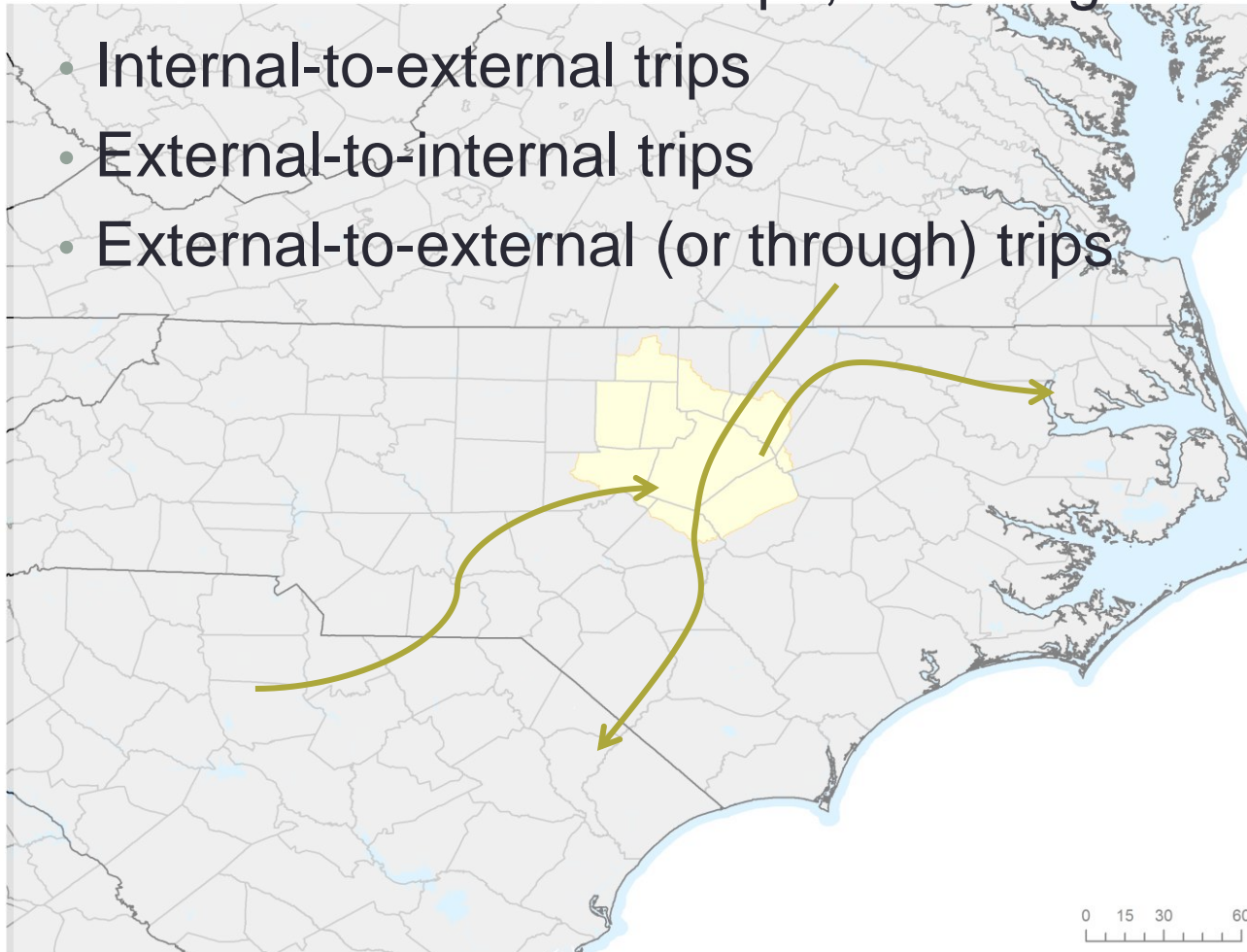
- Ability to model long distance truck trips.
- Built to forecast any year from 2007-2040
- Outputs a trip table that can be incorporated into your MPO model with minimal effort.
- Can be split by time of day.
- Adds appropriate truck congestion to roadways.

MODEL DESIGN

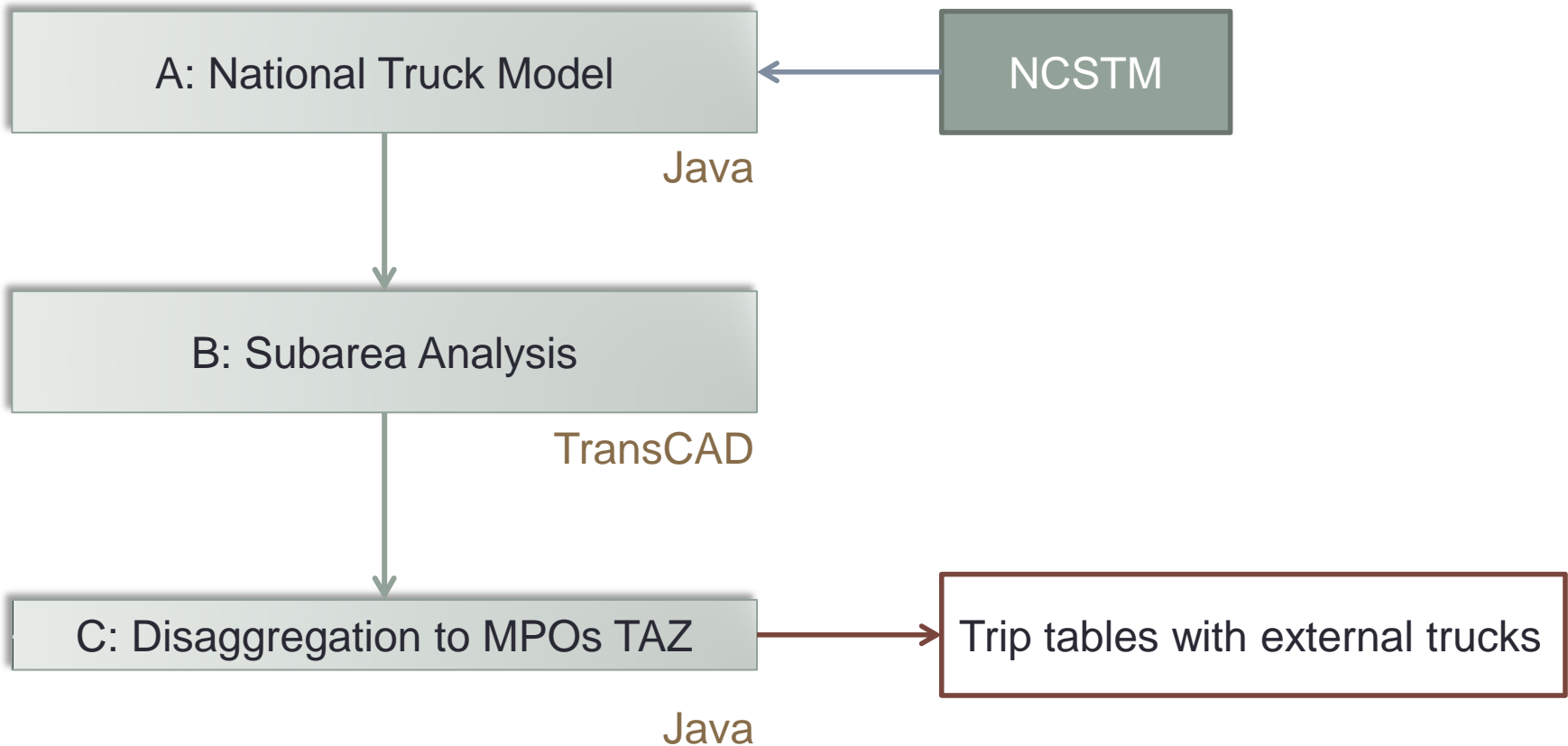
Modeling External Trucks

Purpose

- Generate external truck trips, including
 - Internal-to-external trips
 - External-to-internal trips
 - External-to-external (or through) trips



