Center for Infrastructure, Transportation, and the Environment

Rensselaer

Understanding and Managing E-commerce's Impact on Urban Traffic: Insights and Strategies for MPOs

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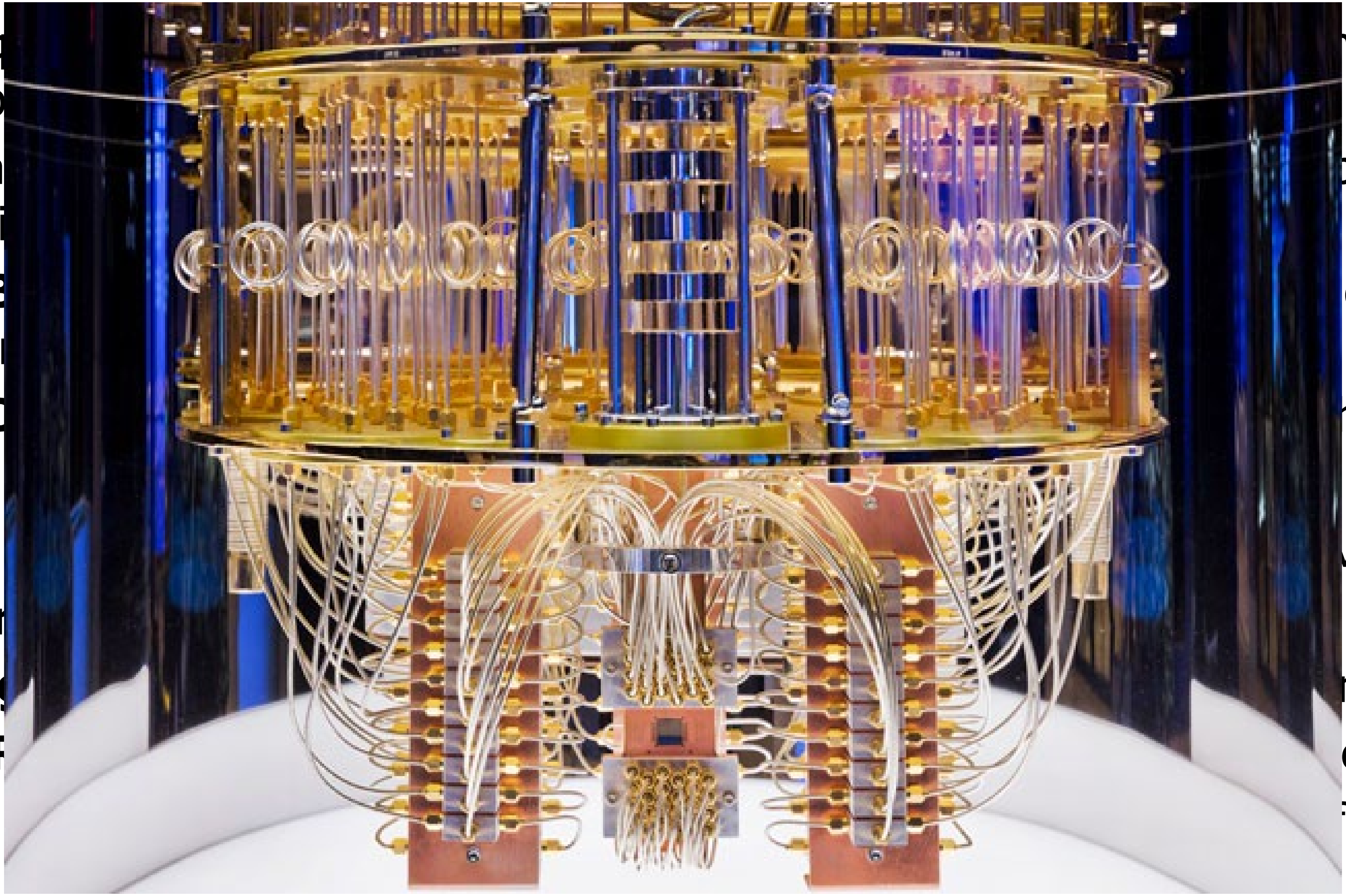
Cara Wang
Professor
Civil and Environmental Engineering
Rensselaer Polytechnic Institute
wangx18@rpi.edu

José Holguín-Veras
William H. Hart Professor
Director of the VREF CoE for Sustainable Urban Freight Systems
Rensselaer Polytechnic Institute
jhv@rpi.edu

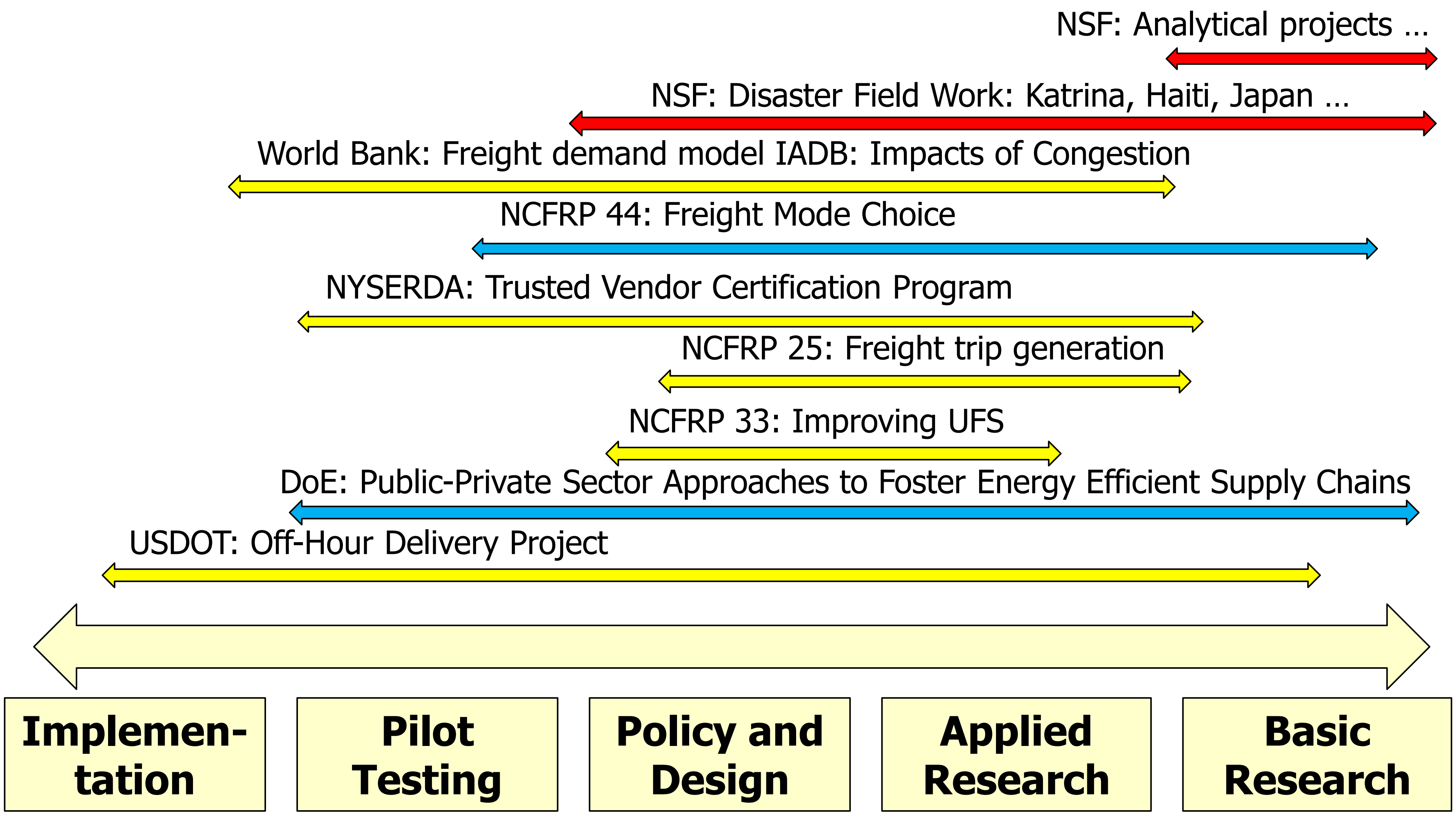
Rensselaer Polytechnic Institute's Research Areas

