



The Illinois Statewide Travel Demand Model

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With
CDM Smith, Inc.
Lochmueller Group, Inc.



The Illinois Statewide Travel Demand Model

- **Statewide Travel Demand Model Approach**
 - Data-driven and Phased
- **Model Inputs**
 - Passive Data
 - Network and Zones
- **Synthetic Demand Models**
 - Passenger Models
 - Freight Models
- **Model Validation and Forecasting**
 - Validation
 - Base and Future Year Forecasts

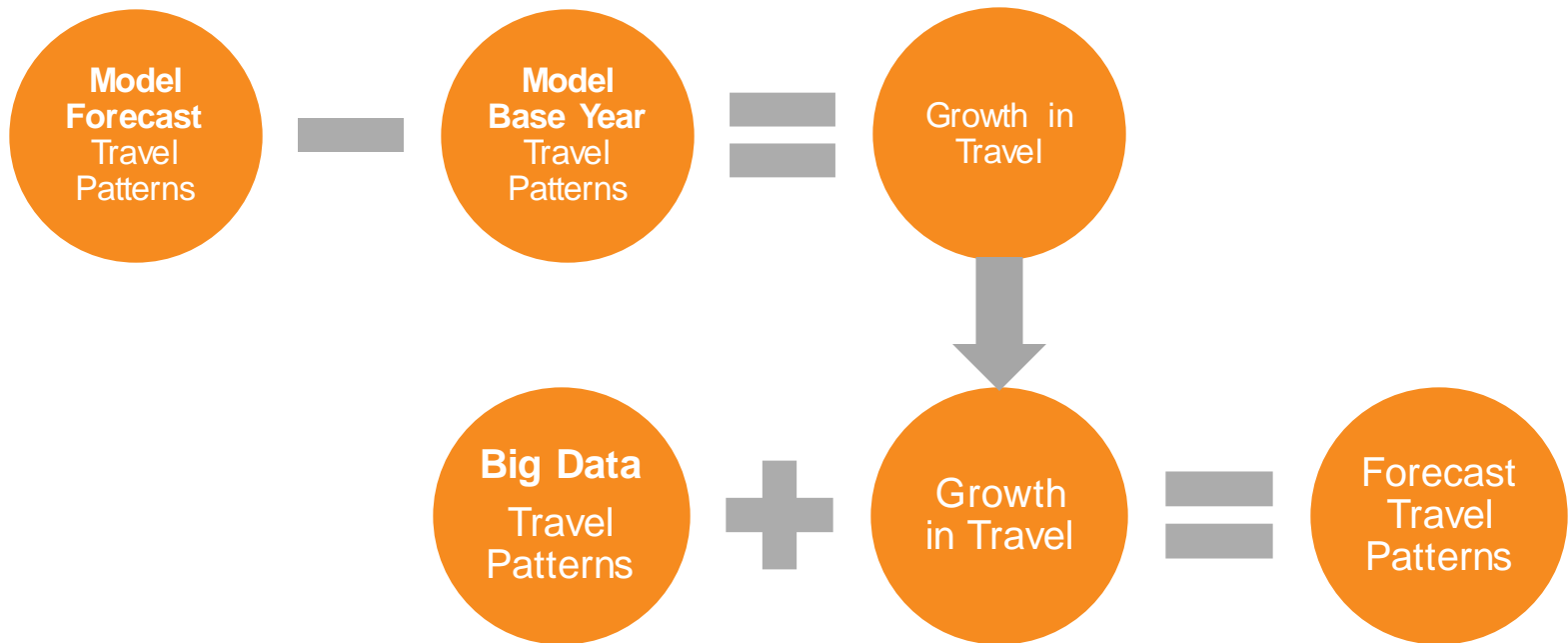




Statewide Travel Demand Model Approach

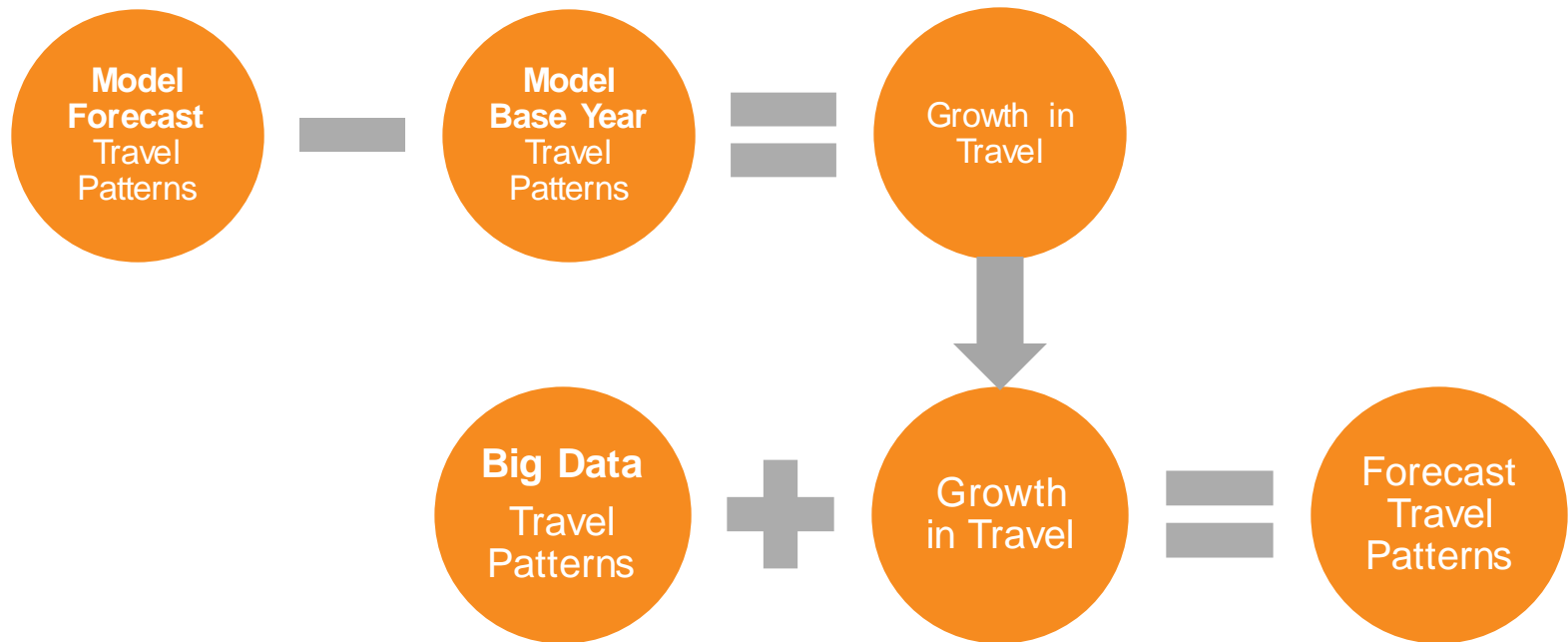
Incremental Forecasts

1. Big Data for Base Year ODs
2. Advanced Trip-Based for growth and sensitivity



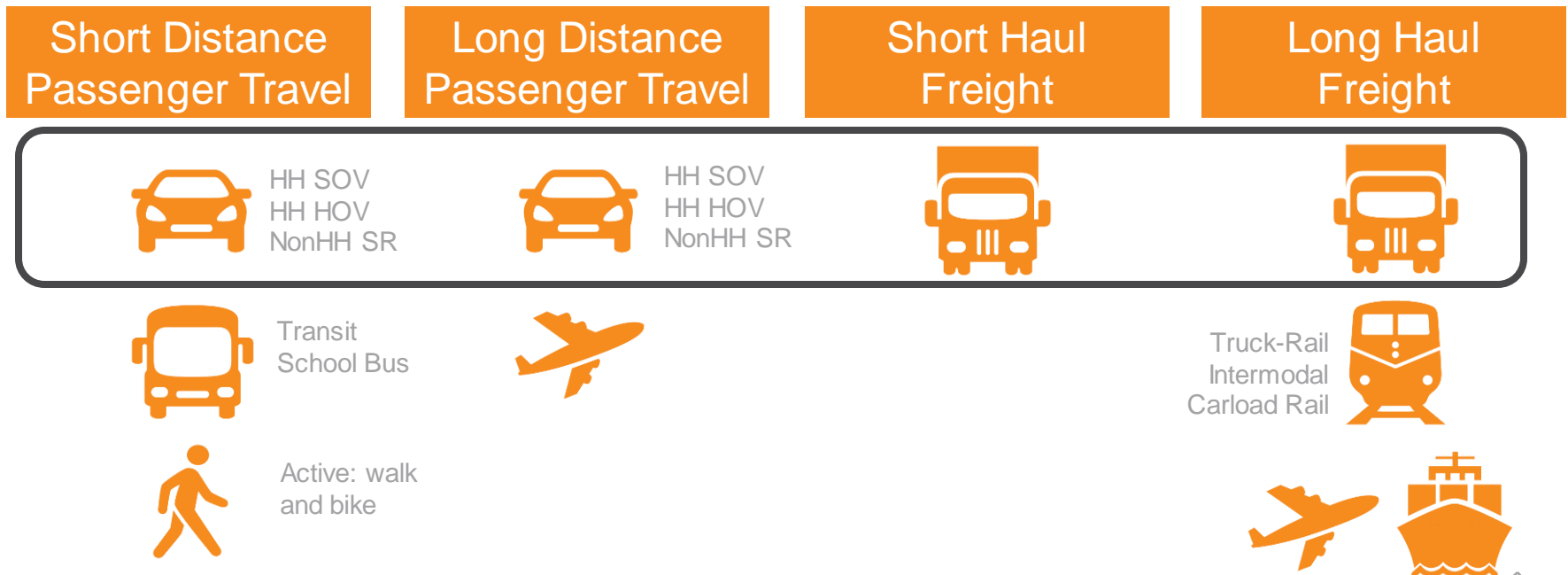
Incremental Forecasts

1. Big Data for Base Year ODs **and development of certain Synthetic models**
2. Advanced Trip-Based for growth and sensitivity



Multimodal Perspective

- Focus on highway modes
- Other modes are included for interactions and scenario planning