Model Design



A: FREIGHT DATA SUMMARY

Modeling External Trucks

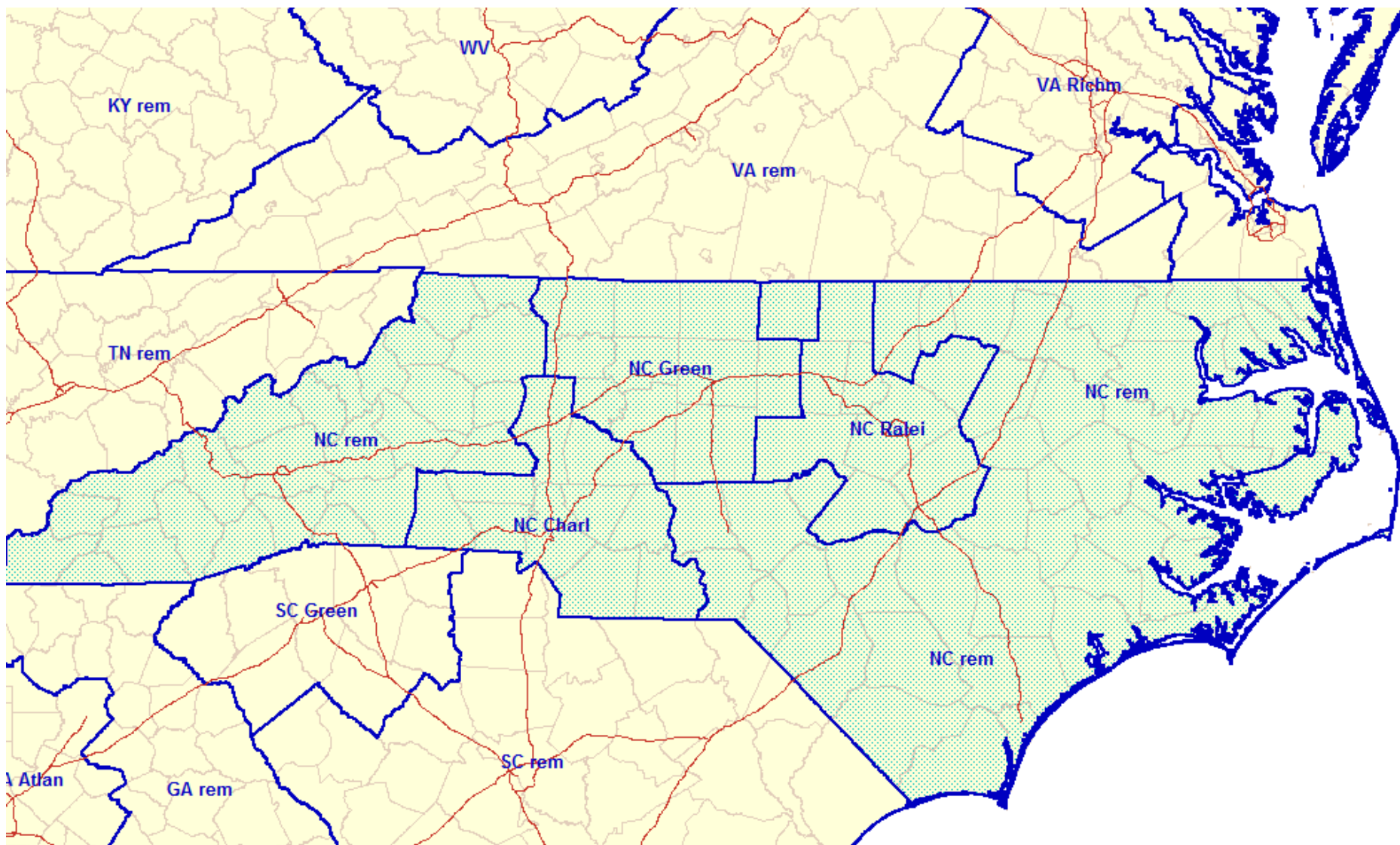
FAF³ Data

Published by FHWA, contains freight flows by

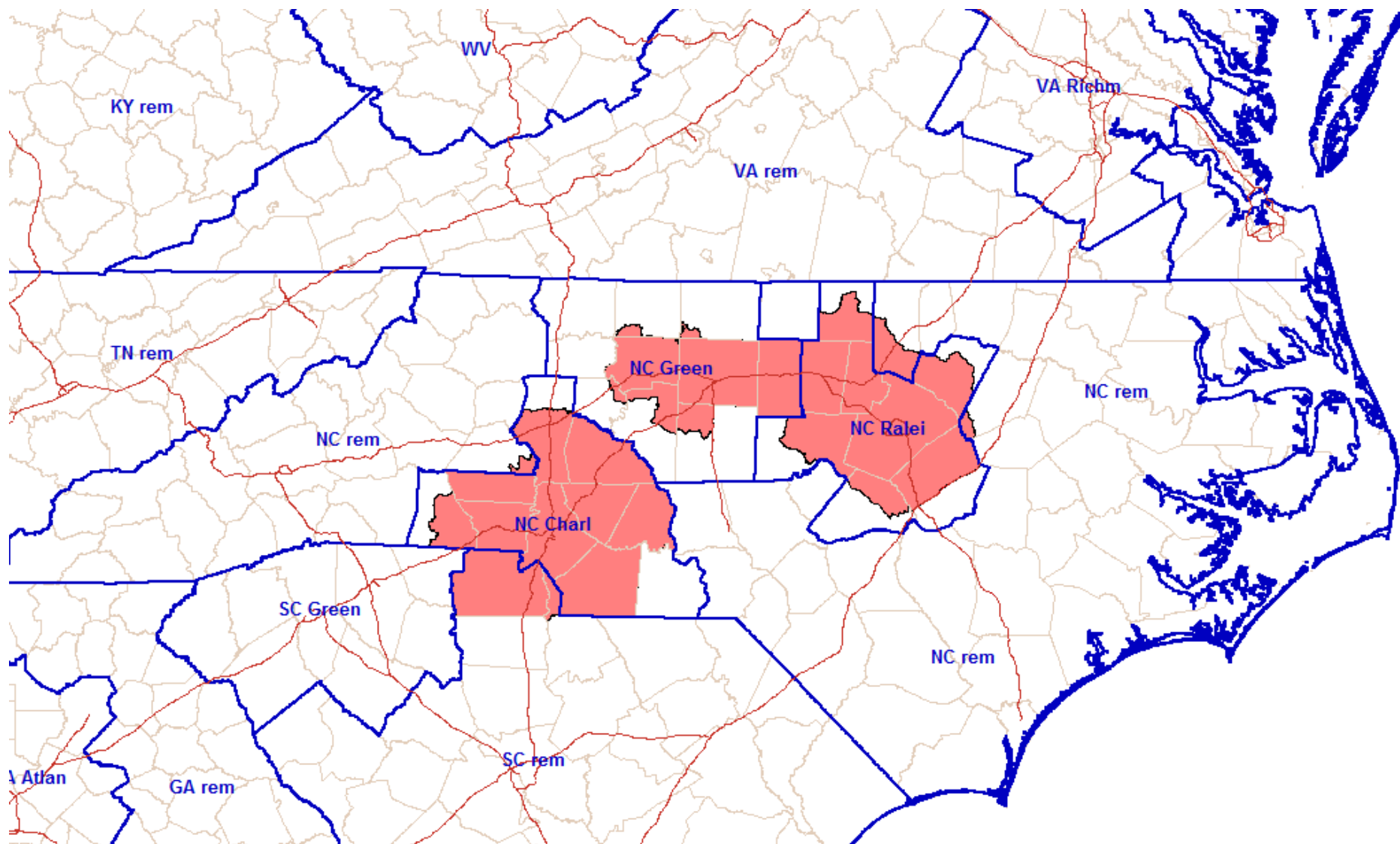
- 123 domestic and 8 international FAF zones
- 7 modes
- 43 SCTG commodities
- Port of entry/exit