Key Research Areas

- **Data Acq** … niques to uncover p…
- **Sustaina** … prove sustainabi…
- **Freight B** … d congestio…
- **Freight D** … nt models.
- **Disaster** …
- **Decision** … vior.
- **Transpor** …
- **Emergin** … nsport.
- **System R** … eliability.
- **Smart &** … frastructure.



Selected Research Projects and Funding Sources

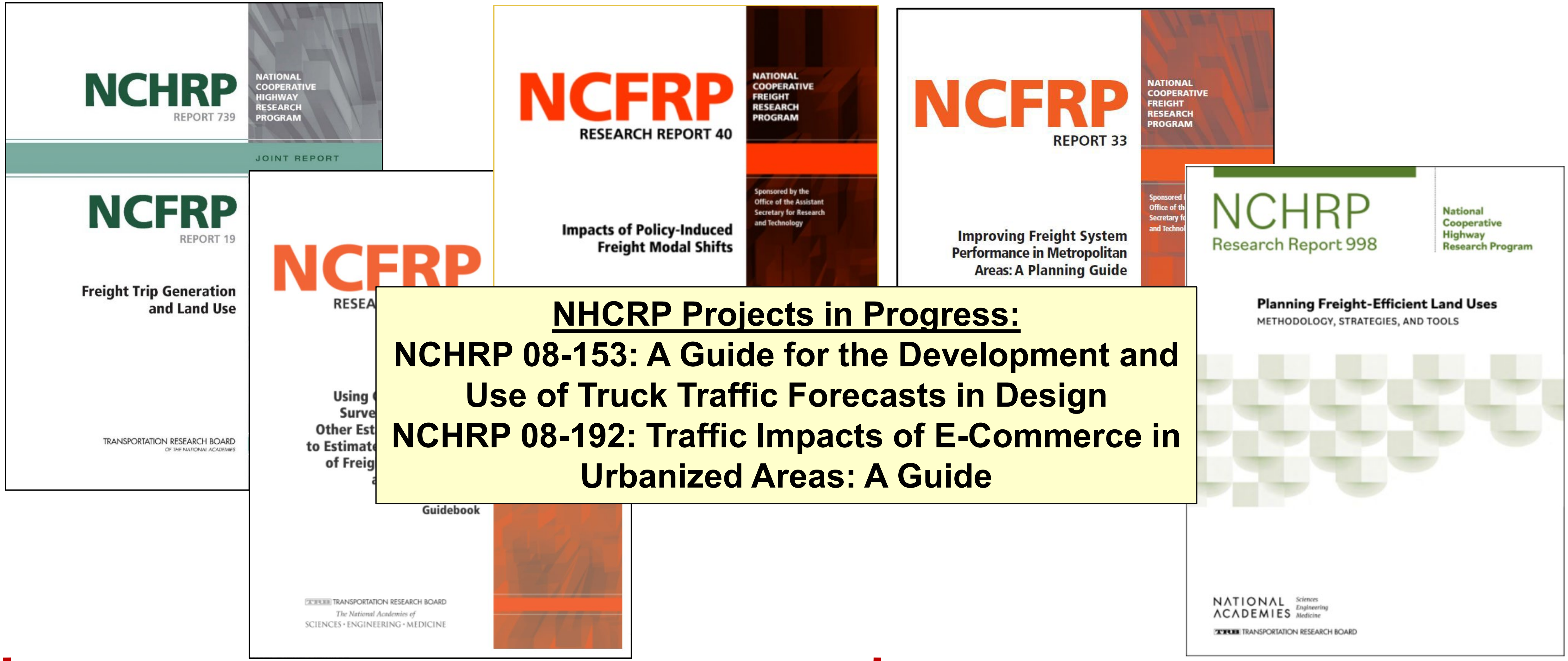


United States DOT, US Dept of Energy, New York State Energy Research and Development Agency, New York State DOT, New York City DOT, Inter-American Development Bank, Strategic Highway Research Program, National Cooperative Freight Research Program, etc.

National Science Foundation

CoE-SUFS Network

NCFRP and NCHRP Projects Led by Rensselaer



NHCRP Projects in Progress:

NCHRP 08-153: A Guide for the Development and Use of Truck Traffic Forecasts in Design