Model Inputs

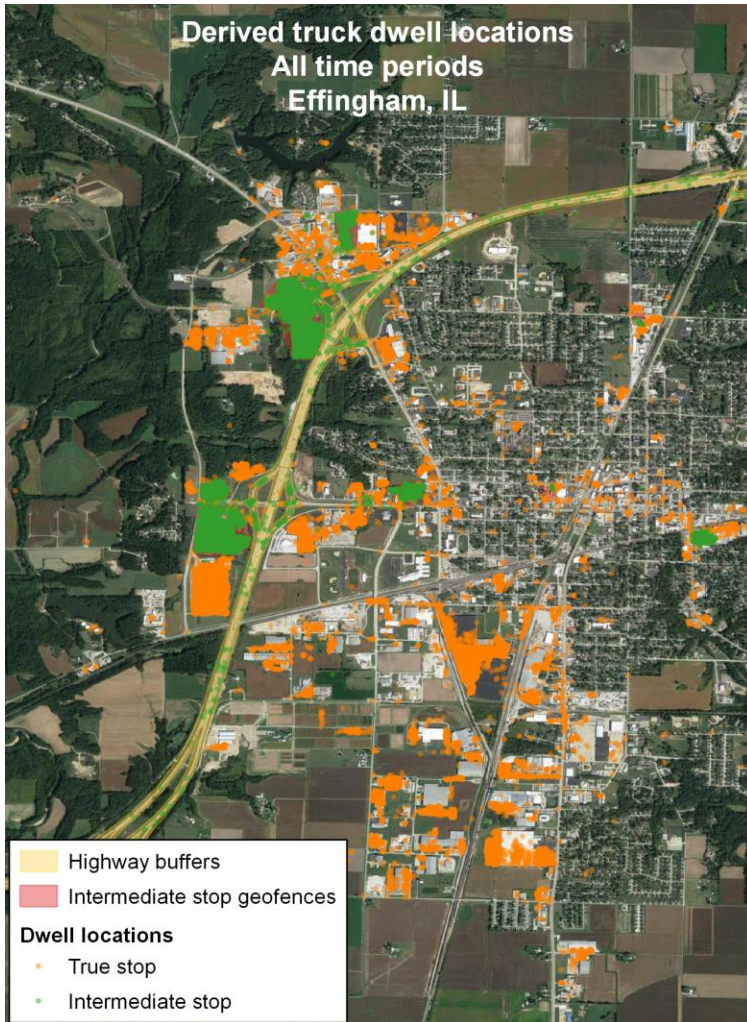
Big Data used in the ILSTDM

| Vehicles | Data | Product/Provider | Needs/Motivations |
|-------------|---|------------------|---|
| Automobiles | Cellphone Location-Based Services (LBS) | rMerge RSG | <ol style="list-style-type: none"> 1. Lacked HH Survey for Residents 2. Long-Distance and Visitor |
| Trucks | Truck GPS | ATRI | <ol style="list-style-type: none"> 1. Truck OD Data 2. Short-Haul and Other Truck Trips missed by FAF |

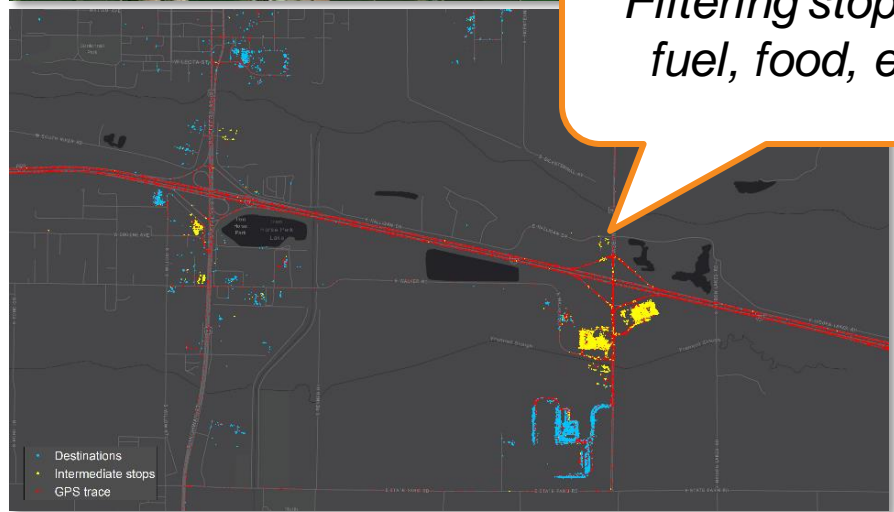


Truck Data Processing

Geofencing around gas stations / truck stops, etc.

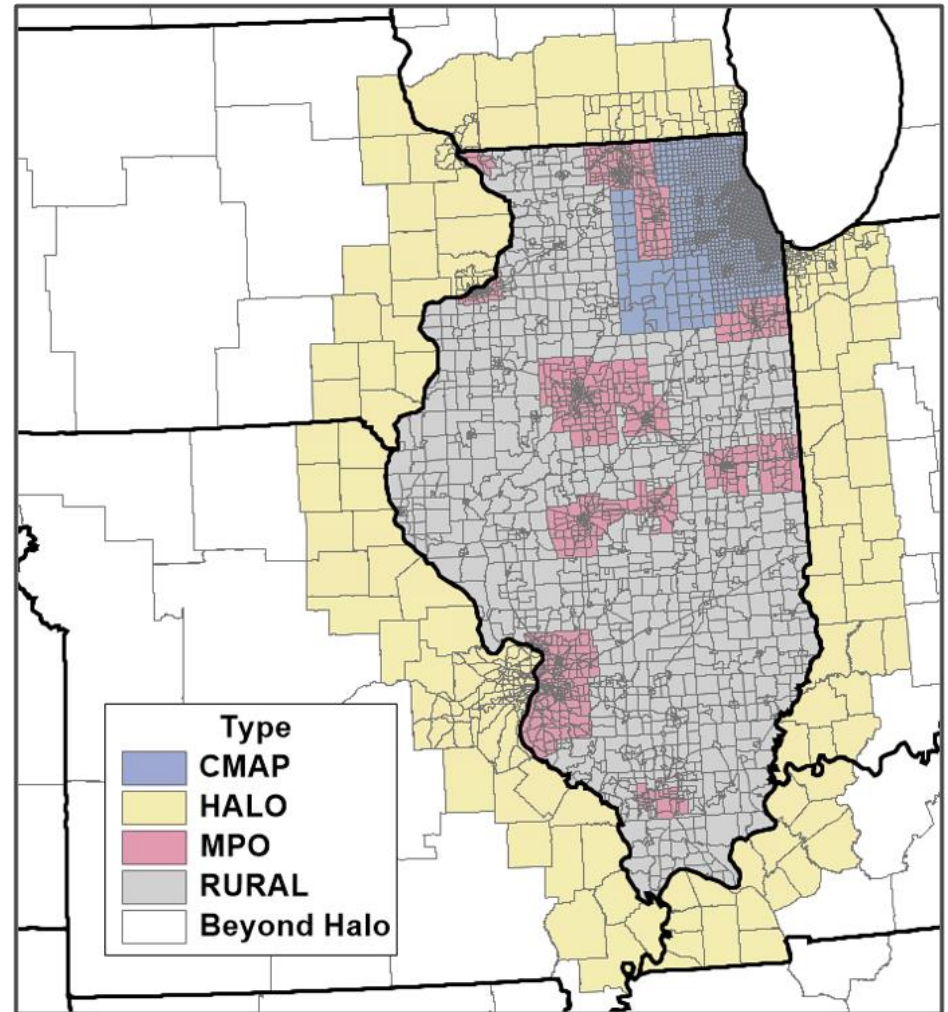


Filtering stops for fuel, food, etc.,



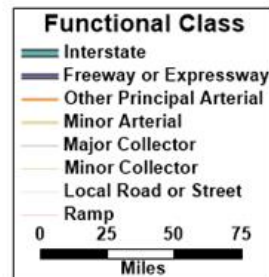
Traffic Analysis Zones

- **4,366** zones in Illinois
- **4,862** zones in the ILSTDMD across the U.S.



Highway Networks

- **42,181** miles of roads in Illinois
- **109,636** miles of roads in the ILSTDM across the U.S.