Most current version: FAF^{3.4}

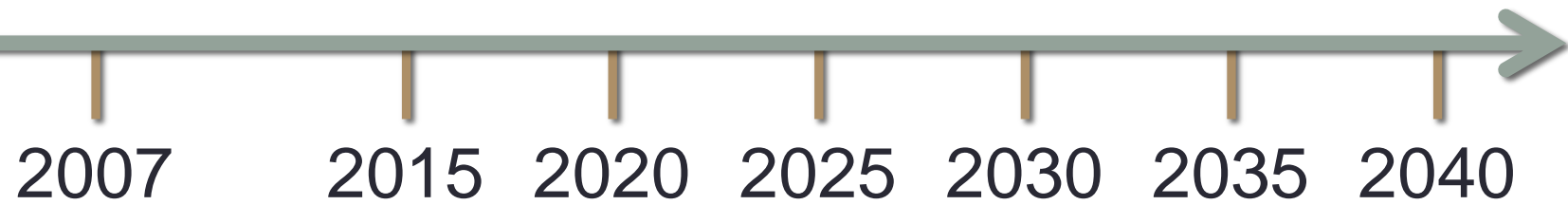
North Carolina FAF Zones



FAF Zones and MPOs



FAF Model Years

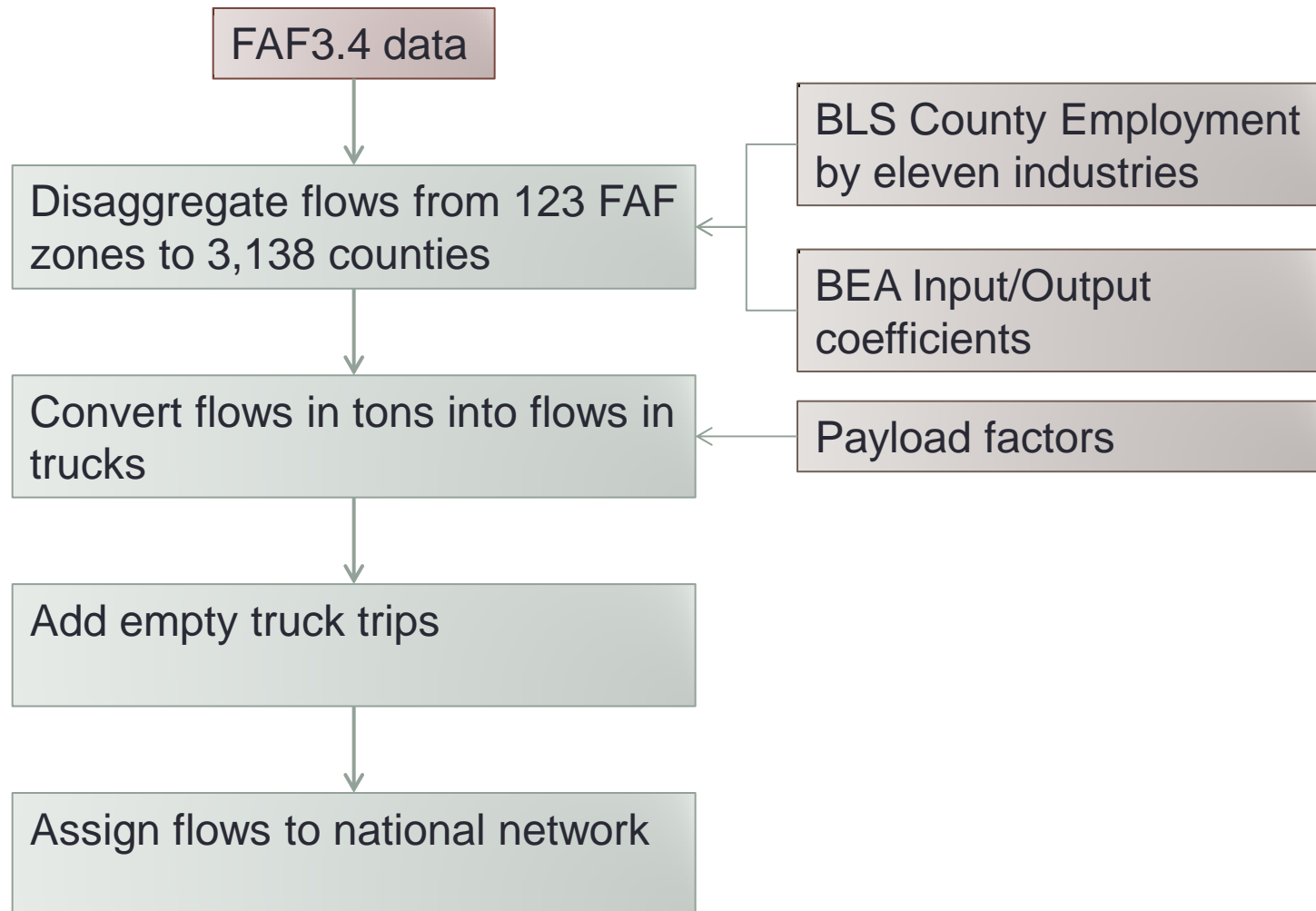


FAF³ years


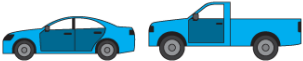












B: NATIONAL TRUCK MODEL

Modeling External Trucks

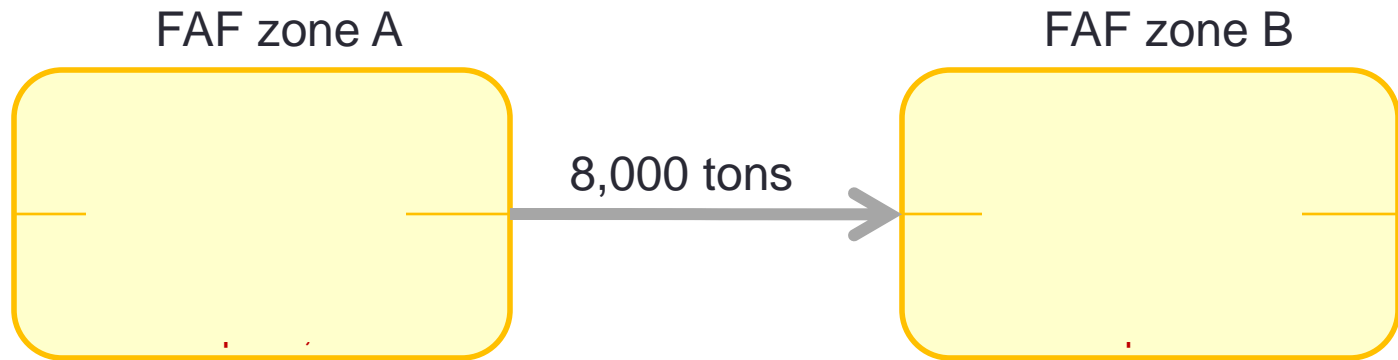
Model Design



FHWA Vehicle Classes

FHWA Vehicle Classifications			
1. Motorcycles 2 axles, 2 or 3 tires 	2. Passenger Cars 2 axles, can have 1- or 2-axle trailers 	3. Pickups, Panels, Vans 2 axles, 4-tire single units Can have 1 or 2 axle trailers 	4. Buses 2 or 3 axles, full length 
5. Single Unit 2-Axle Trucks 2 axles, 6 tires (dual rear tires), single unit 	6. Single Unit 3-Axle Trucks 3 axles, single unit 	7. Single Unit 4 or More-Axle Trucks 4 or more axles, single unit 	8. Single Trailer 3- or 4-Axle Trucks 3 or 4 axles, single trailer 
9. Single Trailer 5-Axle Trucks 5 axles, single trailer 	10. Single Trailer 6 or More-Axle Trucks 6 or more axles, single trailer 	11. Multi-Trailer 5 or Less-Axle Trucks 5 or less axles, multiple trailers 	
12. Multi-Trailer 6-Axle Trucks 6 axles, multiple trailers 	13. Multi-Trailer 7 or More-Axle Trucks 7 or more axles, multiple trailers 		

Disaggregation of FAF³ Flows



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%	4,848
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

Convert Tons to Trucks

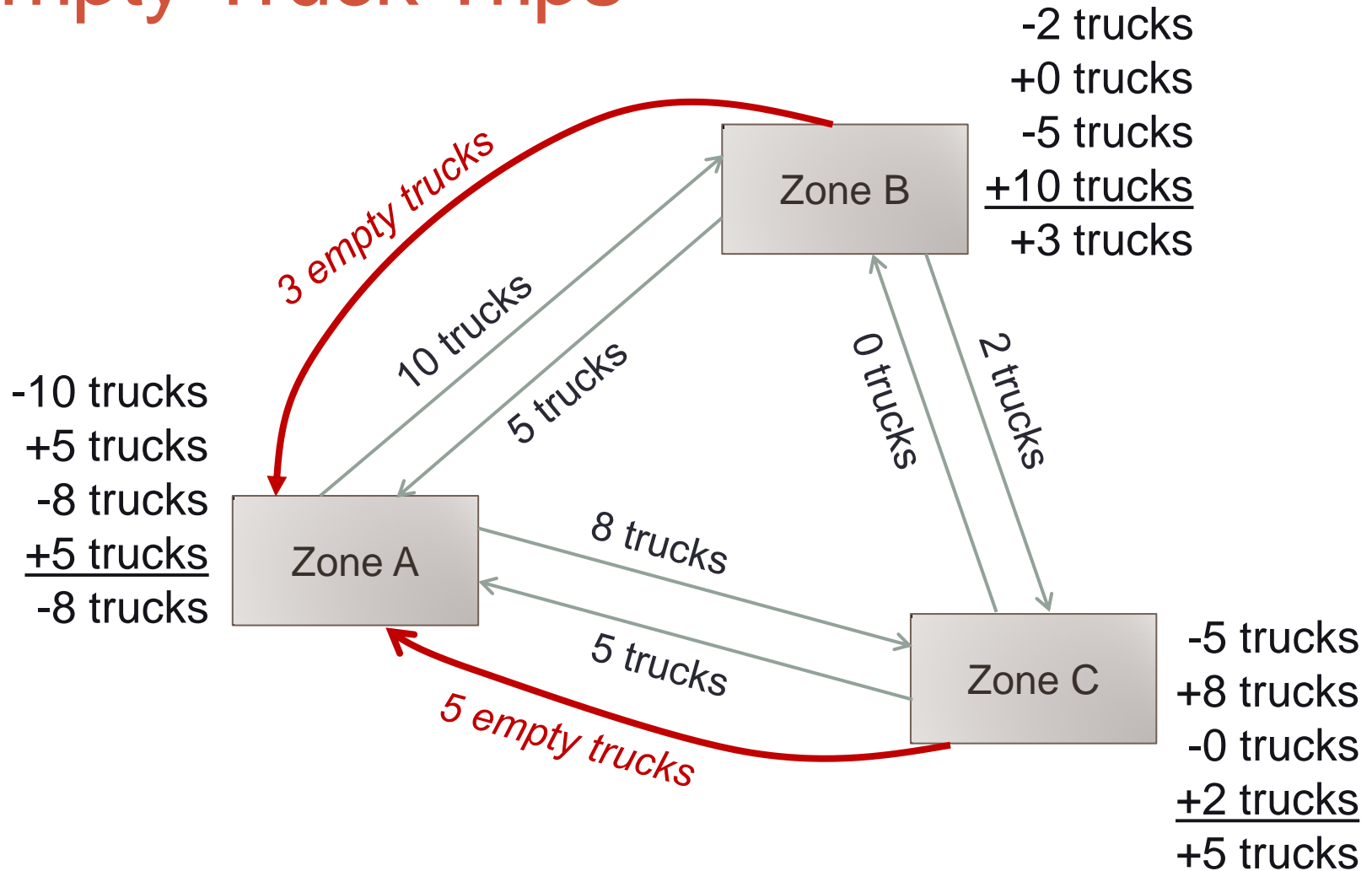
SCTG	Commodity	Payload factor
SCTG01	Live animals/fish	24,492
SCTG02	Cereal grains	27,945
SCTG03	Other ag prods.	22,140
SCTG04	Animal feed	22,967
SCTG05	Meat/seafood	30,691
SCTG06	Milled grain prods.	11,831
SCTG07	Other foodstuffs	25,926
SCTG08	Alcoholic beverages	20,573
SCTG09	Tobacco prods.	25,168
SCTG10	Building stone	25,429
...		
SCTG43	Mixed freight	11,826