NCHRP 08-192: Traffic Impacts of E-Commerce in Urbanized Areas: A Guide

Freight Demand Modeling

Guidebooks

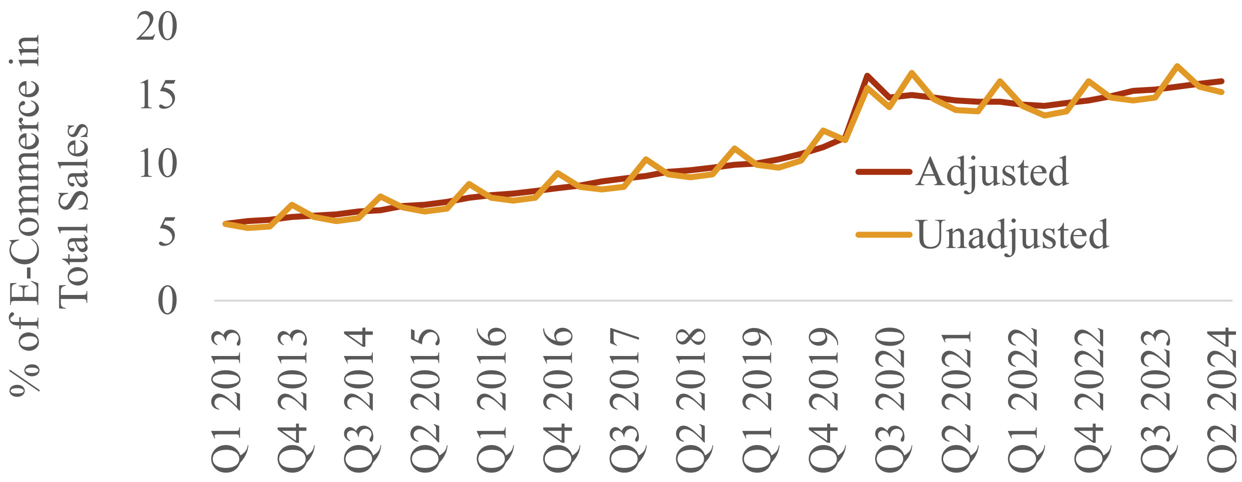
RPI Experience

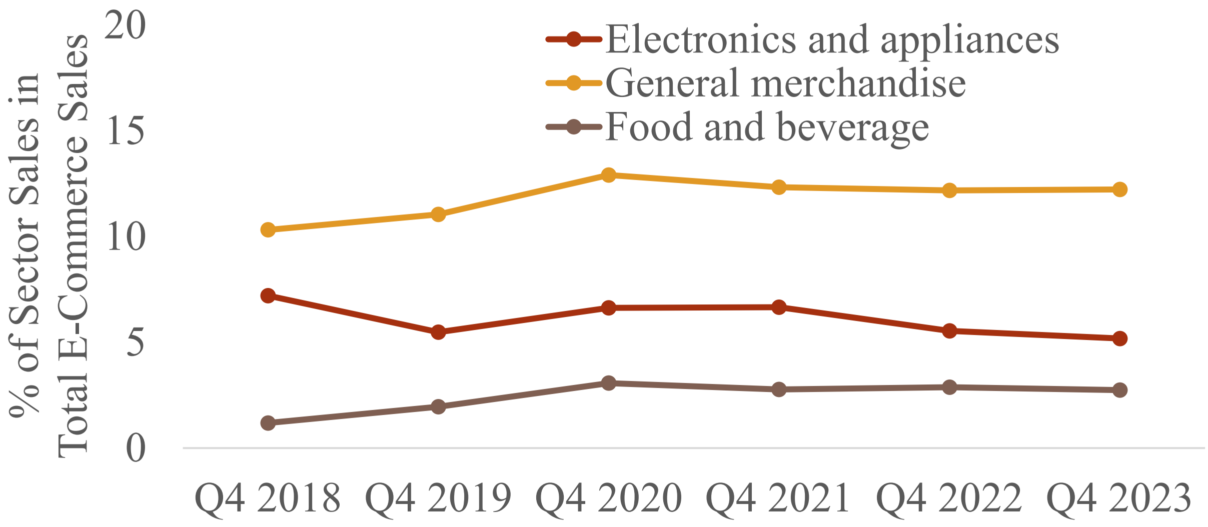
- Most Published and Cited Freight Research Group Worldwide
- Published the **first** paper on the asymmetric relationship between e-commerce deliveries and personal shopping trips
- Authored numerous publications on e-commerce’s impacts on both passenger and freight systems
- Such experience and expertise are needed for recommending **methods aligned with agency resources and integration needs**.

Agenda

- Overview of Ecommerce and Its Impacts
- Part 1- Tracking the Shift **Identifying and Collecting** Data on E-Commerce's Urban Footprint
- Part 2- Anticipating Demand: **Estimation Methods** for E-Commerce Traffic Impacts
- Part 3- Digital Solutions for Urban Freight: **Tools** to Support MPO Decision-Making
- Part 4- From Insight to Action**: Strategic Approaches** for Managing E-Commerce Traffic
- Discussion

E-Commerce Growth Trends





- U.S. annual e-commerce sales rose from **$0.027 trillion in 2000 (0.92%)** to **$1.1 trillion in 2023 (15.3%)**.
- Average annual growth rate: **17.4%**.
- Steady growth observed, with **fluctuations in 2020–2021** due to the COVID-19 pandemic.

- **Electronics and appliance sales share has decreased**, despite being early adopters of e-commerce.
- **General merchandise (e.g., household goods) increased** from **10.3% (2018)** to **12.2% (2023).**
- **Food and beverage e-commerce rose** from **1.2% (2018)** to **2.7% (2023).**
  - These goods are integrated into daily routines, potentially reducing in-person dining and grocery trips.
  - Characterized by reliance on fast last-mile delivery services (e.g., Instacart, UberEats).
  - Result: increased delivery trips, decreased store visits.

Tracking the Shift: Introduction

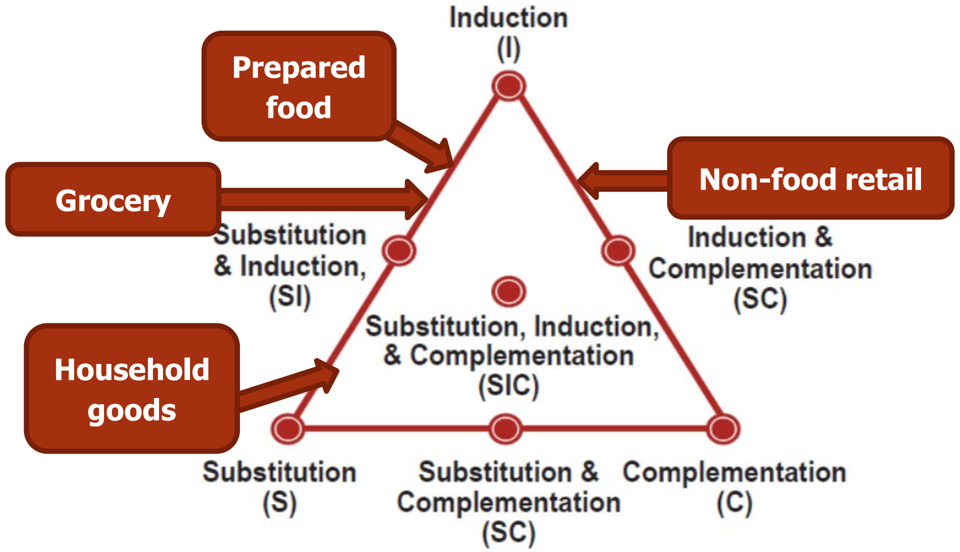
- **E-commerce has reshaped urban traffic patterns** through both direct and indirect mechanisms.
- **Public agencies** face growing challenges in addressing these impacts.

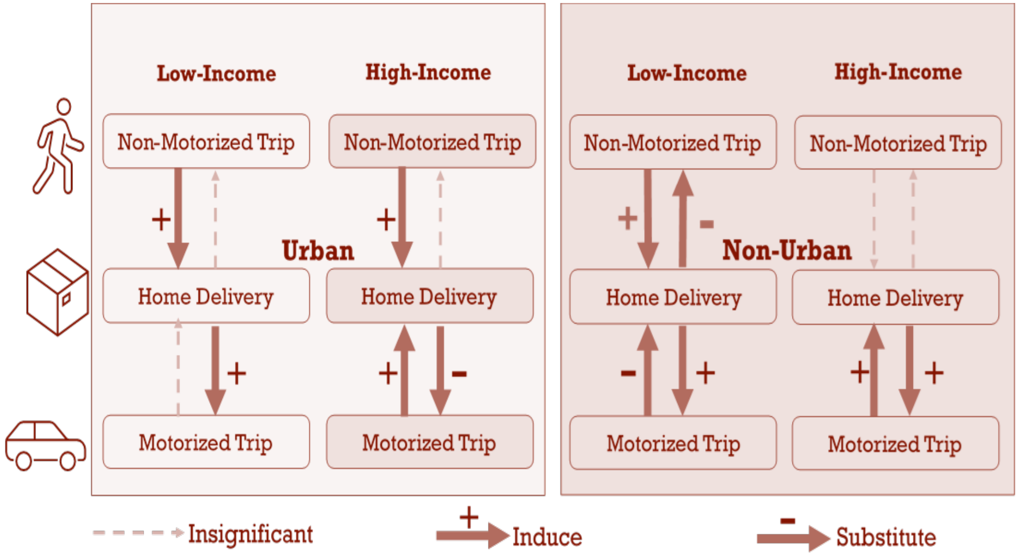
Supply Chain Complexity

- Previously bulk-based systems have evolved into **intricate, decentralized networks**.
- These changes have created **new transportation demands** across all stages.
- Agencies require **tailored data and models** to accurately predict traffic impacts.
- **Stages** of the E-Commerce Supply Chain:

Interdependency of Freight and Passenger Trips

- **E-Commerce Impacts Both Freight and Passenger Transportation**
  - Shopping demand drives **freight deliveries** and **consumer travel behavior**.
  - Effects extend beyond simple substitution of shopping trips.
- **E-Commerce Does Not Always Replace In-Store Shopping**
  - Many consumers **still shop at physical stores** even while using e-commerce.
  - Additional trips can be **induced**.
- **Resulting Travel Patterns Are Complex**
  - E-commerce can **substitute, induce, or complement** passenger trips.
- **Socioeconomic Differences Influence Impact**





Key Traffic Impacts

Increased Delivery VMT (Vehicle Miles Traveled):

- VMT is a more comprehensive metric than trip counts, as it includes **trip length**.
- Even with fixed delivery demand, e-commerce tends to **increase VMT** due to:
  - **Smaller delivery vehicles** making more frequent trips.
  - **Returns and exchanges** creating reverse logistics flows.
  - **Failed deliveries**, lost items, or theft causing repeated trips.
- Estimating VMT distribution across urban road networks is **crucial** to understanding overall impacts.