Other Data Sources

- Statewide Model Parameters

- Michigan
- Tennessee

- Passenger Surveys

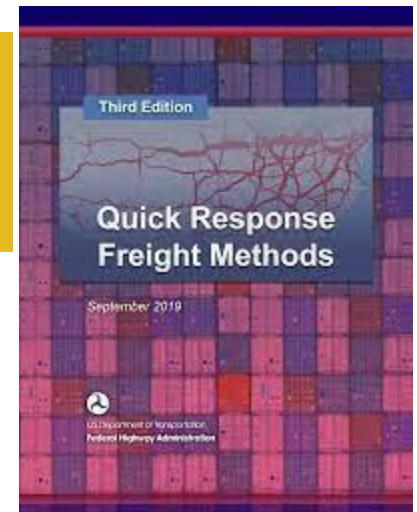
- NHTS
- CMAP Survey
- CTPP

- Freight Characteristics

- FAF4
- QRFM III Manual

National Household Travel Survey

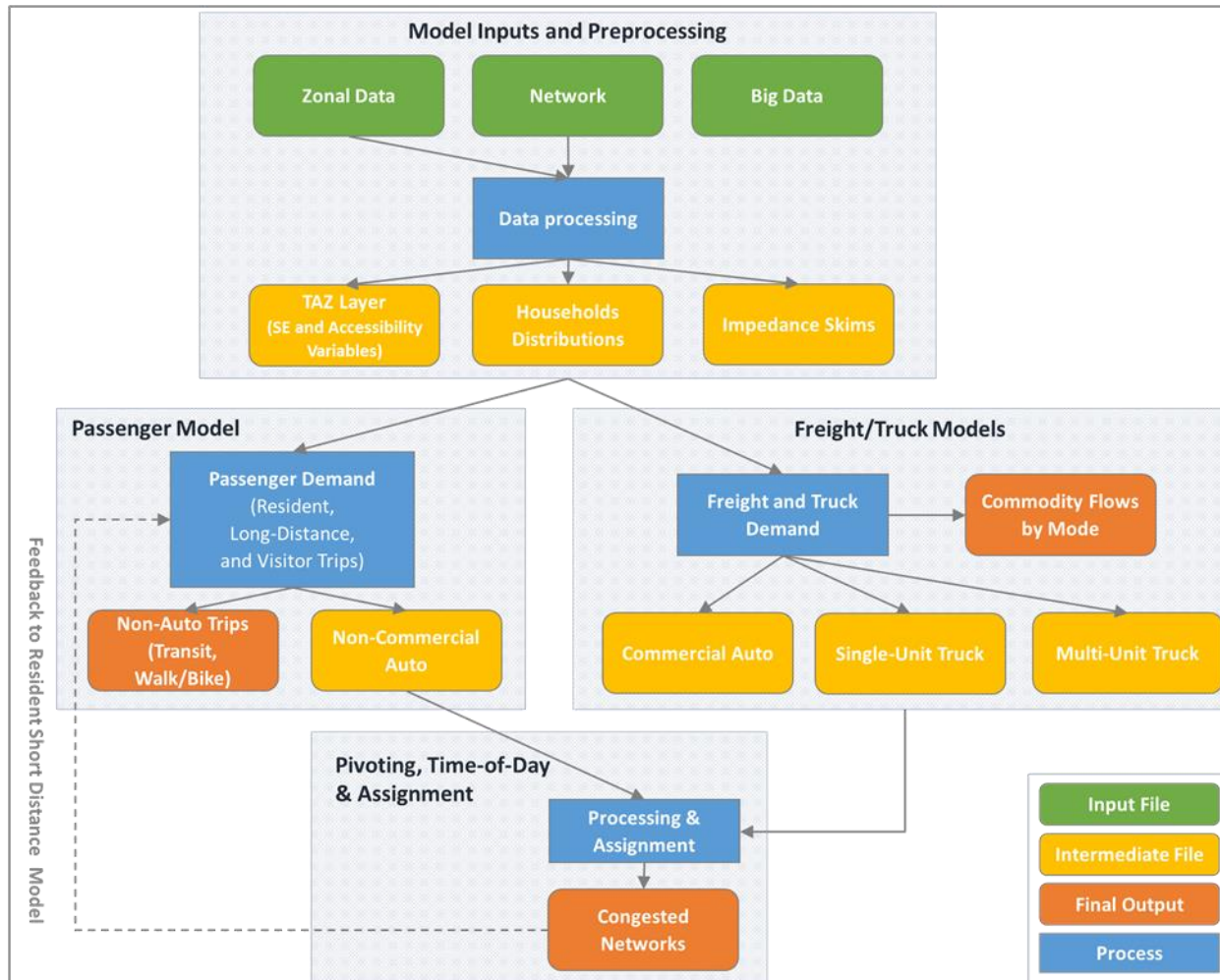
Understanding How People Get from
Place to Place





Synthetic Demand Models

Passenger and Freight Trip Models



Household Synthesis

Zonal Value (Average) as Input

- Household Size
- Household Workers
- Households with Children
- Household Income
- % Households with Seniors
- Population Density



Joint and Univariate Distributions as Outputs

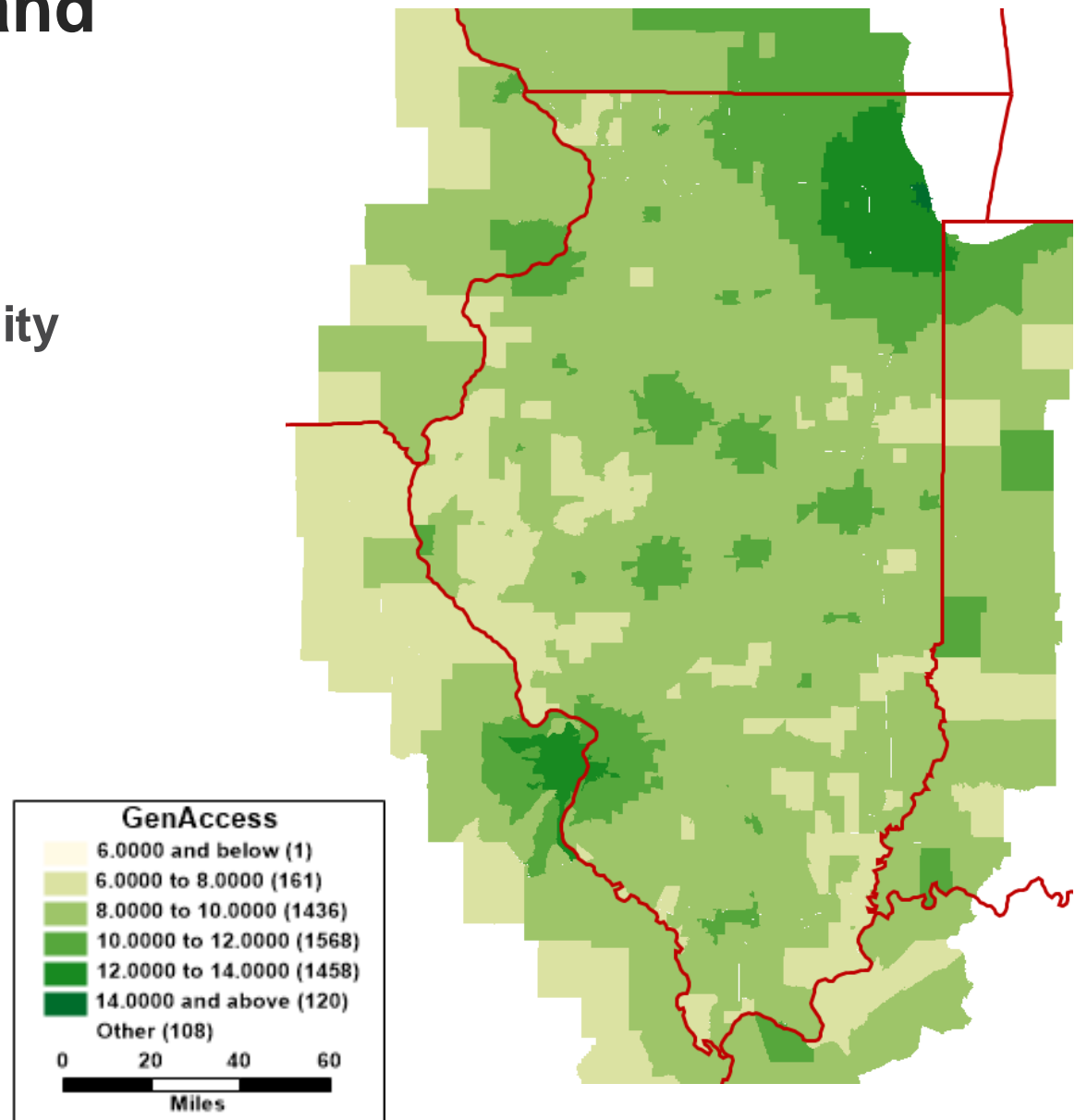
- Size (1,2,3,4,5+)
- Workers (0,1,2,3+)
- Income (<25K, 50K, 75K,100K, >100K)
- Children (0,1,2,3+)
- Adult Non-Workers (0,1,2+)
- Seniors (0,1)



Accessibility and Proximity

- Regional Accessibility (“GenAccess”)
- Local Accessibility (“NearAccess”)
- Retail Accessibility
- Complements
- Substitutes

Regional Accessibility





**Long-Distance
Passenger Demand**

**Long-Distance
Freight Demand**

**Short-Distance
Passenger Demand**

**Short-Distance
Freight Demand**

Short-distance Resident Passenger Models

Home-Based Trips

Trip
Generation

Mode
Choice

Destination
Choice

Non-Home-Based Trips

Trip/Mode
Generation

Destination
Choice

Time-of-
Day



Trip Purpose

Big data or surveys to update models

| Tour Type | Purpose | Home Involved? | Duration | Abbreviation |
|-----------|----------|----------------|--------------|--------------|
| Work | Work | Yes | | HBW |
| | Not Work | Yes | | HBOWT |
| | Not Work | | | NHBWT |
| Other | Not Work | Yes | >30 Minutes | HBOLOT |
| | Not Work | Yes | < 30 Minutes | HBOSOT |
| | School | Yes | | HBSCH |
| | Not Work | | | NHBOT |



Trip Generation Models

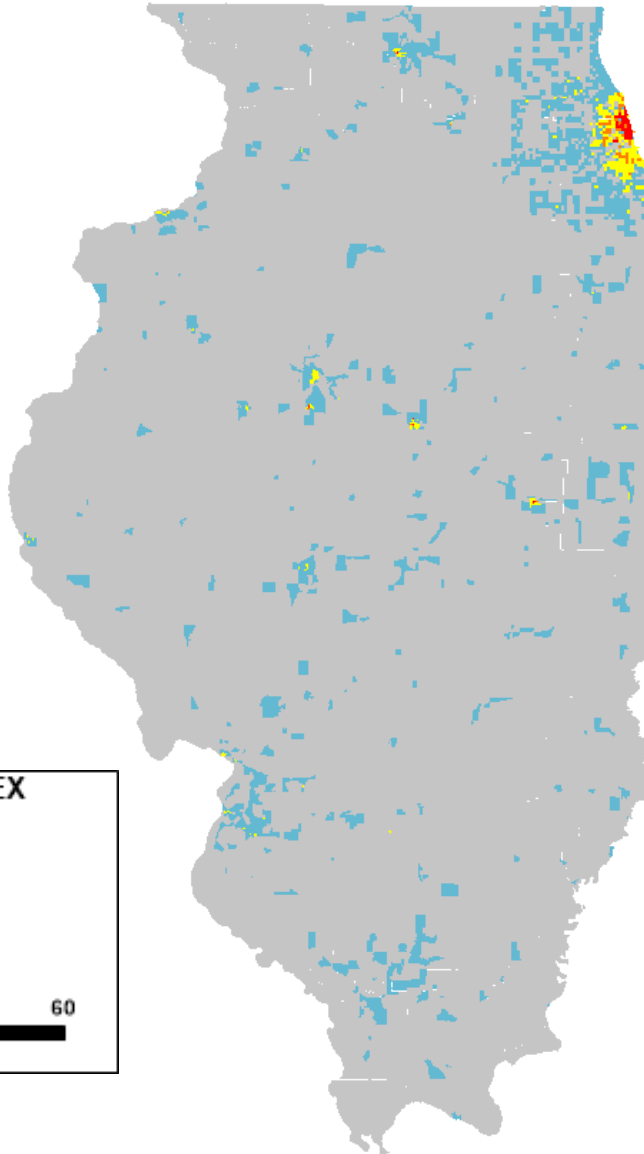
Sensitive to Labor Force and Age Distribution

