Introduction to CMAP's Meso-scale Freight Model

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CMAP

GO TO 2040

CMAP Freight Modeling

Current model estimates only trucks based on observed counts

We need a freight modeling tool that explains the economic choices made for goods movement across multiple modes and commodities

CMAP Meso Freight Model

Predicts how freight moves into, through and out of our region.

Four modes:

- Truck
- Rail
- Water
- Air

SCTG Code	Commodity
1	Live animals/fish
2	Cereal grains
3	Other agricultural products
4	Animal feed
5	Meat, fish, seafood, and their preparations
6	Milled grain products
7	Other foodstuffs
8	Alcoholic beverages
9	Tobacco products
10	Monumental or building stone
11	Natural sands
12	Gravel and crushed stone
13	Nonmetallic minerals
14	Metallic ores
15	Coal
16	Crude petroleum
17	Gasoline
18	Fuel oils
19	Coal and petroleum products
20	Basic chemicals
21	Pharmaceuticals
22	Fertilizers
23	Chemical products
24	Plastics and rubber
25	Logs
26	Wood products
27	Pulp, newsprint, paper, and paperboard

CMAP Meso Freight Model – Two Components

Stage 1: National Supply Chain model

Annual commodity flows between Seller firms and Buyer firms

Stage 2: Regional Truck-Touring model

Movement of commodities within our region for a simulated day

How the National Supply Chain Model Works

1. Firm Generation

- Number of employees, NAICS industry, location
  Source: County Business Patterns

- Producer firms → annual production capacity

- Consumer firms → annual purchase requirements
  Source: BEA Input-Output Make and Use Tables

- Imports/Exports handled in similar manner
  Source: USA Census Trade Online

How the National Supply Chain Model Works

2. Match Buyers to prospective Sellers

- Simulate distribution channel
- Simulate shipment size and frequency
- Simulate cost of shipping via different modes
  - Linehaul, storage, damage, handling fees

3. Simulate Business Transactions

- Buyers consider shipping times, cost and minimization of supply chain disruptions
- Sellers consider whether to trade with a Buyer in the face of other offers
- Firms form trading preferences based on past experience
- Outcome reflects purchase contracts between Sellers and Buyers