Increased Truck Generation from Warehousing and Distribution:

- Warehousing and distribution centers (especially in suburban/industrial zones) significantly **increase truck traffic**.
- This traffic contributes to **congestion, emissions, and road wear**.
- Requires focused **data, modeling, and mitigation strategies**.

Concentration of Delivery Traffic in Residential Areas:

- Leads to **bike/pedestrian safety risks**, **curb space competition**, and **double-parking**.
- Results in **localized congestion** and increased emissions.
- This issue is often **overlooked** but is **central to the study's focus**.

Underrecognized or Emerging Impact Areas

Variety of Delivery Vehicles and Services:

- Fleet diversity includes **trucks, vans, cargo bikes, passenger cars, and delivery robots**.
- Operators range from **major carriers** (UPS, DHL) to **contracted drivers** (FedEx contractors) to **crowdsourced platforms** (Amazon Flex, Uber Rush).
- **Each vehicle type** has different urban impacts and regulatory needs.

Time-of-Day Delivery Patterns:

- Deliveries are increasingly happening during **off-peak hours**.
- While this can reduce peak congestion, **high-demand periods still see traffic surges**.
- Requires consideration of **temporal dynamics** in planning models.

Mixed Impacts on Shopping Trips:

- E-commerce can **reduce** or **induce** passenger trips depending on context.
- Some trips are avoided; others are created for returns, pickups, or product browsing.
- Planning must address **both freight and passenger effects**.

Employment-Driven Commuting to Warehousing/Distribution Centers:

- E-commerce fulfillment centers require large workforces.
- **Commuter traffic** to areas often **lacking transit options** or designed for lower volumes.
- Adds a **non-freight dimension** to e-commerce traffic impact.

Local Variability in E-Commerce Traffic Impacts

Impacts Vary by Local Context:

- E-commerce effects are not uniform across urban areas.
- A single data set, model, or solution cannot address all urban scenarios.
- The guide will be designed to be flexible and adaptable by considering diverse local factors.

Key Factors Contributing to Variability:

- Urban Structure and Density:
  - Dense urban areas:
  - High retail employment density may reduce e-commerce demand.
  - Compact layouts shorten trips; sprawling layouts increase VMT.
- Consumer and Commodity Characteristics:
  - Demographics like age, income, education influence online shopping habits.
  - Commodity type affects logistics:
  - Interactions with passenger travel differ: 2021 RPI survey findings show shopping behaviors vary by product and demographic.
- Existing Transportation Systems and Technology:
  - Warehouse location and road connectivity affect delivery efficiency.
  - Congested or poorly connected areas experience higher delivery VMT.
  - Emerging tech (e.g., AVs, drones) may shift patterns, reduce traditional traffic.

Part 1
Data Collection and Processing

Tracking the Shift: Identifying and Collecting Data on E-Commerce's Urban Footprint

Examining Emerging Data Sources (NCHRP 08-192)

- **Commercial Data Availability:**
  - Sources include **NielsenIQ, Colography, ComScore, Business of Apps**.
  - Used to **estimate regional delivery volumes** and track service providers.
- **Public Data Sources:**
  - Includes **household travel surveys**, **industry reports**, and **academic studies**.
  - Offers accessible data for **tracking long-term e-commerce trends**.
- **Vehicle Telematics and Location Services:**
  - Tools such as **INRIX, Streetlight, and Stoovo**:
- **Shopping Behavior Insights:**
  - Data from **Factori, Forrester, Replica** describe:
  - Supports a **rarely studied intersection** of e-commerce and mobility.
- **Facility Location Data:**
  - **Public datasets:** e.g., **Census employment data**, **MWPVL**.
  - **Commercial datasets:** e.g., **CoStar, Data Axle**.
  - Provide detailed information on **warehouses and fulfillment networks**.
- **Retail and E-Commerce Establishment Data:**
  - Sources: **SafeGraph, Predik, Xtract, Placer.ai, Brick Meets Click, Digital Commerce 360**.
  - Enable mapping of **retail/e-commerce footprint**, including
- **Primary Data Collection by Agencies:**
  - Agencies are increasingly:
    - Adding **e-commerce-specific questions** to surveys.
    - Monitoring curb use with **sensors and cameras**.
    - **Collaborating with e-commerce firms** to obtain delivery data.
  - Some agencies have secured **formal/informal data-sharing agreements** on:
    - Package deliveries
    - Food deliveries
    - Other mobility patterns

Examples of Data Collection for E-Commerce

Type of Data	Public Data	Commercial Data	Examples of Data Collection Opportunities
Delivery Traffic and Parking Data: Types of vehicles (trucks, vans, passenger vehicles, cargo bikes, EVs, hand carts, etc.). Delivery tours, routes, stops, deliveries per tour, and other operational characteristics.	➢ No publicly available data exists that focuses on deliveries ➢ Data sets on warehouse and retail establishment freight generation (e.g., ITE Trip generation (e.g., ITE Trip Generation Manual, NCFRP Research Report 37, etc.) ➢ Commercial vehicle speed data on NHS in NPMRDS ➢ Commercial vehicle statistics from VIUS ➢ Many federal data sets cover long-haul/middle- (e.g., FAF, CFS, STB Waybill Sample. BTS T-100 reports, USACE Waterborne Commerce)	➢ Plethora of location-based data sets describing the movements of commercial vehicles (e.g., INRIX, ATRI, Geotab, Replica, Streetlight, RITIS, etc.). However, teasing out e-commerce deliveries is generally challenging. ➢ New data sets tracking on-demand deliveries, such as Stoovo and Uber Movement. ➢ New data on parking, curbs, sidewalks (e.g., INRIX Curb Analytics, CurbIQ, etc.)	➢ Direct data collection from businesses and instrumenting of delivery vehicles (e.g., NYCDOT collecting data from delivery companies/cargo bikes) ➢ Commercial driver diary surveys ➢ Collection of traffic data from fulfillment centers, as done in the Inland Empire ➢ Video monitoring of high-traffic curbs (Portland Bureau of Transportation).Vehicle data from DMV registrations and inspections

RPI’s Expertise and Experience on Data Processing

- Familiarity with both public and commercial e-commerce datasets.
- **Capable of integrating new data sources and processing techniques**, including video/image recognition and edge computing, to enhance real-time decision-making and system responsiveness.
- **Experience working with agencies** across the U.S. has built strong understanding of:
  - Agency data needs
  - Varying technical and analytical capabilities