- Regression Models
- Informed by Synthetic Population

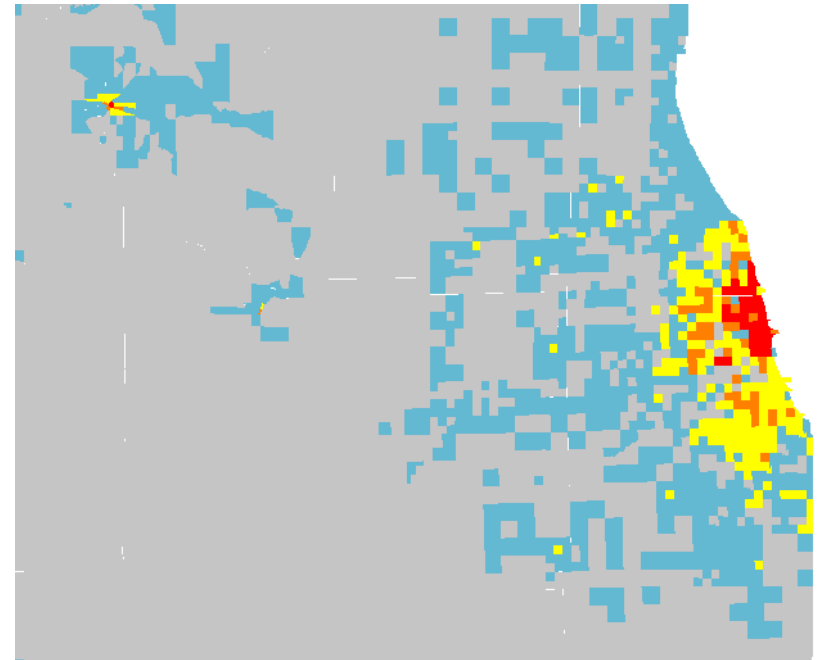
| | Variable | HBW | HBOWT | HBOLOT | HBOSOT | HBSCCH |
|-------------|-------------|-----|-------|--------|--------|--------|
| | Income | ▲ | ▲ | ▲ | | |
| Trip Makers | Workers | ▲ | ▲ | ▲ | ▲ | ▲ |
| | NonWorkers | ▲ | ▼ | ▲ | ▲ | ▲ |
| | Children | ▼ | ▲ | ▲ | ▲ | ▲ |
| | Seniors | ▼ | | ▲ | ▲ | ▼ |
| Access | Near Access | ▲ | | ▲ | ▲ | ▲ |
| | Access Emp | | ▲ | | | |



Walk Index (walkability)

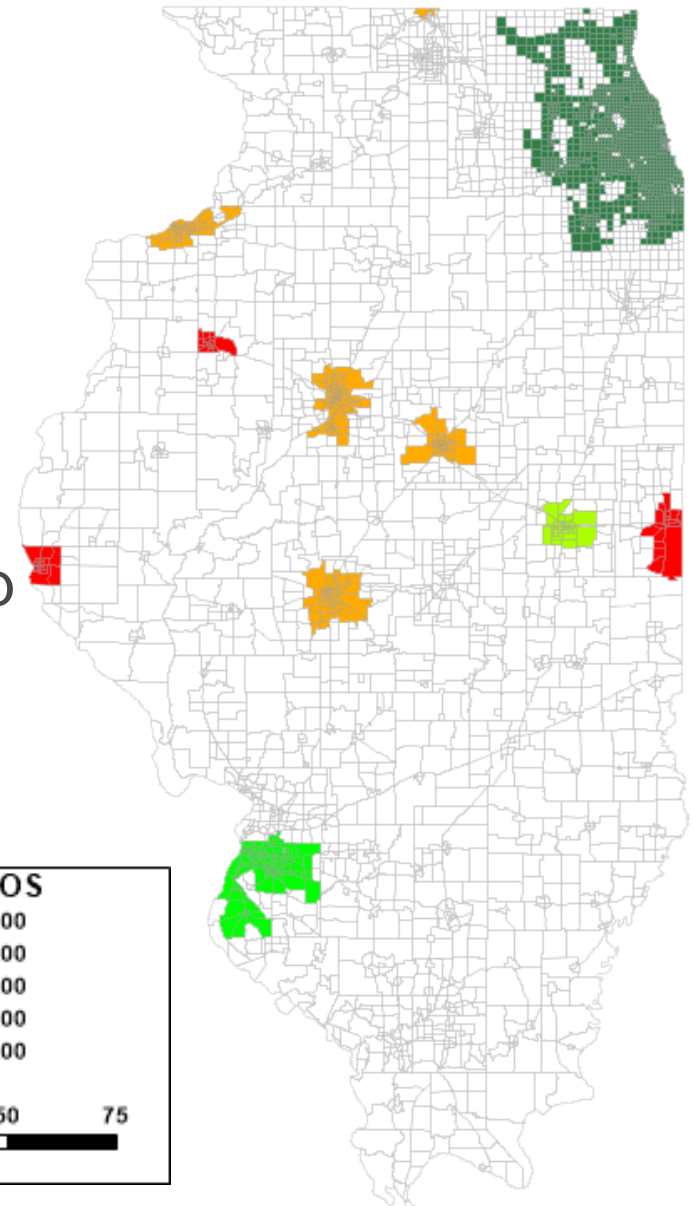
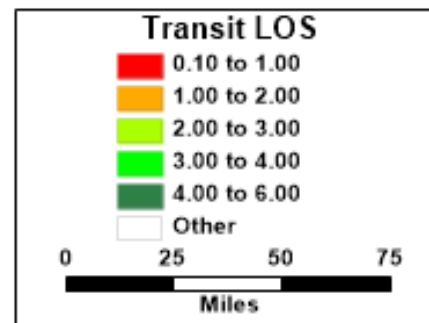


- Intersection Density
- Nearby Employment/Amenities
- Users can edit walk index in forecast scenarios



Transit Level of Service

- System level
- Ratio of funding to households
- Applies to HH within ½ mile of stop
- Users can code higher funding or more service area



Destination Choice

Provides sensitivity to many types of variables

| Impedance Negative | Attractions Generally Positive | Boundaries Generally Negative | Accessibility Mixed |
|------------------------------|--|---|-------------------------------|
| Travel Time | Employment by NAICS Category | Different County | Gen Accessibility |
| Distance | Enrollment | Different State | Emp Accessibility |
| | Households | River X'ing | Complements |
| | | Railroad X'ing | Substitutes |
| | | Interstate X'ing | |



Local Growth
has Local
Impacts

Non-home-based Models

- NHB productions from HB attractions by mode
- Spatial consistency
- Parameters from other statewide models
- Calibrated to Passive Data

HB and NHBOT Linkage

| | NHB SOV | NHB HOV | NHB Sharedride |
|-------------------|---------|---------|----------------|
| HBOSOT SOV | *** | * | * |
| HBOLOT SOV | ** | * | |
| HBSCH SOV | * | | |
| HBOSOT HOV | * | *** | |
| HBOLOT HOV | | ** | * |
| HBSCH HOV | | * | * |
| HBOSOT Sharedride | | * | *** |
| HBOLOT Sharedride | | | ** |
| HBSCH Sharedride | | | * |