Scenario Planning Extension

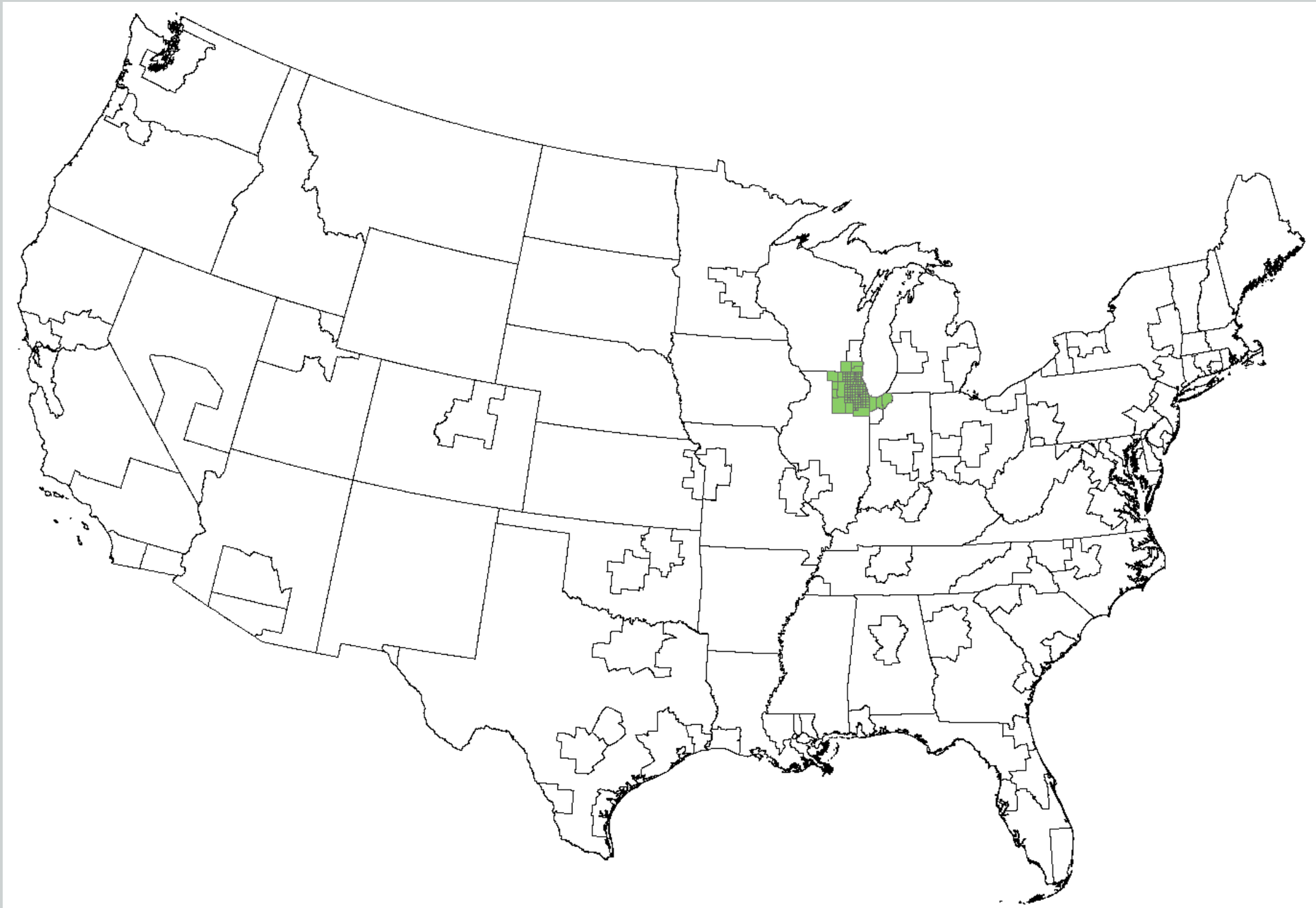
FAF data

- Continuation of current trends (one possible future)