Convert Annual Into Weekday Flows

$$trucks_{daily} = \frac{trucks_{yearly}}{365.25} \cdot \frac{AAWDT}{AADT}$$

$$\frac{AAWDT}{AADT} = 1.02159$$

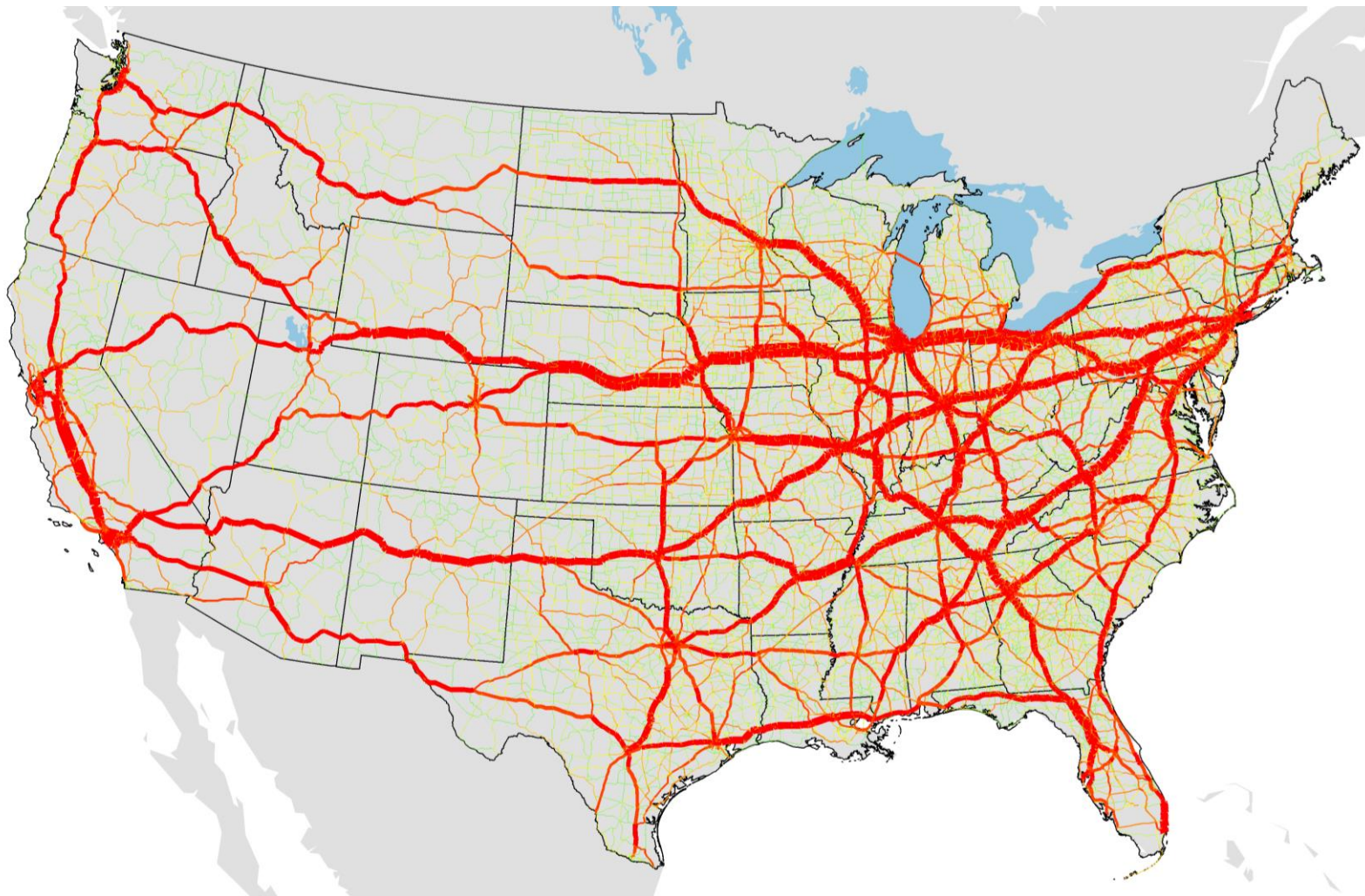
Empty Truck Trips



Assignment

- At national level for all counties
- Multi-class assignment
- PCE for single-unit trucks (1.5) and multi-unit trucks (2.0)
- Background volume assumed based on facility type

National Assignment



C: SUBAREA ANALYSIS

Modeling External Trucks

Sub-Area Analysis

The screenshot displays the 'Planning' menu and the 'Multi-Modal Multi-Class Assignment' dialog box. The 'Subarea Setting' sub-dialog box is open, showing the 'Create Subarea Using' options.

Planning Menu:

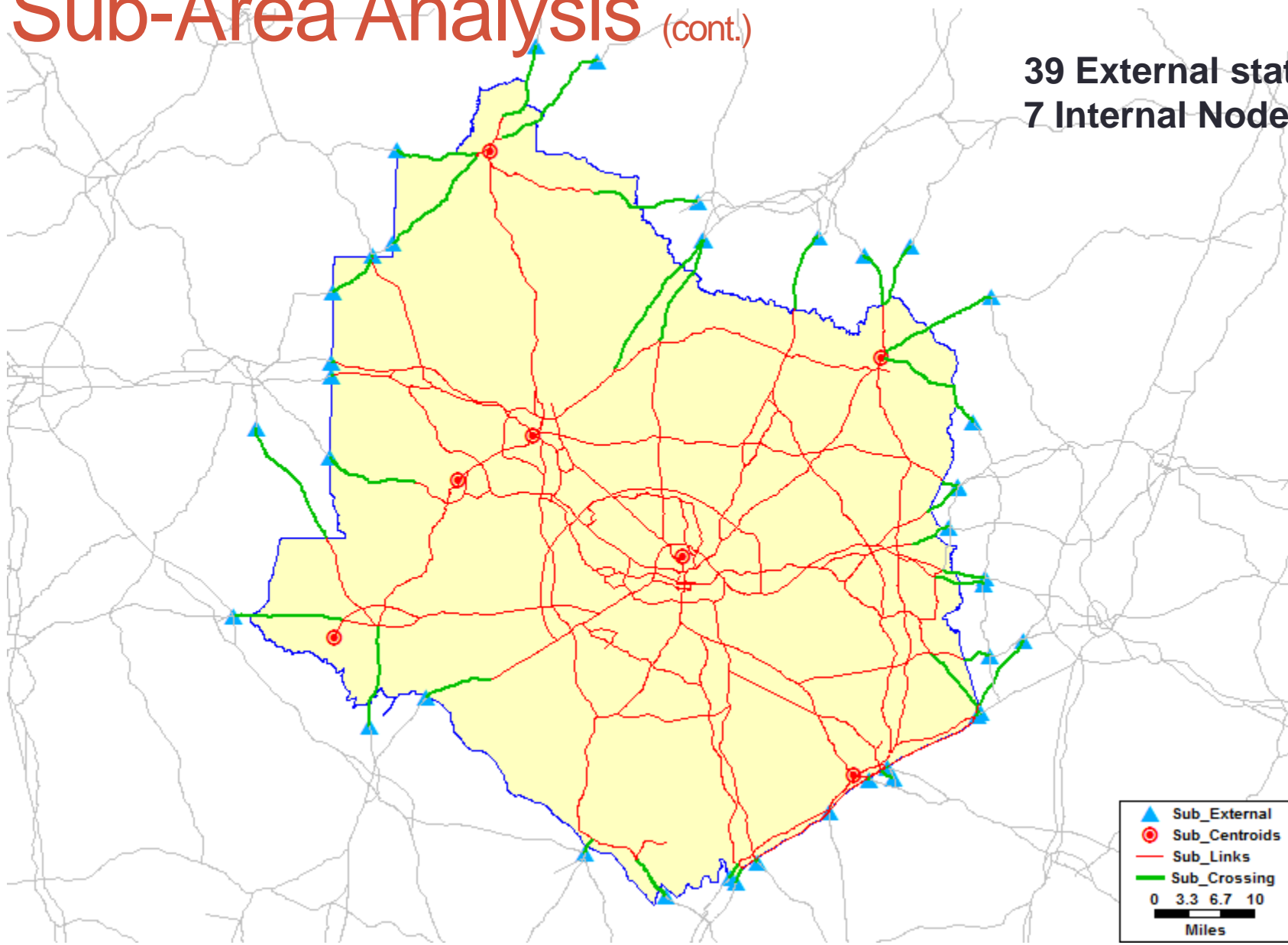
- Trip Productions
- Trip Attractions
- Balance...
- Quick Response Method...
- Trip Distribution
- Mode Split
- P-A to O-D ...
- Time of Day Analysis...
- Single Class Traffic Assignment
- Multi Class Traffic Assignment**
 - Multi-Modal Multi-Class Assignment...**
 - Multi-Modal Multi-Class Subarea Analysis...**
- Other Assignment Methods
- Assignment Utilities
- OD Matrix Estimation
- Import Planning Data
- Planning Utilities
- Census Utilities
- Survey Utilities
- Distributed Computing
- Logging
- Batch Editing