*** Strongest Predictor

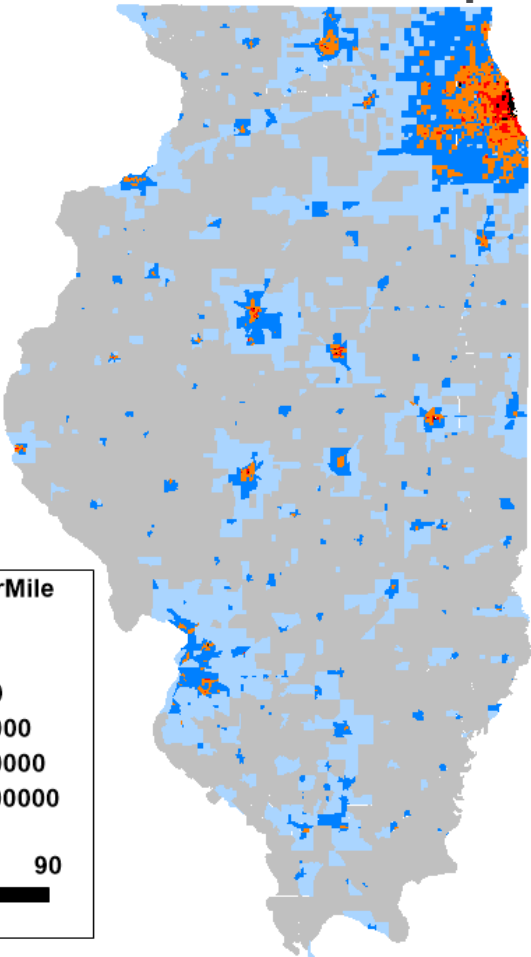
** Second Strongest Predictor

* Other Predictor

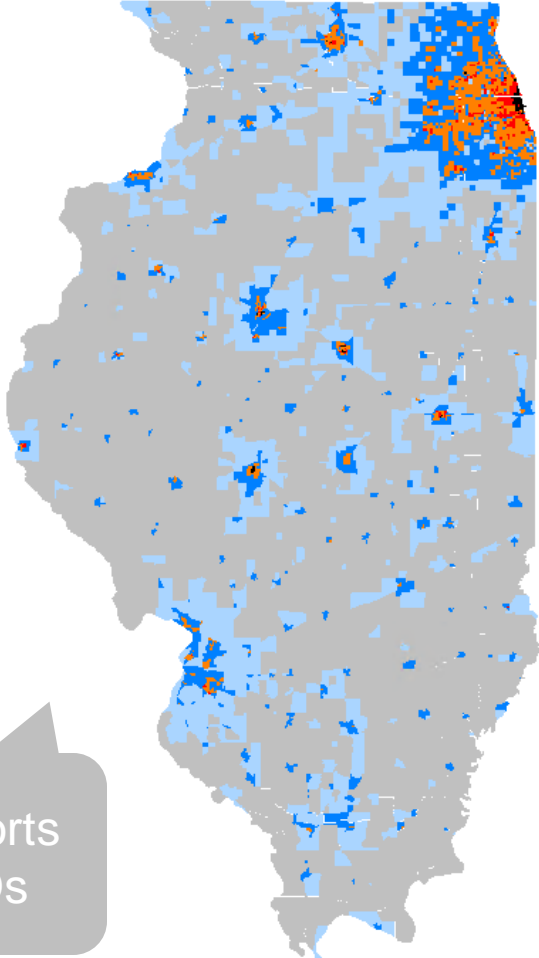


Auto Trip Patterns

Passive Data Trips



Synthetic Model Trips



Supports
MPOs





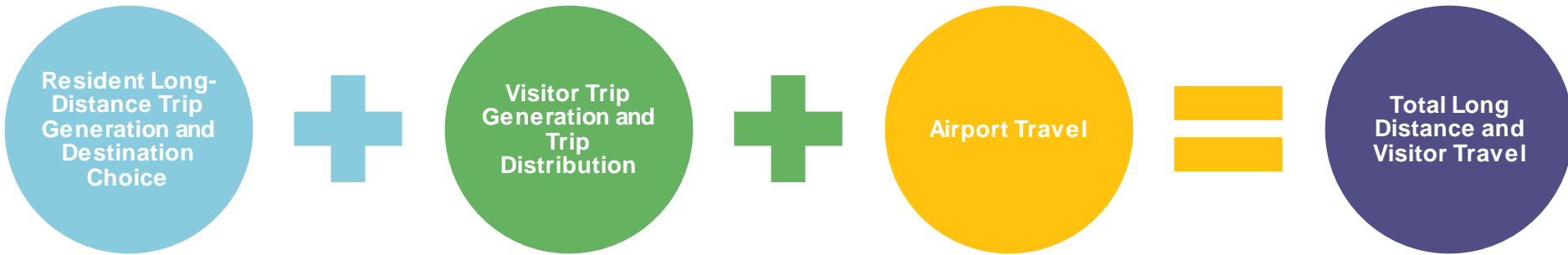
**Long-Distance
Passenger Demand**

**Long-Distance
Freight Demand**

**Short-Distance
Passenger Demand**

**Short-Distance
Freight Demand**

Long-distance Travel



Long-distance resident

Passenger trip purposes are:

- Business
- Personal Business
- Commute
- Leisure

Visitor trips

Both ends > 50 miles from home

Include both short and long-distance trips

Airport trips are based on enplanements



Long-distance Passenger Models

Long-Distance Trips

Trip
Generation

Destination
Choice

Mode
Choice

Visitor Trips

Trip/Mode
Generation

Destination
Choice

Time-of-
Day



Long Distance Generation

Non-Resident

| Variable | Val |
|------------|-----|
| Distance | ▼ |
| Population | ▲ |

Resident

| | Variable | Commute | Business | Maintenance | Leisure |
|-------------|--------------|---------|----------|-------------|---------|
| Agent | HH Workers | ▲ | ▲ | | |
| | HH Persons | | | ▲ | ▲ |
| Demographic | Income | ▲ | ▲ | ▲ | ▲ |
| | Has Children | ▼ | | ▼ | ▼ |
| | Has Senior | | | ▲ | ▲ |
| Location | Urban | ▼ | ▼ | ▼ | ▼ |