Part 2
Freight Demand Modeling

Anticipating Demand: Estimation Methods for E-Commerce Traffic Impacts

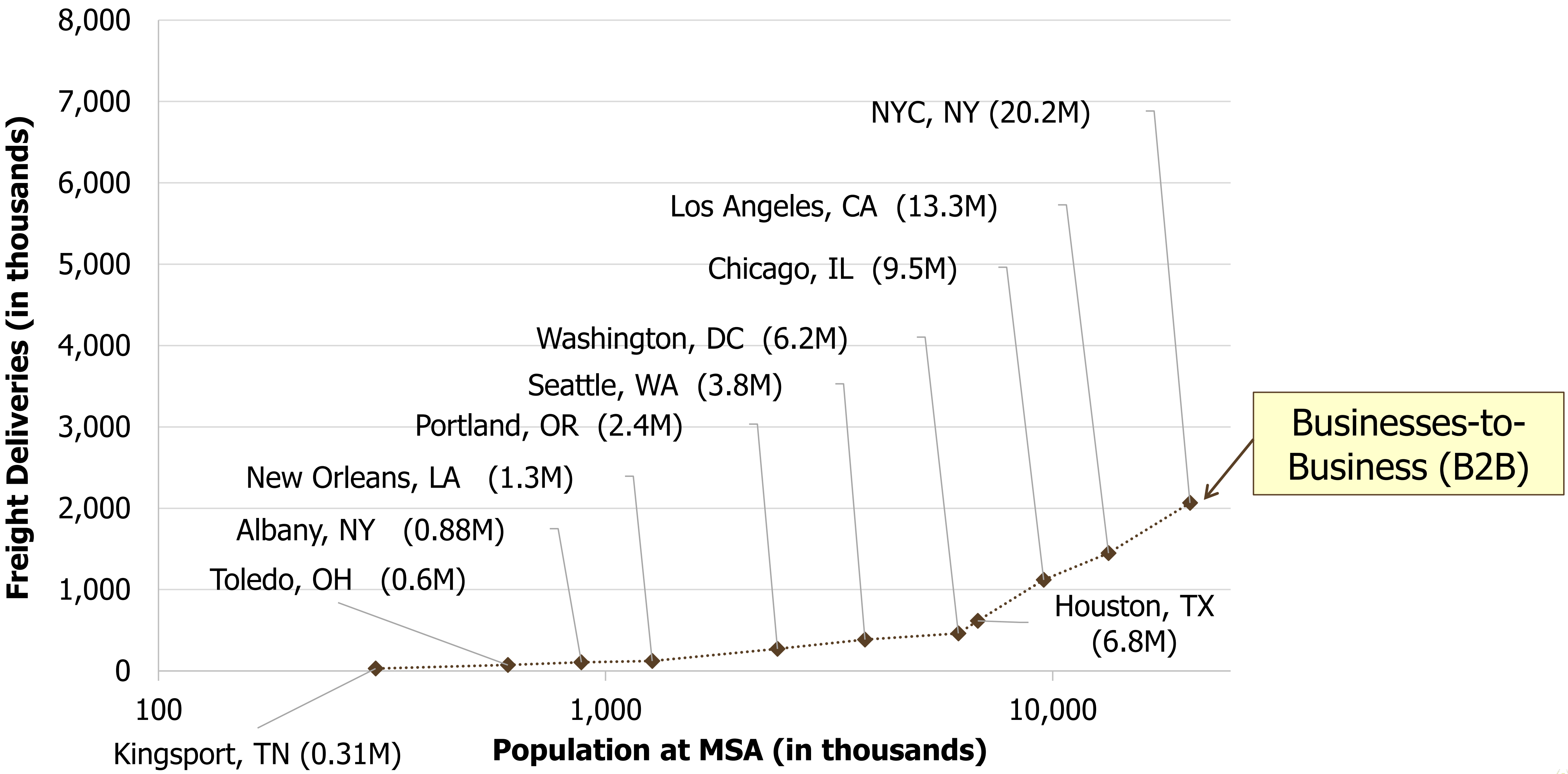
Freight and Freight Trip Generation Models

Impacts of Ecommerce → A Major Focus

Some of these trends have implications directly related to the scope of this paper. The prospect of e-commerce generating a significant number of small deliveries, most likely in small delivery vans, and the resulting increase in urban congestion should call the attention of transportation planners to the study of the decision-making processes that determine the selection of the type of commercial vehicle. Among other things, this would enable the implementation of policies aimed at increasing the use of environmentally friendly commercial vehicles, and/or encourage the use of those types of vehicles that produce less externalities, relative to the amount of cargoes they transport.

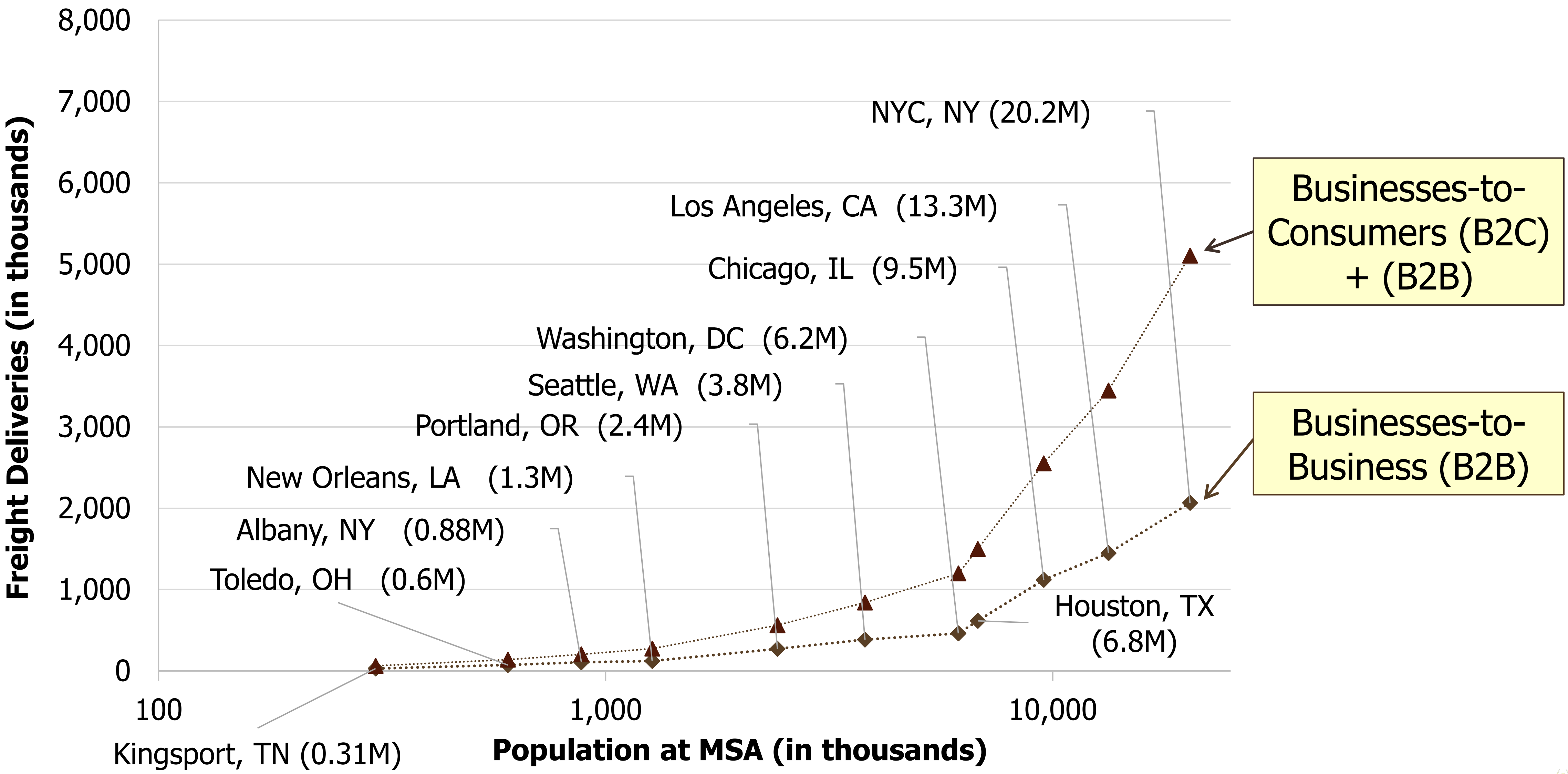
Holguín-Veras, J. (2002). "Revealed Preference Analysis of Commercial Vehicle Choice Process." Journal of Transportation Engineering 128(4): 336.