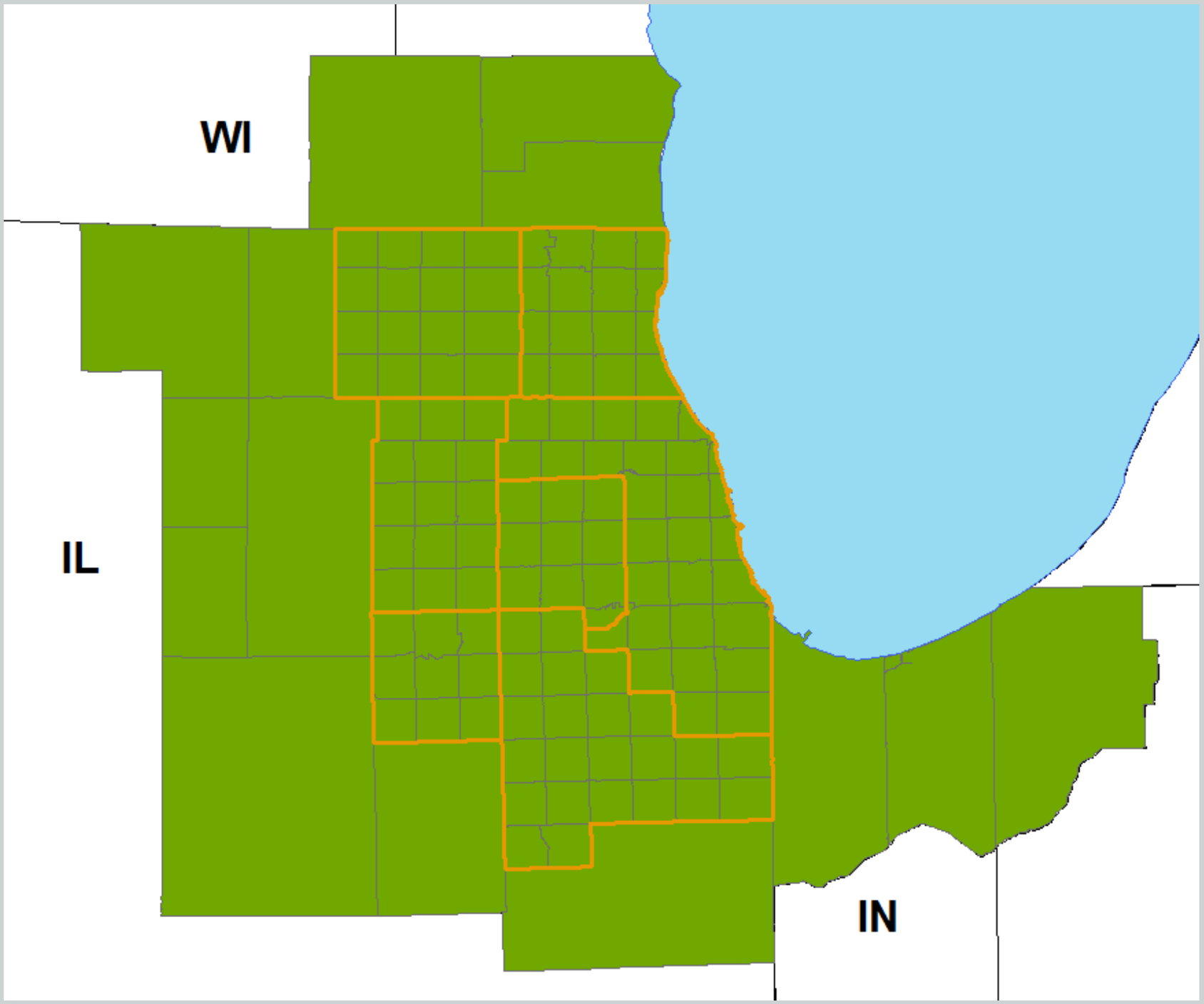
Flexible tool for scenario testing:

- Macroeconomic conditions
- Transport and logistics costs
- Business operating strategies

Meso Freight Model Zone System



Meso Freight Model Zone System - CMAP



Supply Chain Model Sample Output

Buyer

Firm ID	Firm Location	Industry	Employees
222752	Orland Township, Cook County, IL	Non-residential Maintenance and Repair	1-19