**Also some regional constants in models*

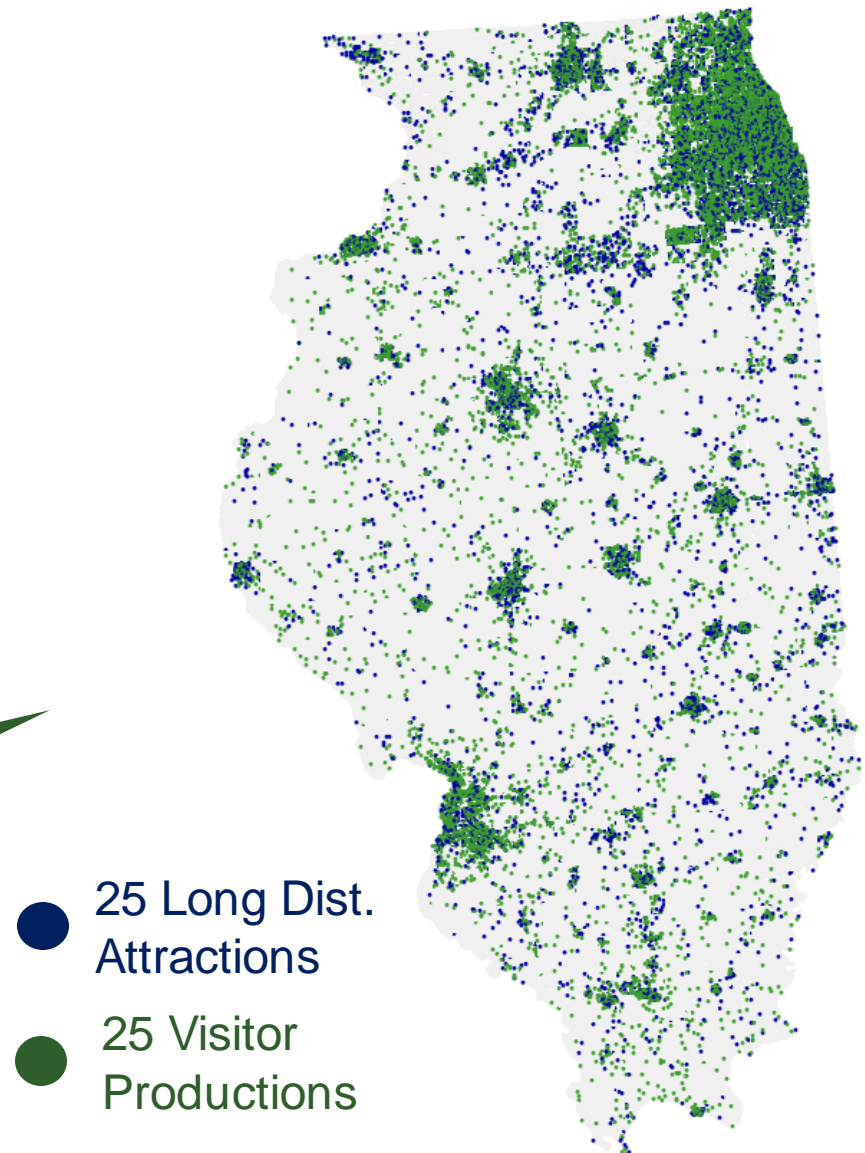


Long Distance and Visitor Big Data

- Derived from rMerge data
- Visitor model uses Long Distance Attractions

Supports
Corridor
Planning

Big Data for Estimation





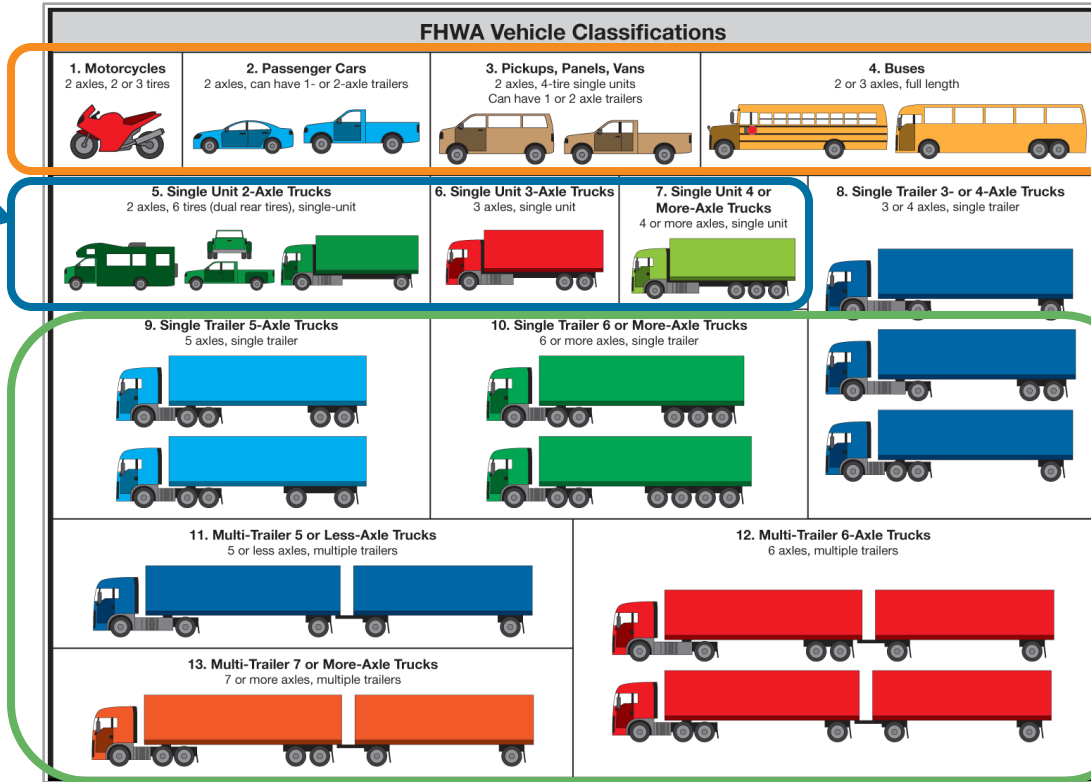
**Long-Distance
Passenger Demand**

**Long-Distance
Freight Demand**

**Short-Distance
Passenger Demand**

**Short-Distance
Freight Demand**

IDOT and FHWA Vehicle Classes



Single-Unit Trucks

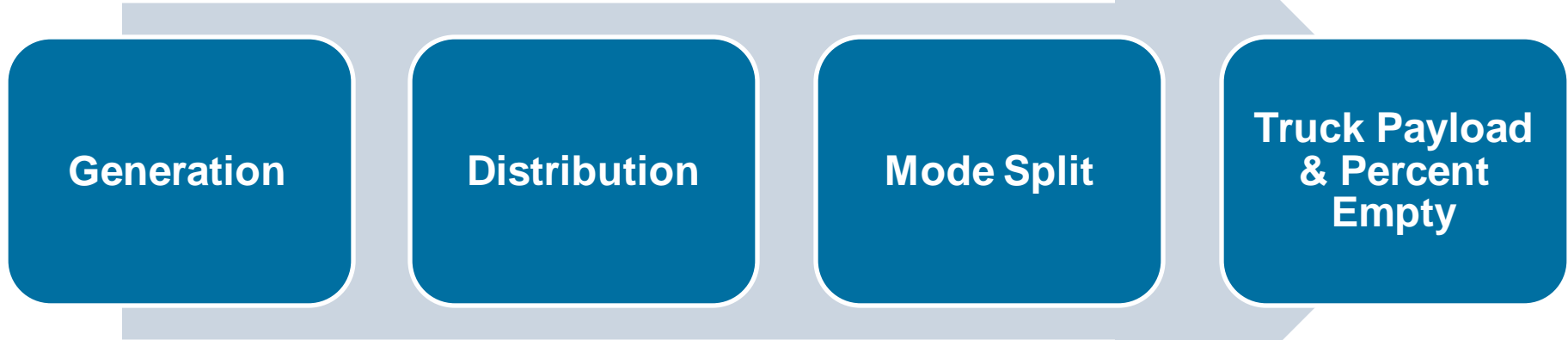
Four-Tire Commercial Vehicles

Multi-Unit Trucks



Long-distance Freight

Commodity-Based Freight Model

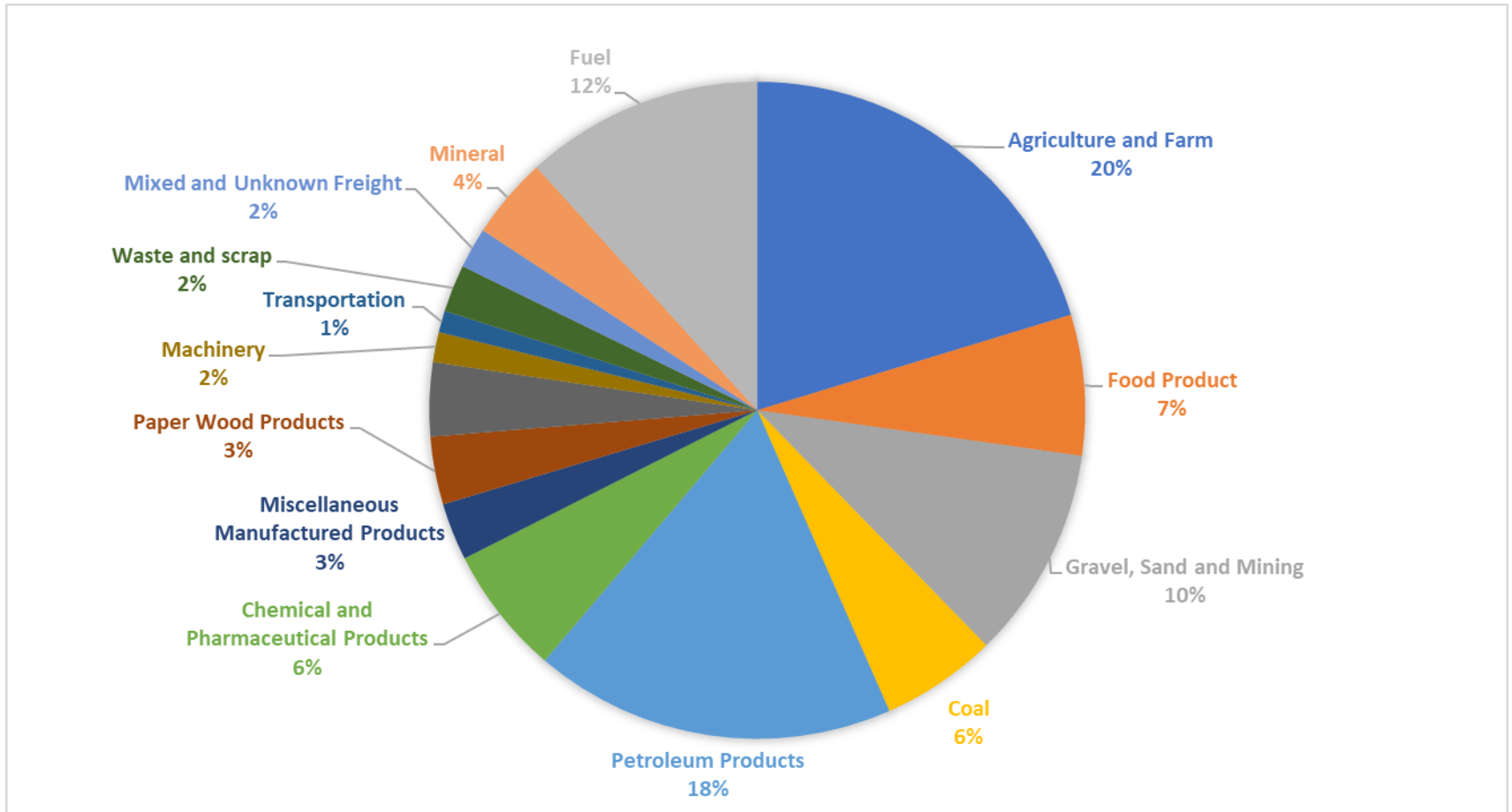


- Freight Analysis Framework (FAF4)
- Demand Models
 - Employment by 20 categories
 - Farm and Forest acreage
 - Coal production
 - Total population

Supports
Freight Plans
and Economic
Analysis



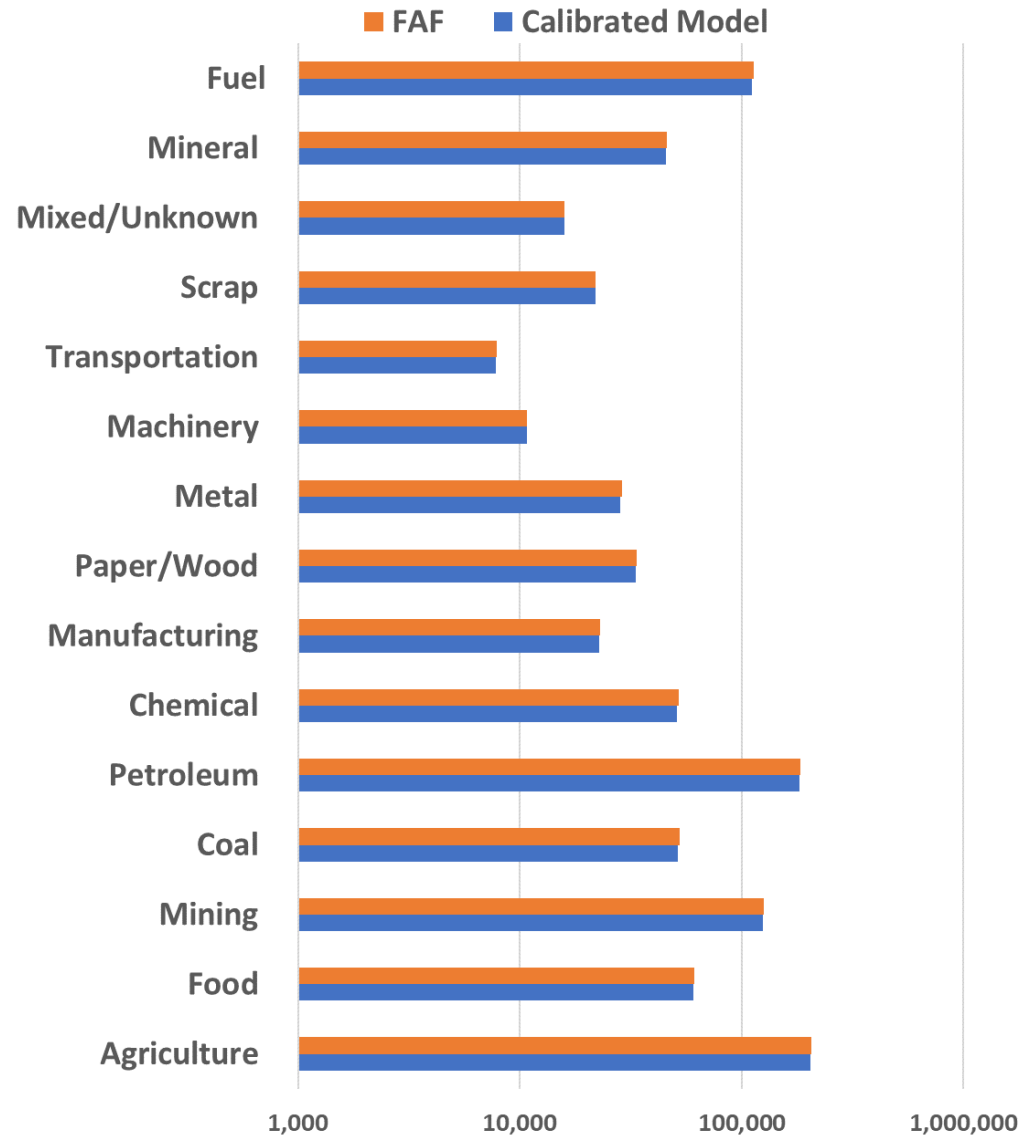
Commodity Groups



Freight Generation

- Simple Regression
- Production/Consumption
- 3 Movements
 - In State
 - Outbound
 - Inbound
- External from FAF

Illinois Consumption (Annual Ktons)