This is What It Used to Be (Before Ecommerce)



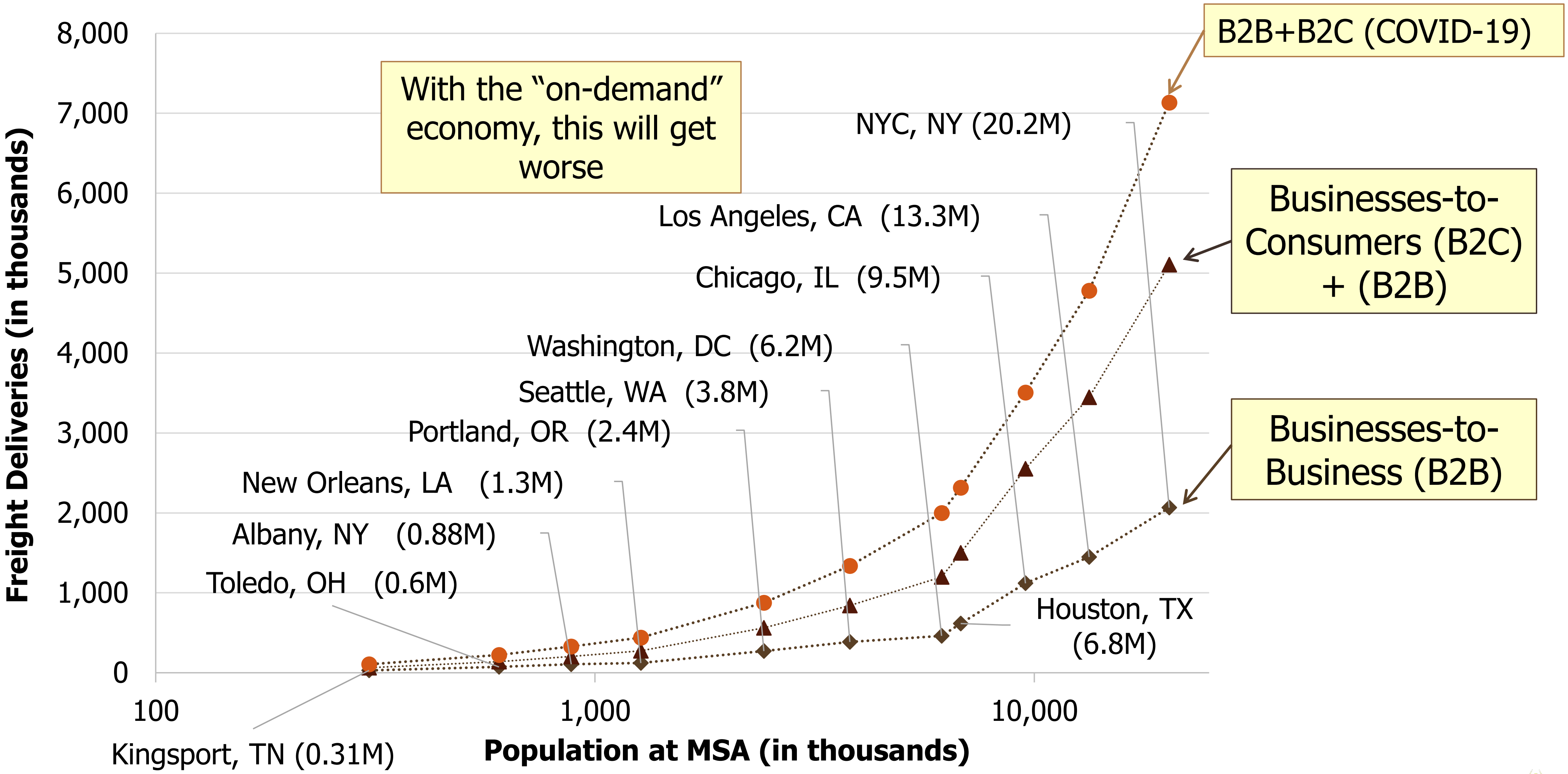
Estimates produced by the Freight and Service Trip Generation Software (FASTGS)

This is What It Became with Ecommerce (Before COVID-19)



Estimates produced by the Freight and Service Trip Generation Software (FASTGS)

This is What Became with Ecommerce (During COVID-19)



Estimates produced by the Freight and Service Trip Generation Software (FASTGS)

Freight Generation / Trip Generation Models

- For more than 15 years:
  - Collected thousands of surveys
  - Establishment level
- Estimated FTG models
  - Establishment-level
  - Economic based
- Estimated Freight Production models with confidential CFS
- Developed aggregation techniques
- Validated them
  - Good models, though imperfect
  - Transferable in US conditions