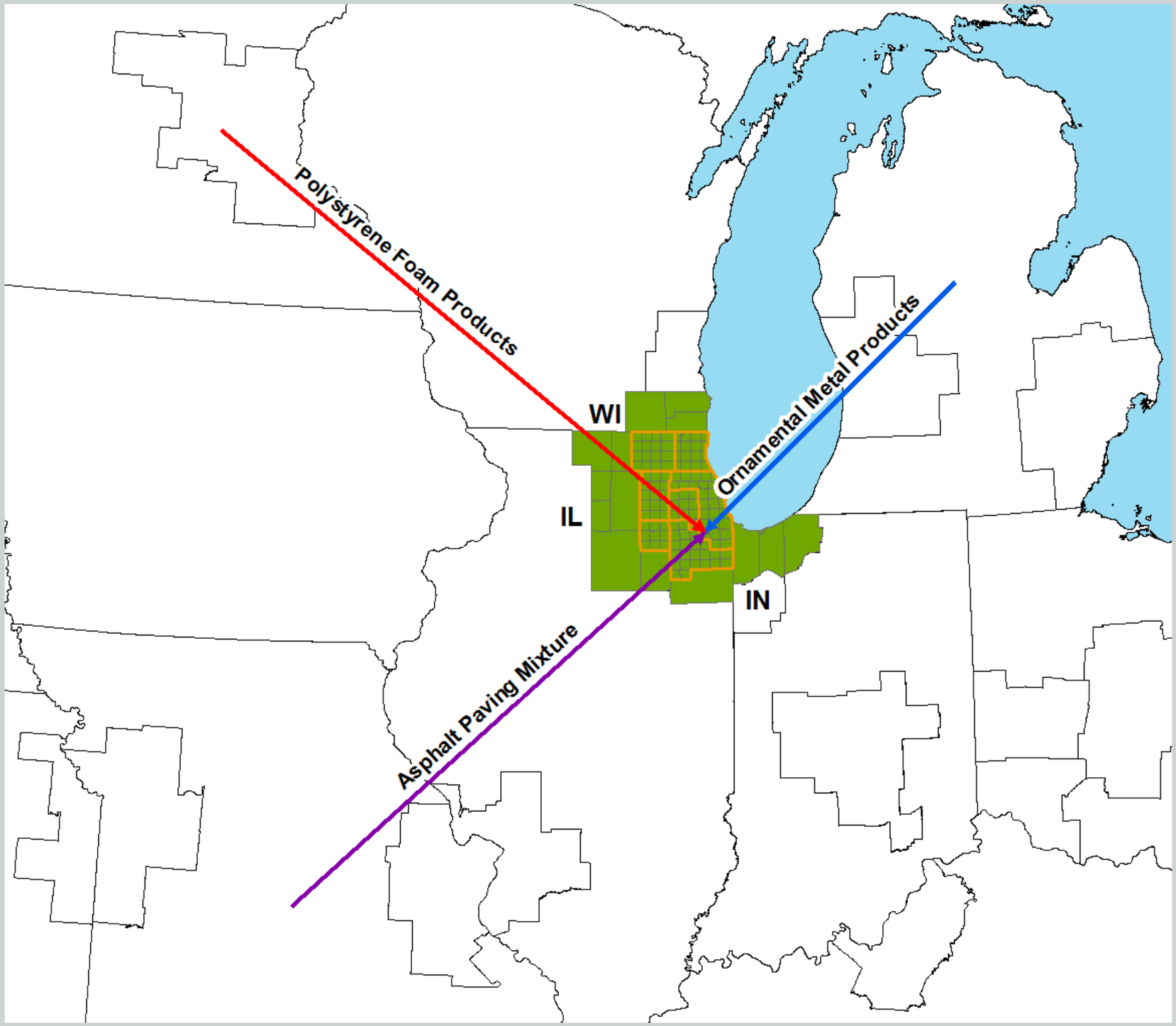
Seller

Firm ID	Firm Location	Industry	Employees
7216283	South Township, Cook County, IL	Paint and Coating Manufacturing	100-249

Transaction

Commodity Purchased	Amount	Transport Mode	Distance
Chemical Products	259 lbs.	Truck	34

Sample Commodity Flows to a Single Firm



How the Regional Truck-Touring Model Works

Simulate daily truck trips in region

- Trip Assigned to Warehouse/Distribution Center
- Estimate size of shipment & truck
- Estimate tour pattern, duration of stops, start time