Multi-Modal Multi-Class Assignment Dialog:

- Line Layer: Highway
- Network File: F:\... \fafNetwork_withPhantomCounties.ne
- Method: User Equilibrium
- Delay Function: Bureau of Public Roads (BPR)
- O-D Matrix: Critical Matrix
- Toll Matrix:
- Class Information: Matrices, PCE, PCE G, VOT, Fixed Toll, Road Toll, Exclusion Set
- Subarea Setting:
 - Create Subarea Using:
 - ☐ Polygon
 - ☒ Area Layer
 - ☐ Selections
 - Layer: TRM_TAZ_Dissolve
 - Selection: All Features
 - Area Info: Centroids: 7 External Stations: 39 Internal Links: 588
- Globals:
 - Iterations: 20
 - Rel Gap: 0.01
 - Path Diff: 0
 - Function:
 - Error: 5
 - ☐ Calculate Proportionality
 - Iterations: 10

Sub-Area Analysis (cont.)

39 External stations
7 Internal Nodes



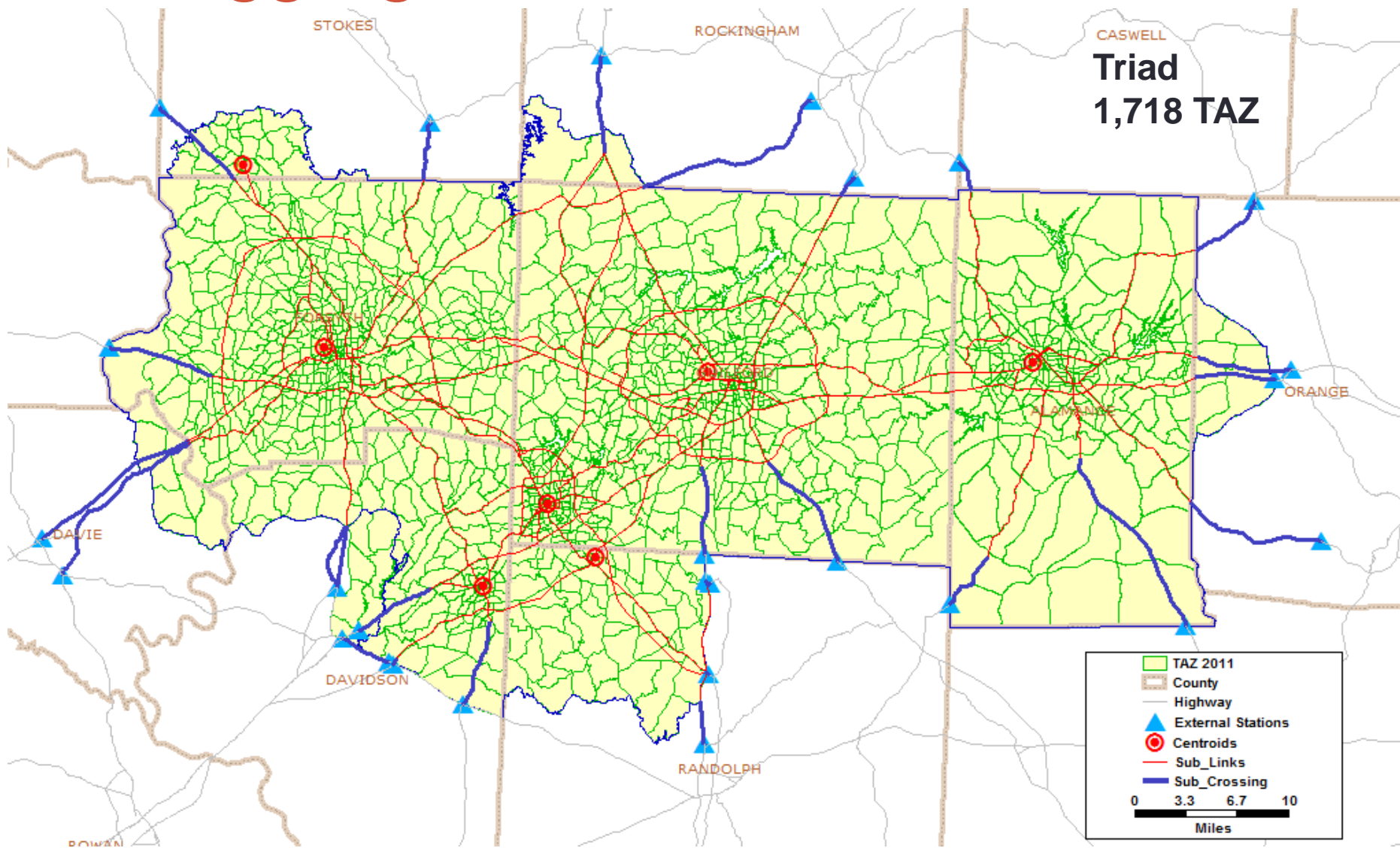
D: DISAGGREGATE TO MPO TAZS

Modeling External Trucks

Input Files

- National FAF Network
- Centroids
- Local Network
- Local TAZ Layer
- Local Socioeconomic Data
- Trip Rates
- TAZ to County mapping
- External Station Mapping
- Counts for Calibration