Freight Orders vs. Freight Trips

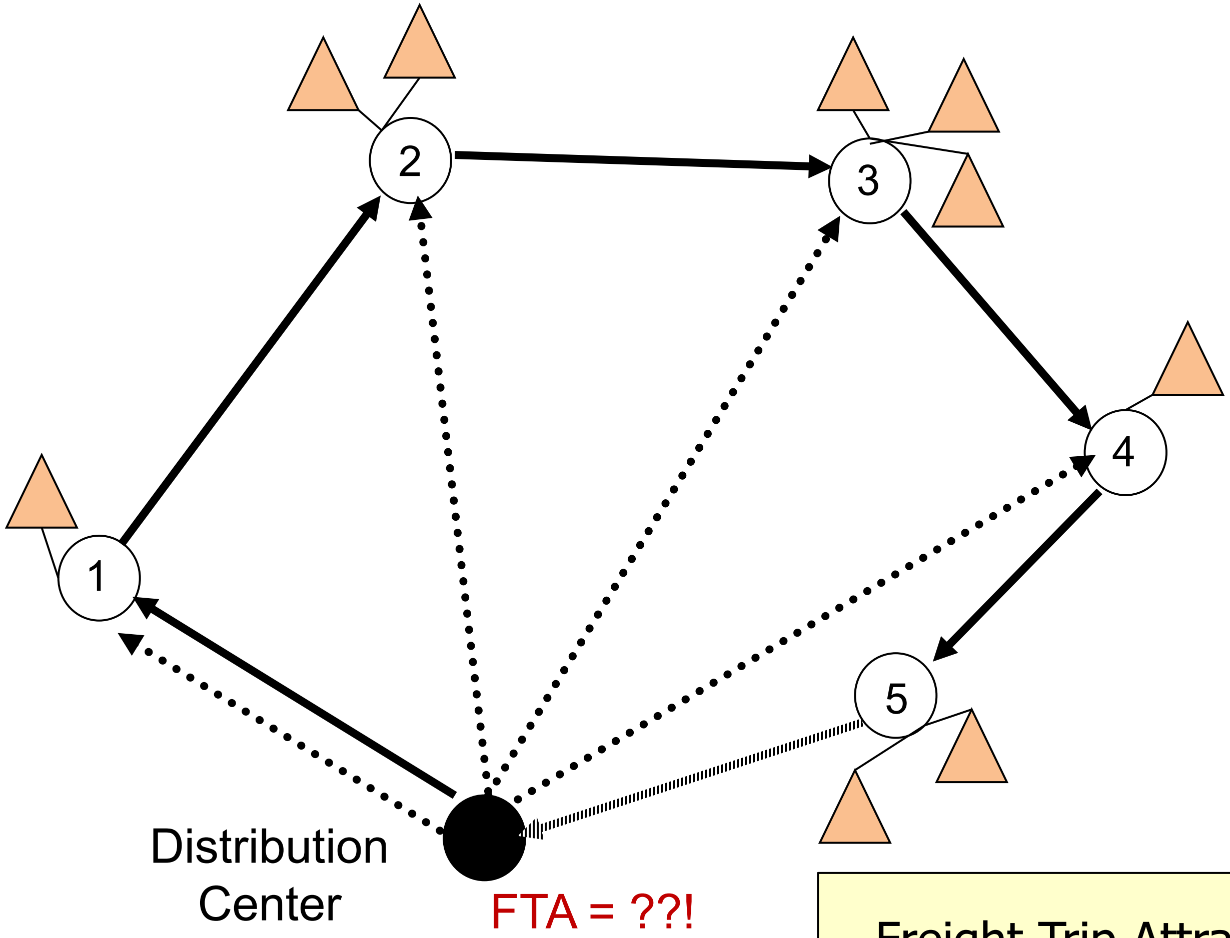
Inputs (FA)

Outputs (FP)

Inputs (FA) and outputs (FP) are transported using the combination of order frequency and shipment sizes that minimizes the logistic costs of the receiver (customer)

The orders are sent to carriers that consolidate orders from multiple customers and schedule a delivery / pick-up tours

Traditional FTG Models Do Not Work Well, We Know That…



Notation:

- Identical stores that get one delivery/day
- Empty vehicle-trip
- Loaded vehicle-trip
- Commodity flow

Key Insights:

- **FTG changes from place to place, even if establishments are the same!**
- Ordering and shipping practices are stable
- Using orders and shipments to estimate FTG is better than using FTG directly

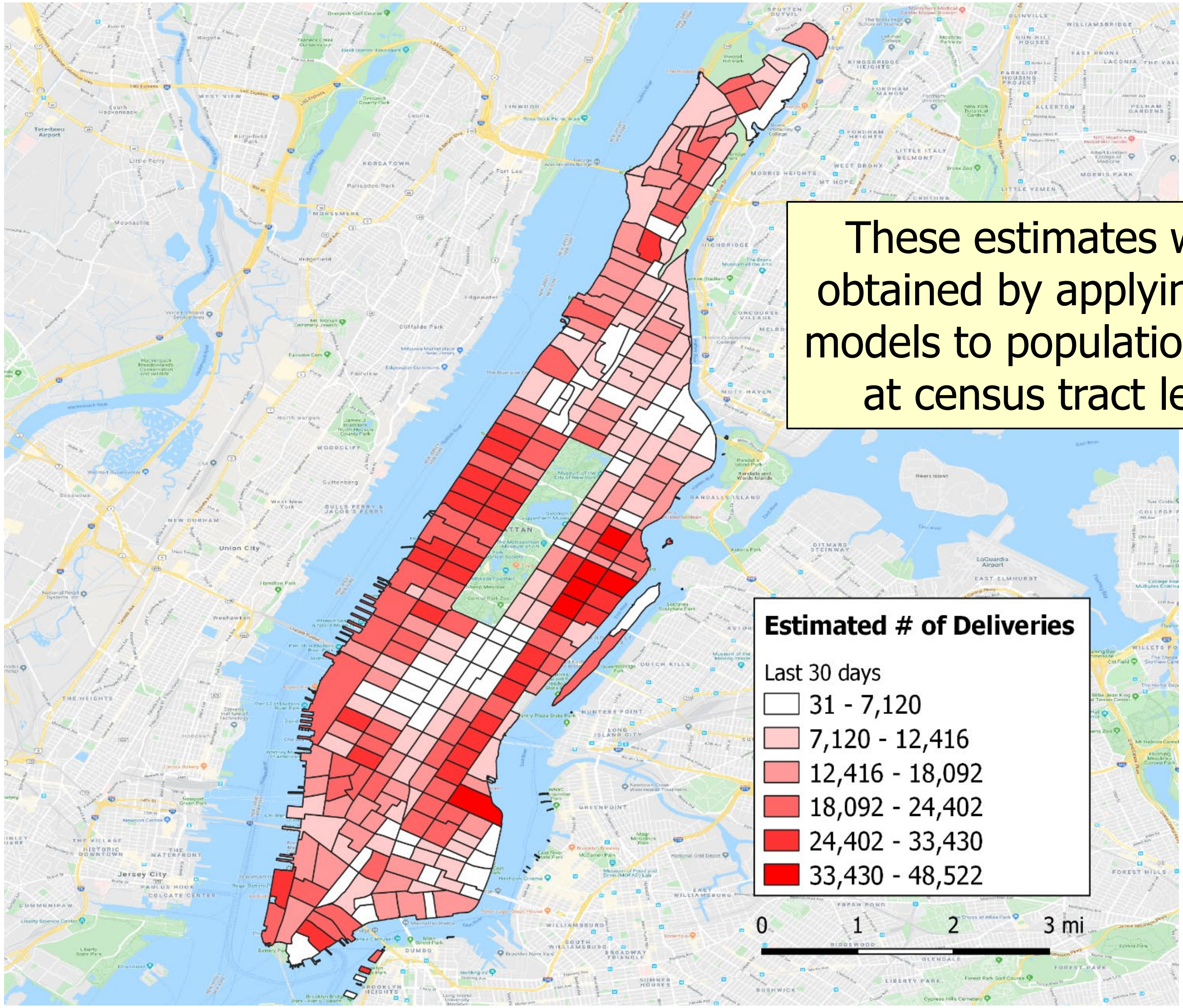
$$\text{Freight Trip Attraction} = \frac{\text{(Number of deliveries)}}{\text{(Average number of deliveries per vehicle-trip)}}$$

$$\text{Freight Trip Production} = \frac{\text{(Number of shipments sent out)}}{\text{(Average number of shipments per vehicle-trip)}}$$