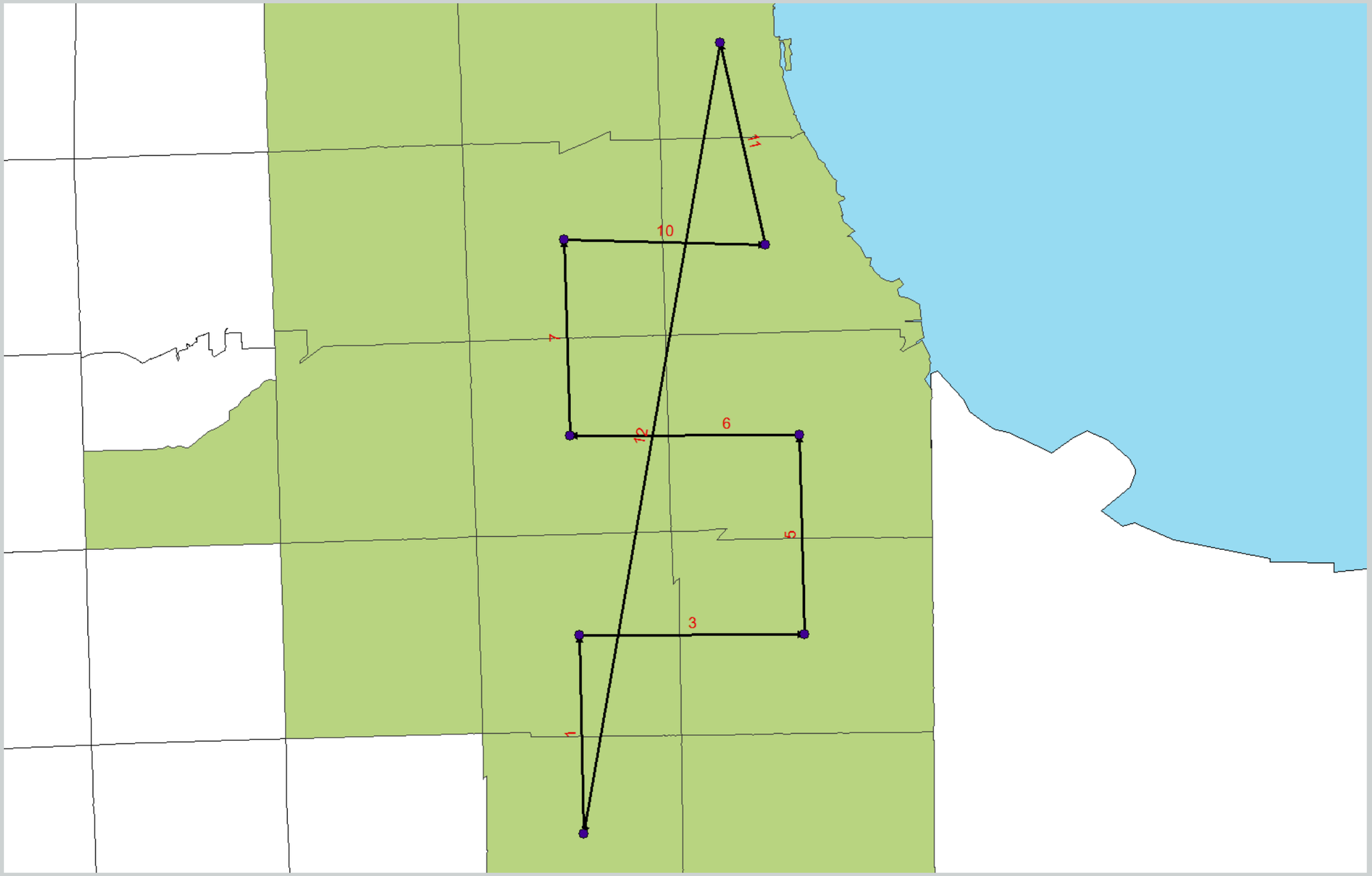
Truck Tour Data Sample

Starting from warehouse 116 in zone 28

2-axle truck

Trip Sequence	Origin	Destination	FirmID	SCTG Commodity	Shipment Weight	Start Time	End Time
1	28	26	859424	33	150	5:00	5:15
2	26	26	6477459	34	75	5:30	5:30
3	26	27	841003	34	75	5:53	6:06
4	27	27	4687996	38	1219	6:21	6:22
5	27	24	739754	19	225	6:37	6:50
6	24	23	30578	23	75	7:28	7:46
7	23	19	1395402	19	75	8:01	8:14
8	19	19	895164	32	375	8:36	8:37
9	19	19	6491151	35	75	8:59	8:60
10	19	20	7179506	29	75	9:22	9:37
11	20	17	761815	24	600	9:52	10:07
12	17	28	---	---	---	10:22	10:59

Truck Tour Example



What's Next?

Validate Model Output

- Examine commodity flows by mode
- Examine truck tour characteristics
- Run a test scenario

THANK YOU

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