**Long-Distance
Passenger Demand**

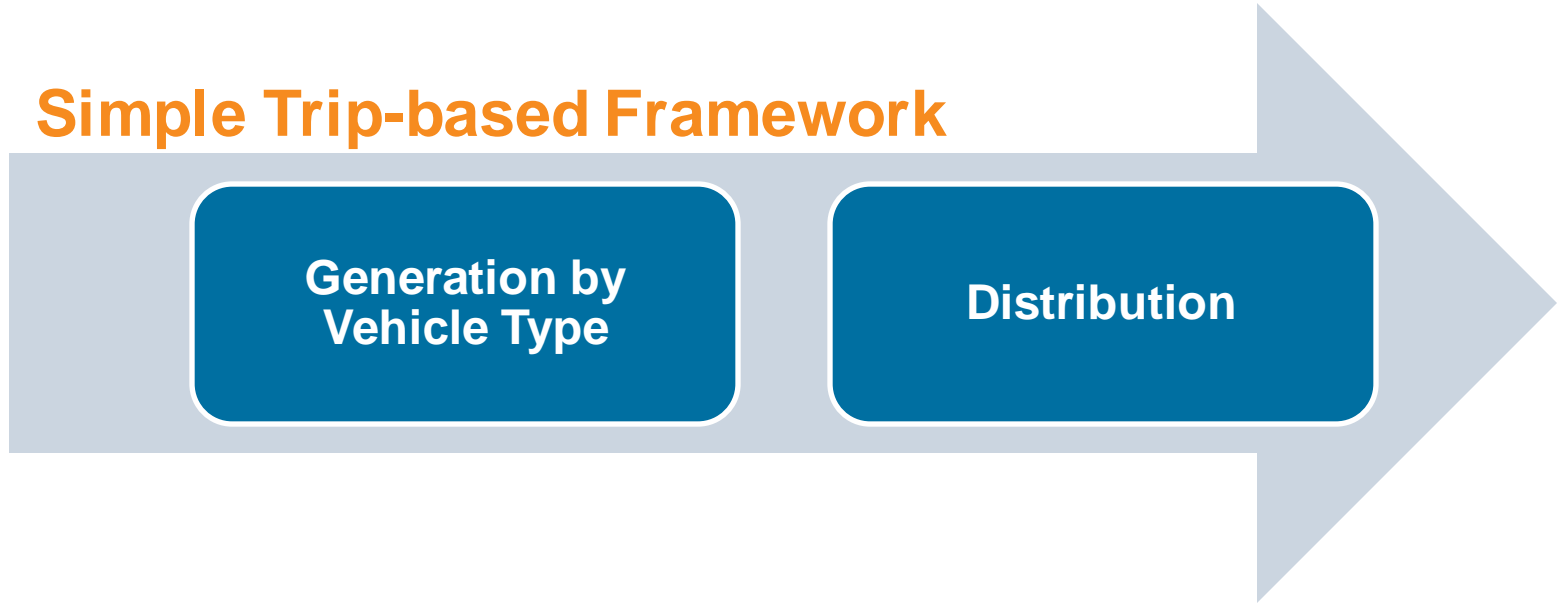
**Long-Distance
Freight Demand**

**Short-Distance
Passenger Demand**

**Short-Distance
Freight Demand**

Short-distance Truck Model

Simple Trip-based Framework



- Includes pickup and delivery goods movement and services
- Produces three vehicle types
 - Four-Tire Commercial Vehicles (FTCV)
 - Single-Unit Trucks (SUT)
 - Multi-Unit Trucks (MUT)



Short Distance Truck Generation Models

- Regression Models from Freight Manual III
- FTCV, SUT, MUT
- Scaled to meet traffic counts

Truck Model Variables

Agriculture + Mining + Construction Employment

Manufacturing + Transportation + Comm + Utilities + Trade Employment

Retail Employment

Office Employment

Households

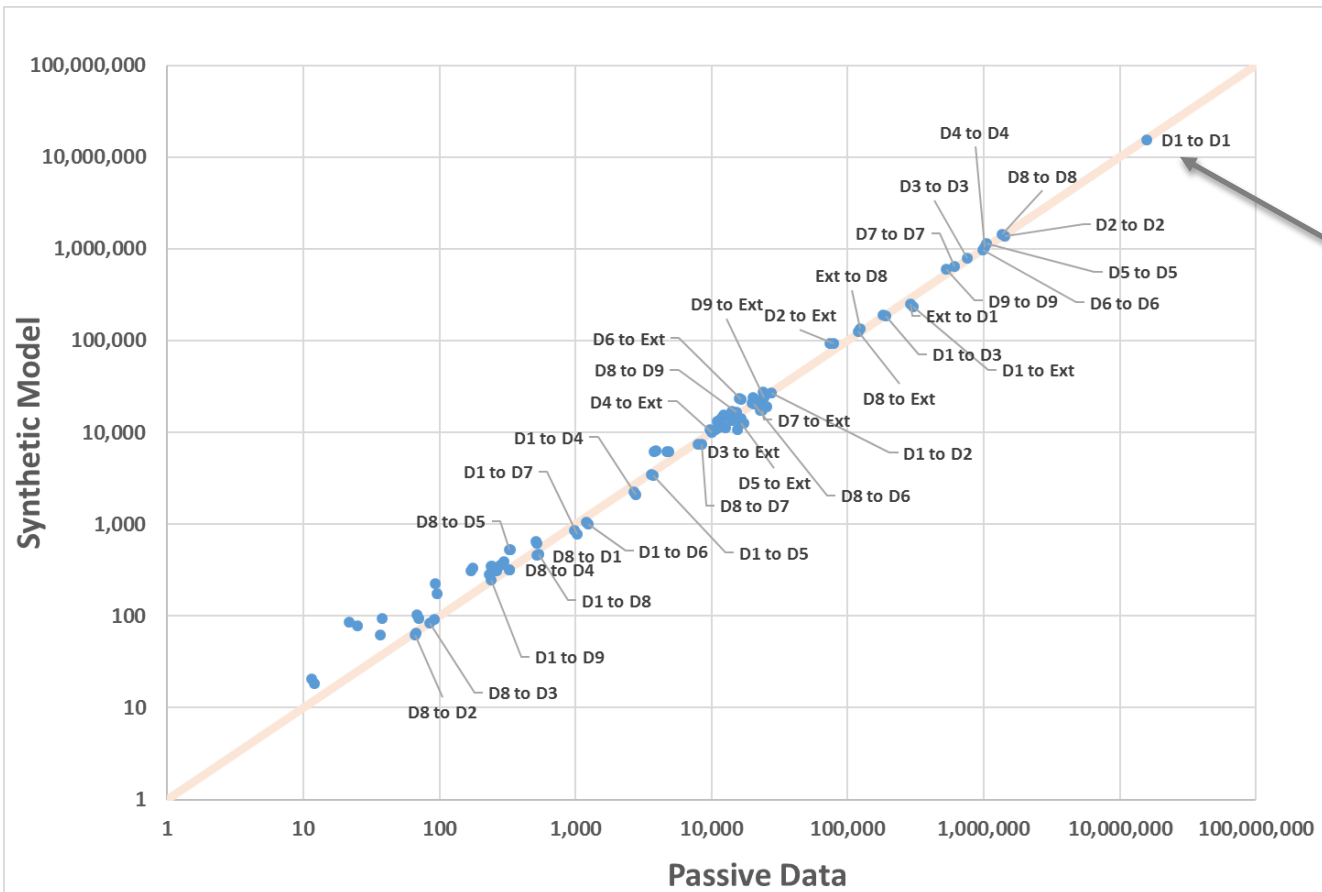




Model Validation and Forecasting

District-Level Auto Vehicle Trip Validation

Passive Data and Synthetic Model Auto Vehicle Interzonal District Flows



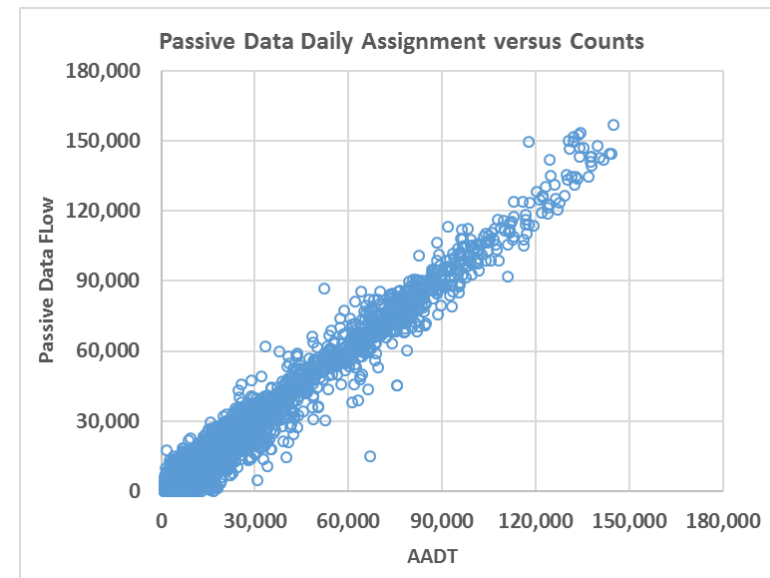
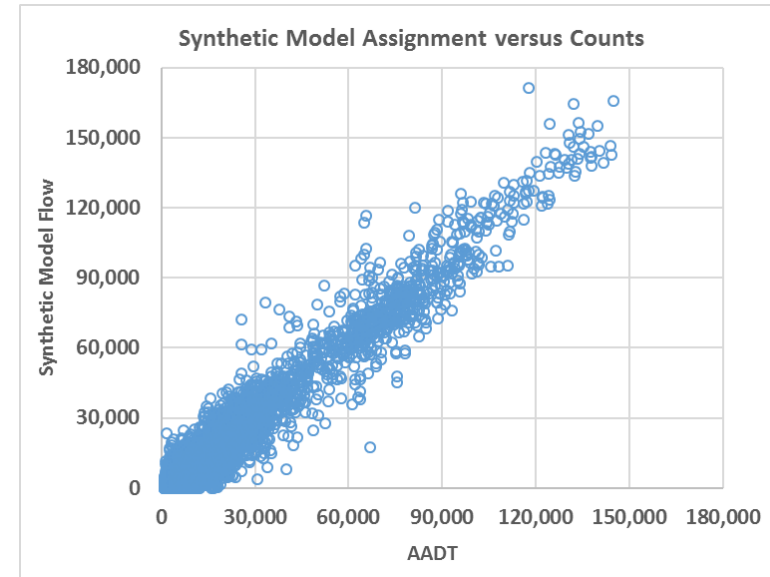
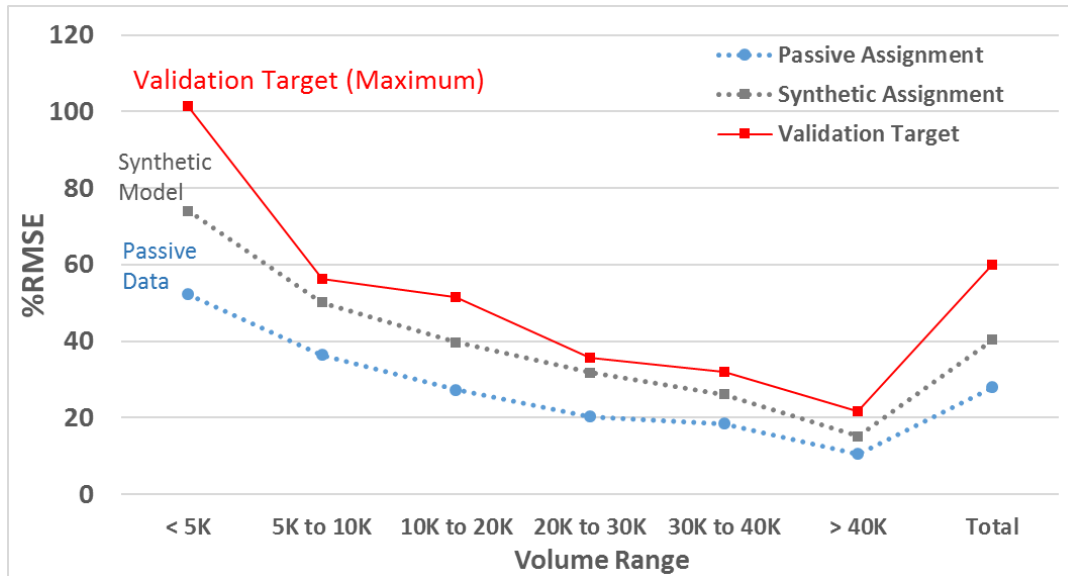
~15.5M Interzonal Auto Vehicle Trips **Start** and **End** in **District 1** in both Synthetic Model and Passive Data