Disaggregation to MPO TAZ



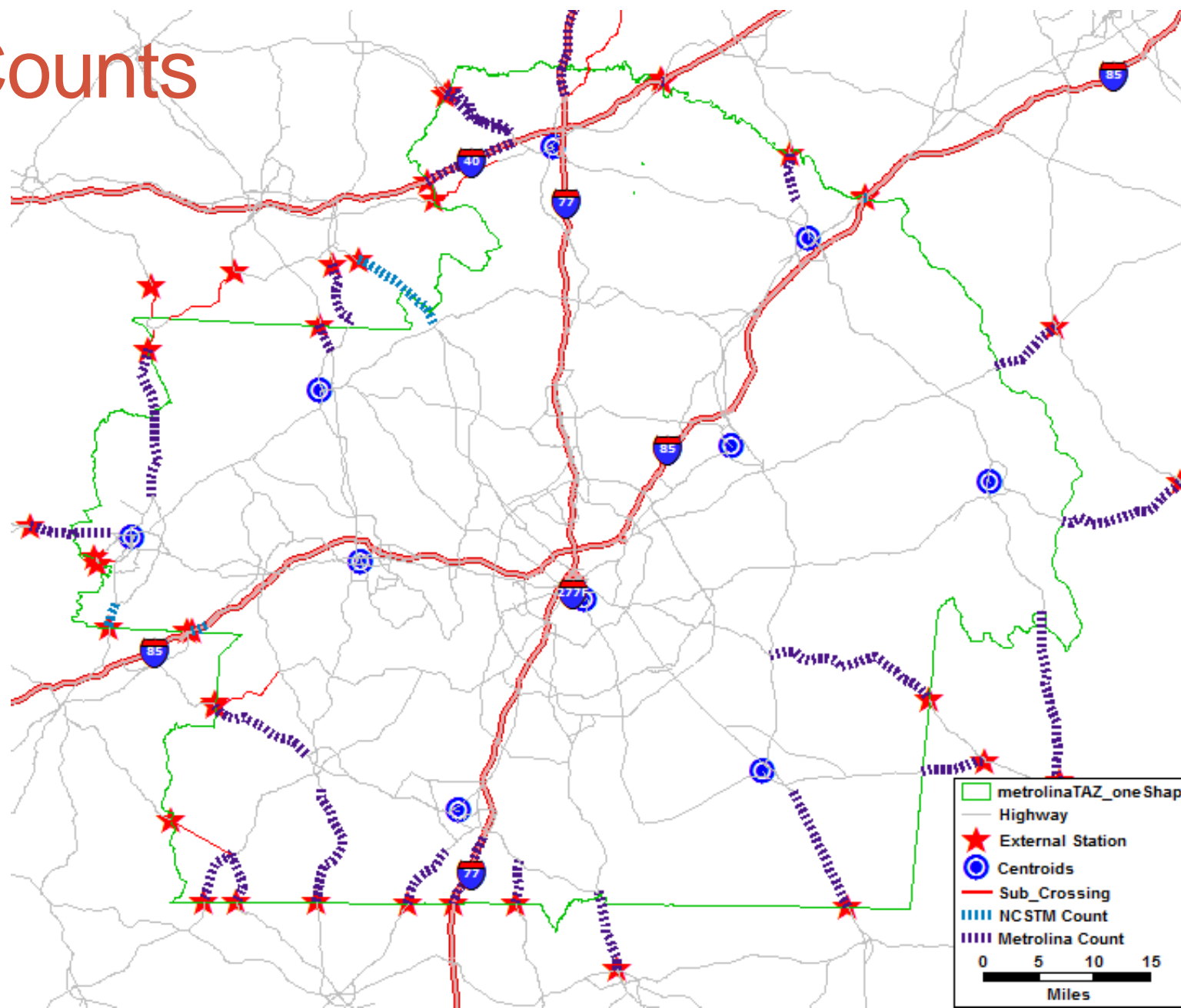
Disaggregation of Truck Trips to TAZ

Direction	Origin	Destination
Internal-to-External	Based on employment	Given by external station
External-to-Internal	Given by external station	Based on employment
External-to-External	Given by external station	Given by external station

E: CALIBRATION

Modeling External Trucks

Counts



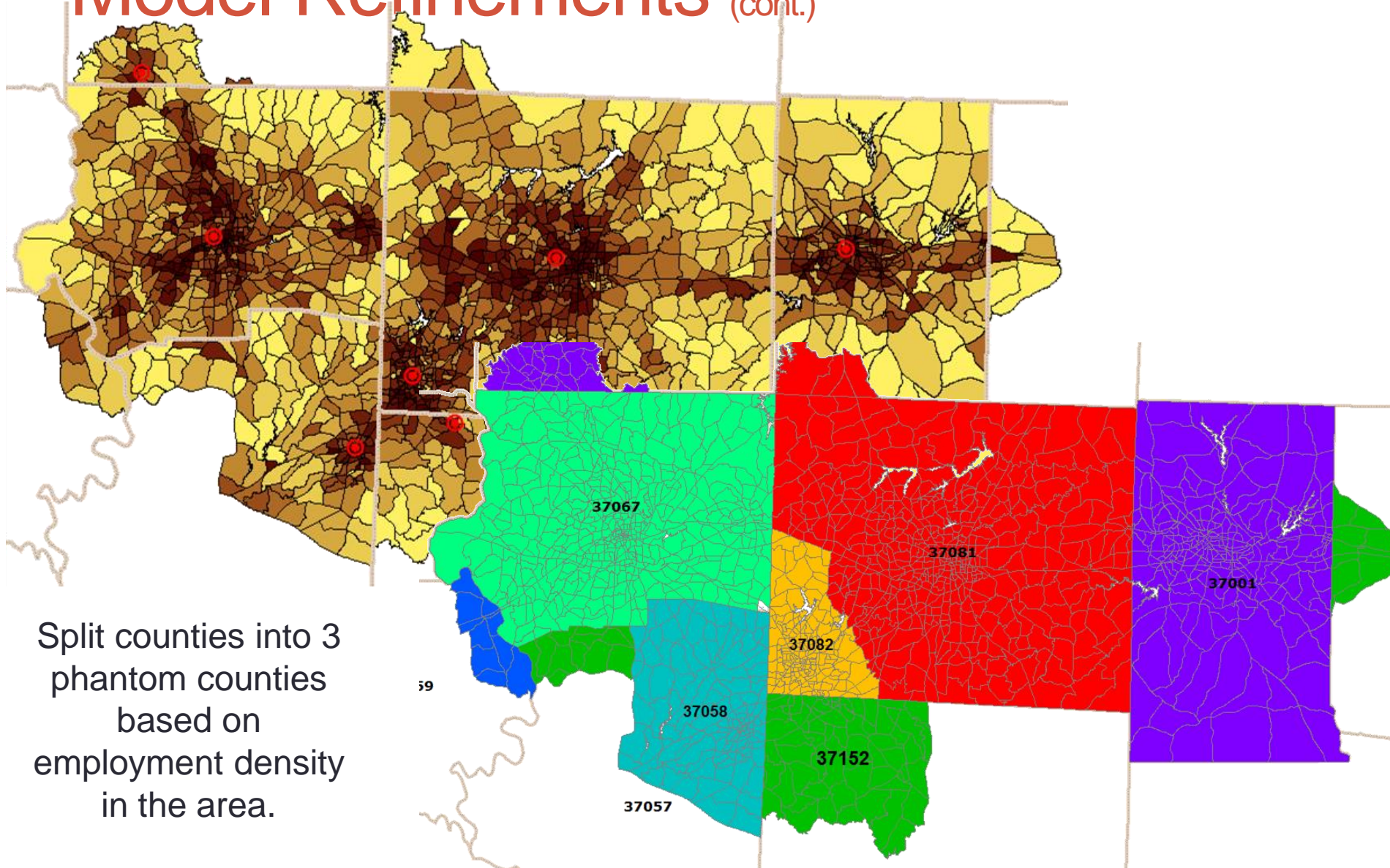
Scaling Factors

- Master truck ton adjustment
- Percent SUT adjustment
- Truck trip adjustment
 - FAF_FAF,
 - STATE_STATE,
 - STATE_FAF,
 - FAF_STATE
- County scalar

Model Refinements

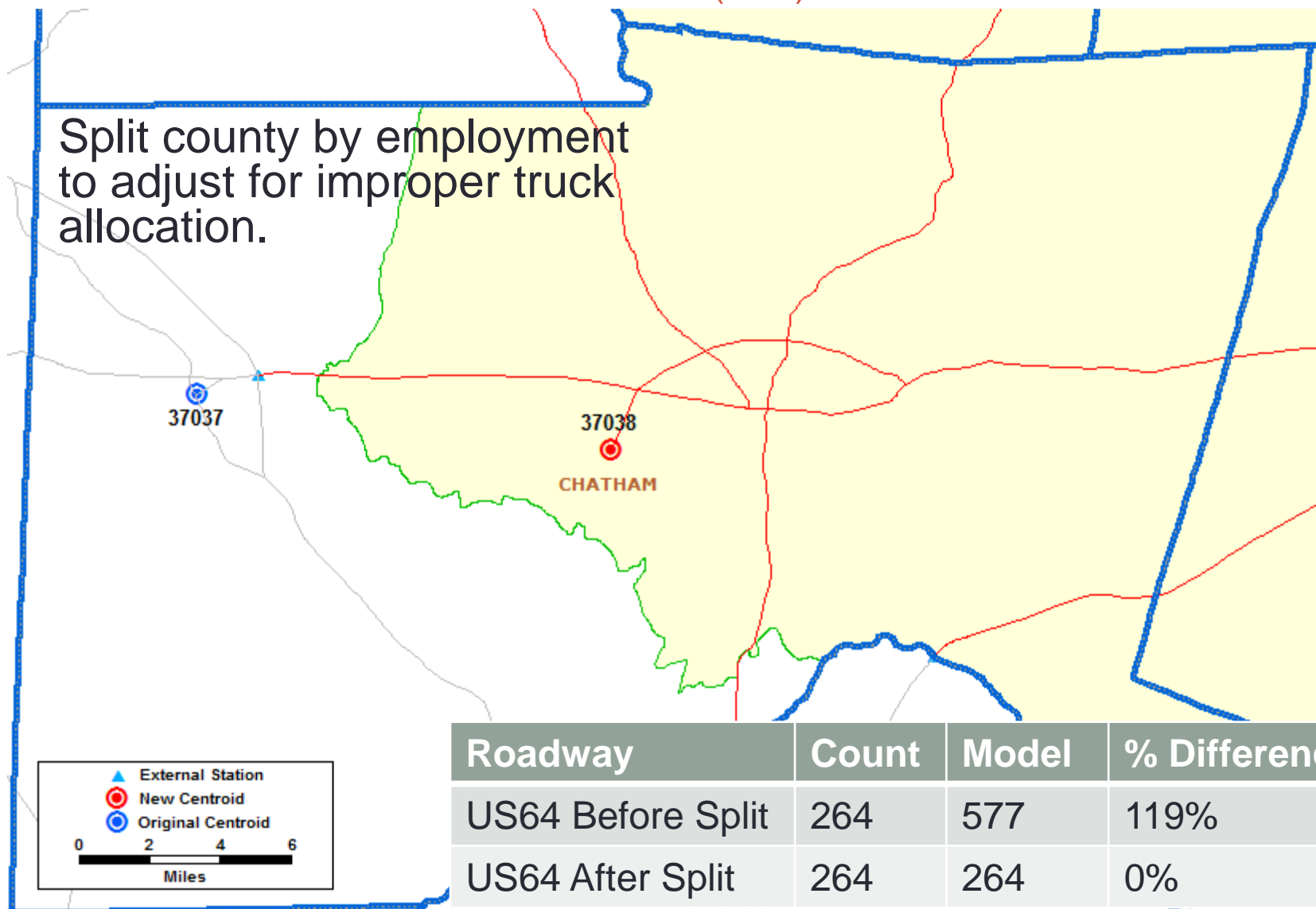
- Splitting counties by employment
- Increase/decrease speeds to adjust travel time
- Run select link analysis

Model Refinements (cont.)



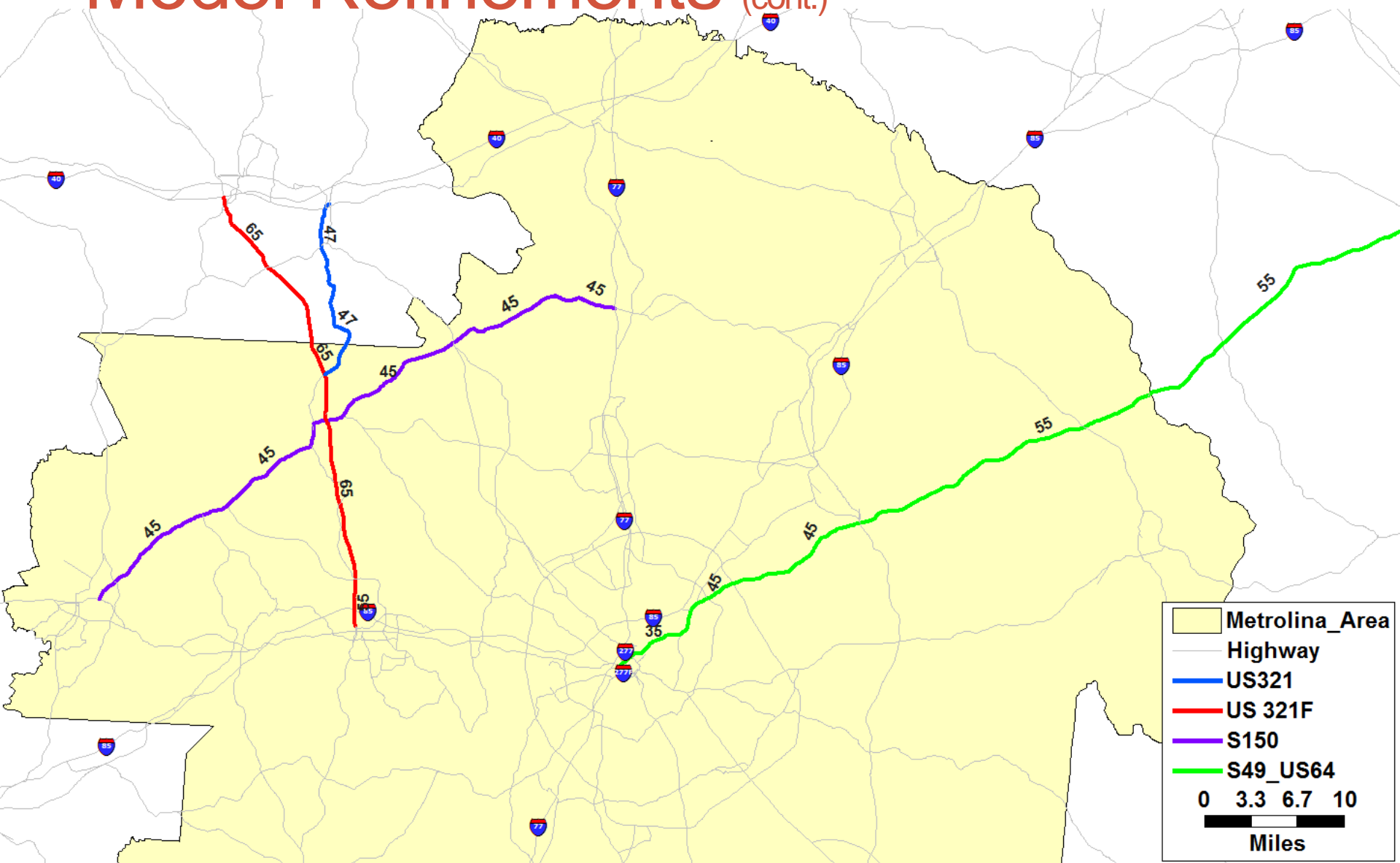
Model Refinements (cont.)

Split county by employment to adjust for improper truck allocation.



Roadway	Count	Model	% Difference
US64 Before Split	264	577	119%
US64 After Split	264	264	0%

Model Refinements (cont.)