“D1” = District, “Ext” = External or out of state

Traffic Volumes by Volume Group

Validation to Traffic Counts

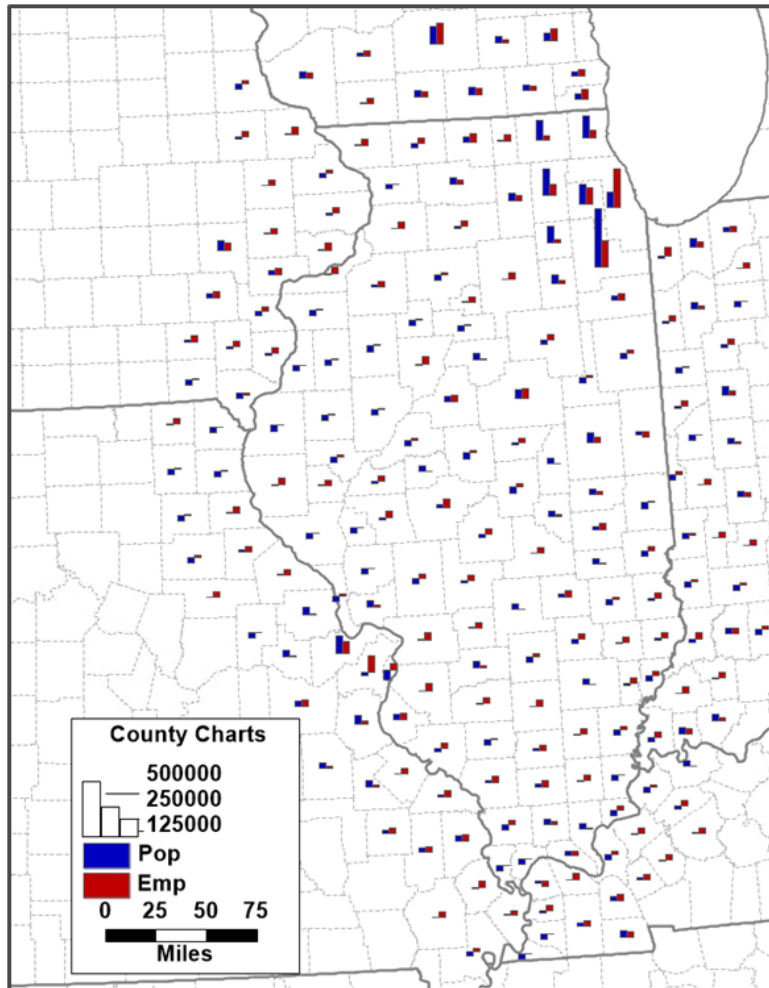


Future Year Forecasts

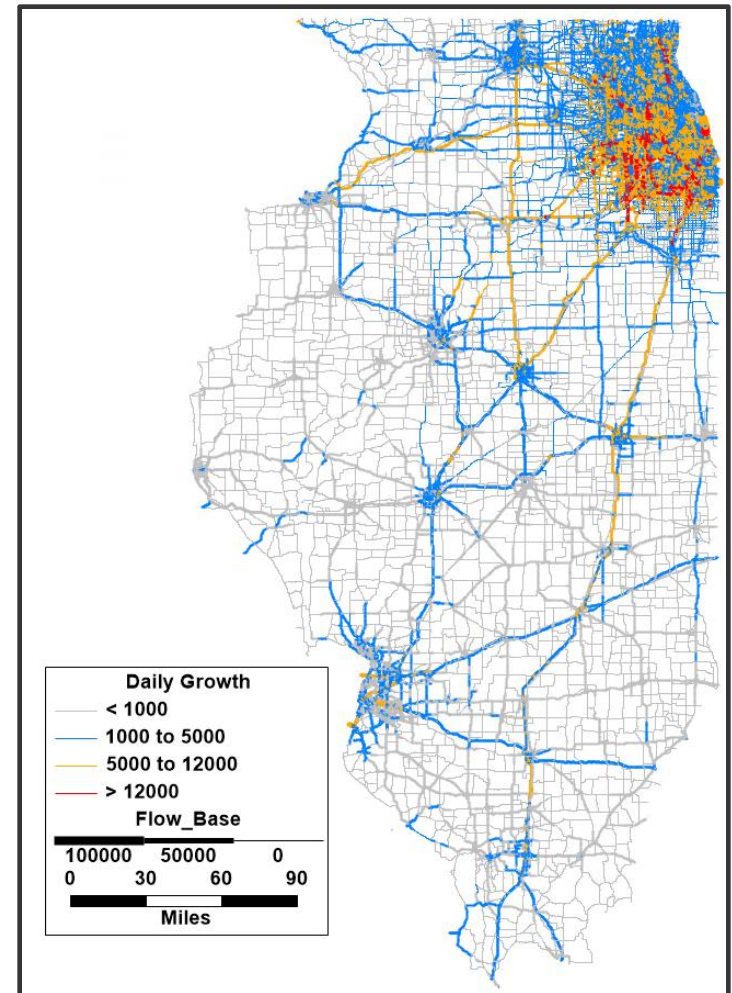
Final Forecast Year: 2045

Interim Forecast Years: 2020, 2025, 2035

Population/Emp. Growth to 2045



New Traffic

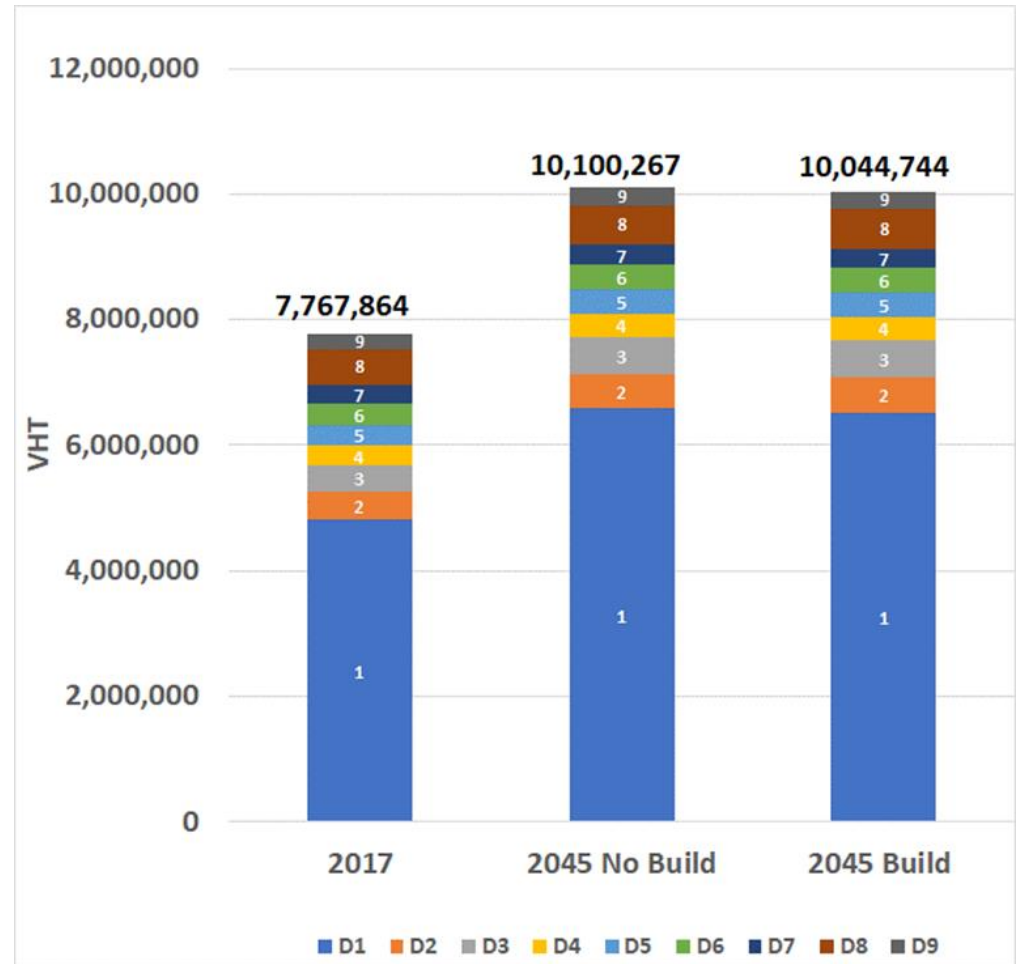


Model Forecasts

Forecasts

1. VMT/VHT
2. Costs
3. Emissions
4. Crashes
5. Accessibility
6. Connectivity

Daily Vehicle Hours Traveled





Contacts

rsginc.com

Stephen Tuttle (RSG)

SENIOR CONSULTANT

Stephen.Tuttle@rsginc.com

603.393.5440

Maren Outwater (RSG)

VICE PRESIDENT

Maren.Outwater@rsginc.com

619.269.5263

Sheng Chen (IDOT)

TRAVEL DEMAND MODELING AND FORECASTING SECTION CHIEF

Sheng.Chen@illinois.gov

312.793.1491