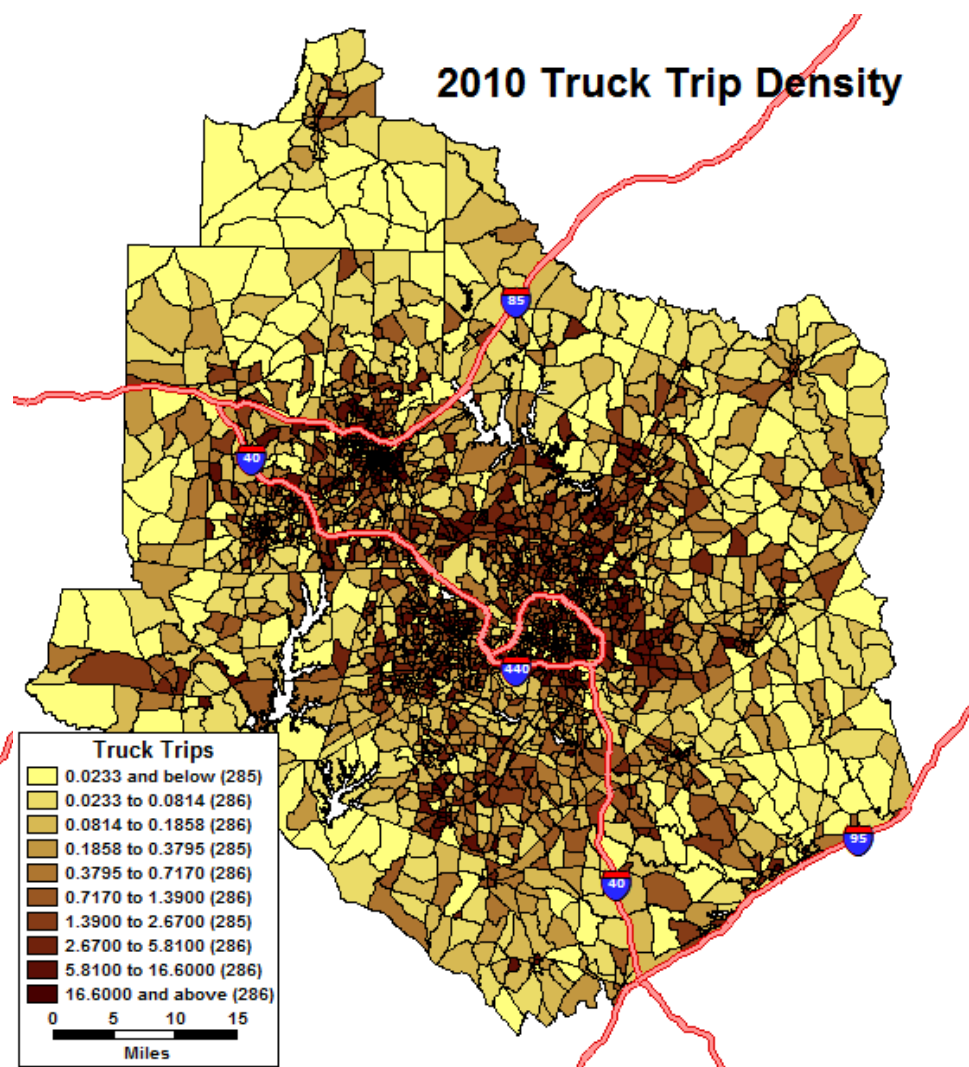
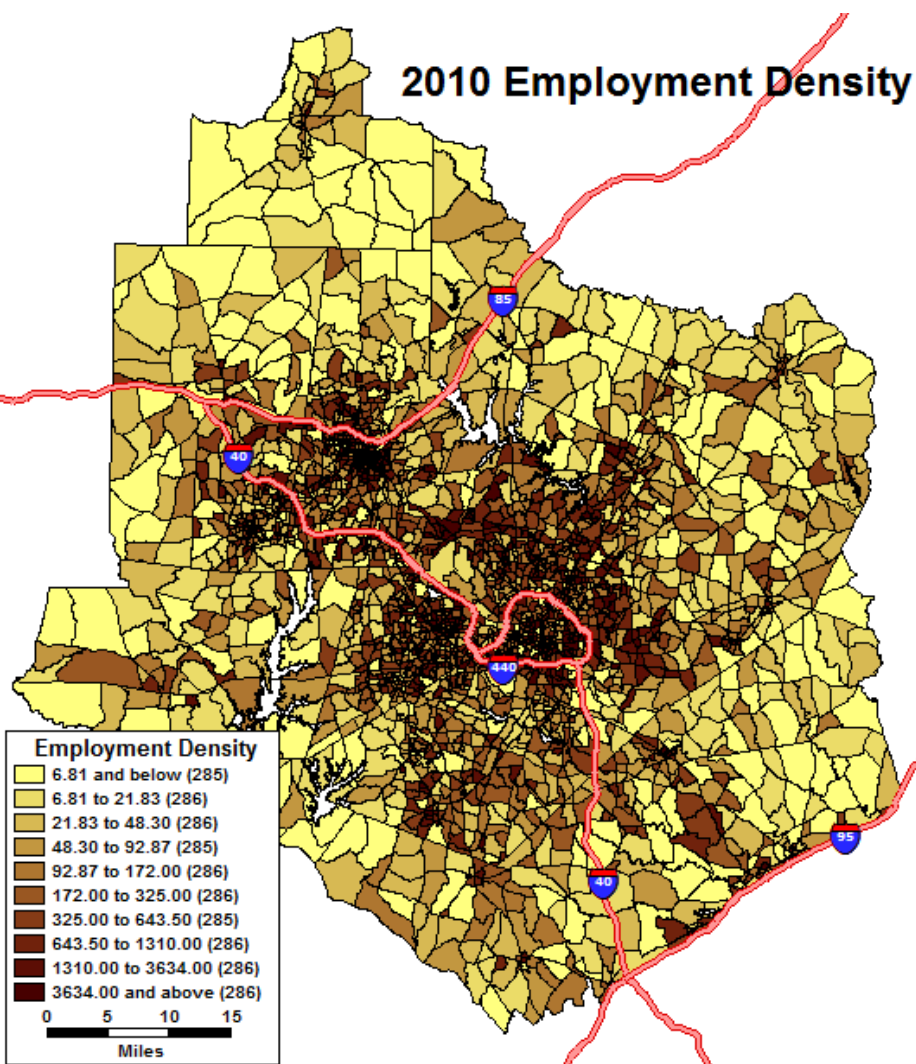
F: RESULTS

Modeling External Trucks

External Truck Trip Table

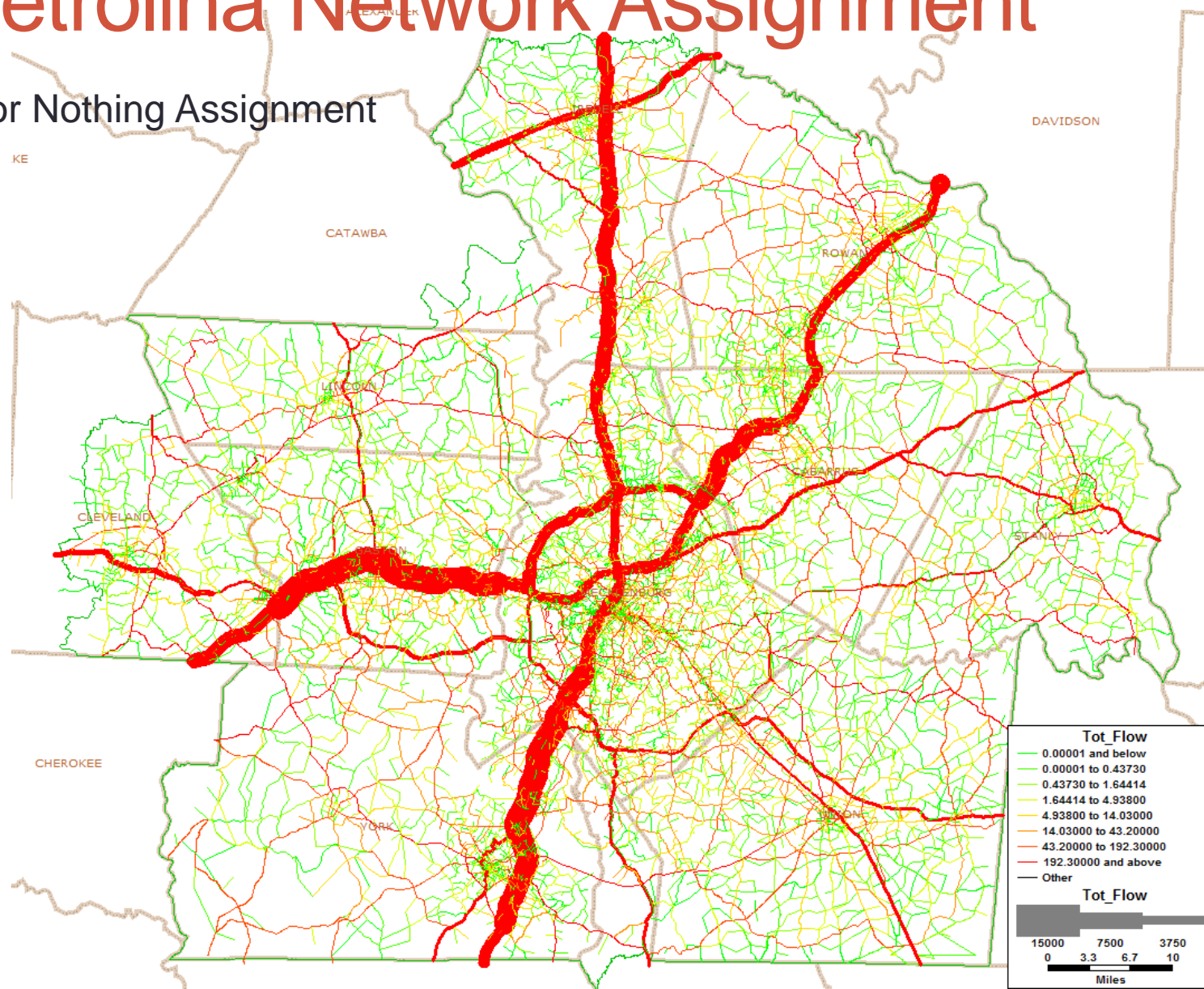
OrigZone	DestZone	singleUnitTrucks	multiUnitTrucks
2905	2925	1072.9000	2552.1899
2925	2905	1096.5000	2501.6599
2876	2951	854.1900	1798.5500
2951	2876	780.4500	1731.3900
2951	2896	154.1000	597.8400
2951	2901	162.9700	574.6300
2896	2951	136.2900	568.8400
2901	2951	145.1600	551.4000
2915	2951	135.9200	534.6200
2923	2951	150.7600	520.5600
2951	2915	131.1100	518.2300
2951	2923	134.3600	448.8300
2932	2930	162.8000	381.8100
2930	2932	107.3300	326.8400
2907	2925	103.5000	317.2400
2925	2907	95.8600	305.9600
2905	2919	88.8000	158.7700
2876	2936	71.9500	139.9300
2936	2876	31.5100	95.6800
2919	2905	30.4600	88.5800
2925	2917	30.8600	75.9100
2917	2925	32.8100	61.6700

Employment and Truck Trips



Metrolina Network Assignment

All or Nothing Assignment



F: CURRENT USES

Modeling External Trucks

MPO Models

- The following MPO's are using this model or a similar approach to produce external truck trips:
 - Triangle (Raleigh, NC)
 - Metrolina (Charlotte, NC)
 - NORPC (New Orleans, LA)
 - RTC (Reno, NV)

Other Models

- The national FAF model methodology is also being used in the following models:
 - NCSTM (North Carolina)
 - NYMTC (New York)
 - Illiana (Indiana and Illinois)

Questions?



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