Freight Trip Generation Applications

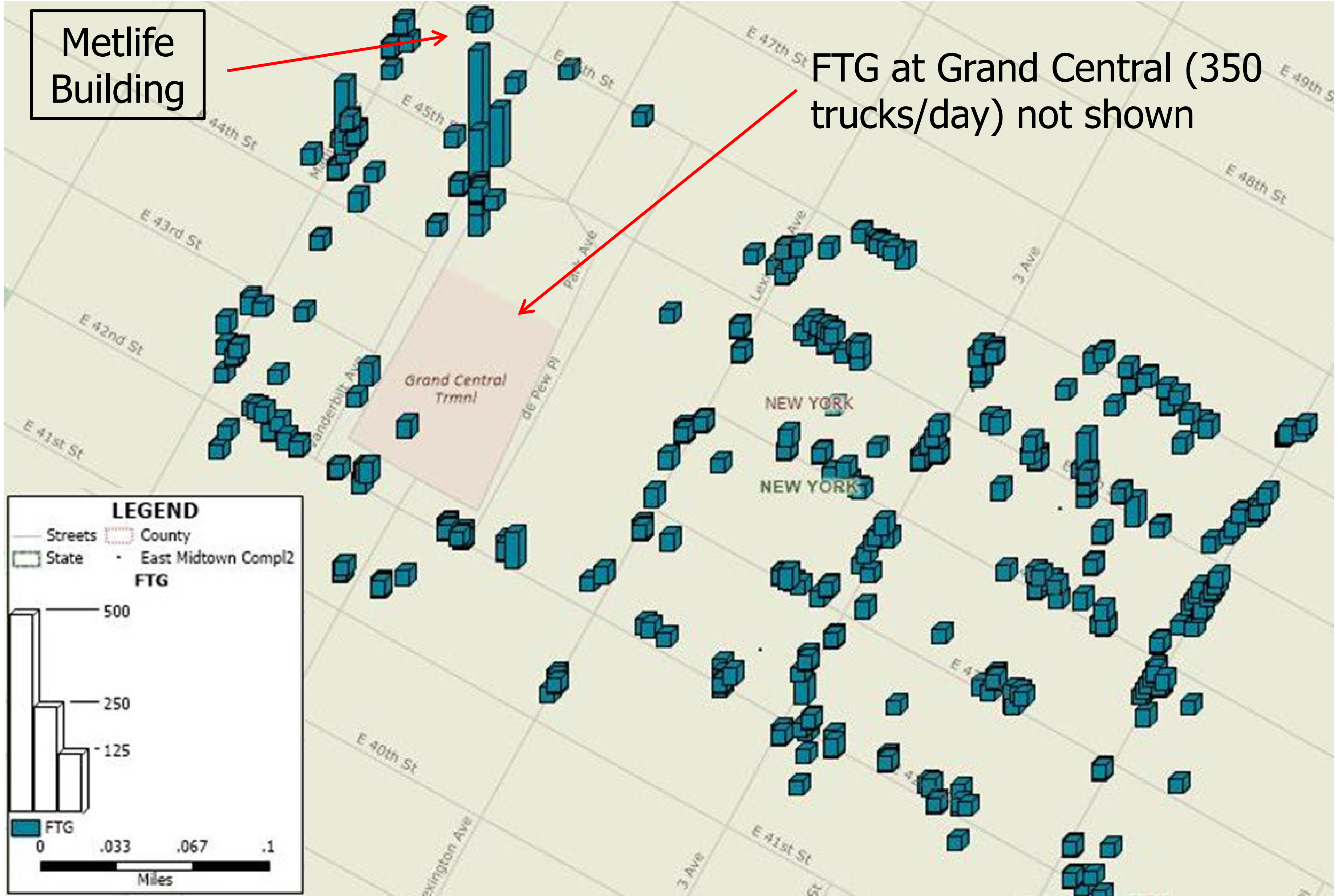
Estimates of Internet Deliveries to Households

Ecommerce Deliveries to Manhattan



These estimates were obtained by applying the models to population data at census tract level

Deliveries at the Establishment Level



New York, NY: Midtown Manhattan (10001)

ZIP Code: 10001

Population (2016): 23,947

Establishments: 8,221

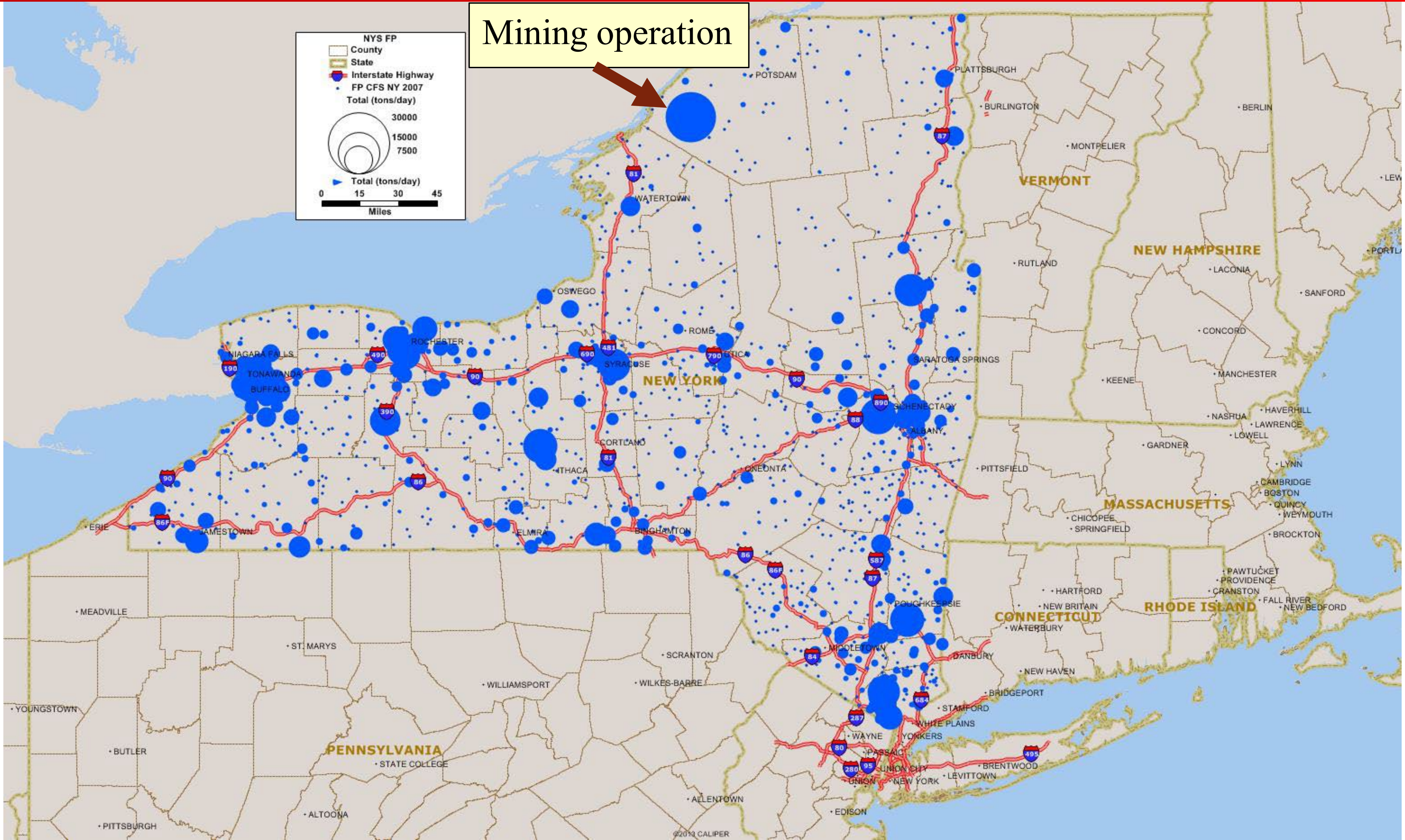
Employment: 174,552

Deliveries/day	= 16,250	→ FTA = 16,250 truck trips
Shipments/day	= 18,920	→ FTP = 18,920 truck trips
B2C deliveries/day	= 3,830	→ FTA = 550 truck trips
Service visits	= 2,400	→ STA = 2,400 trips

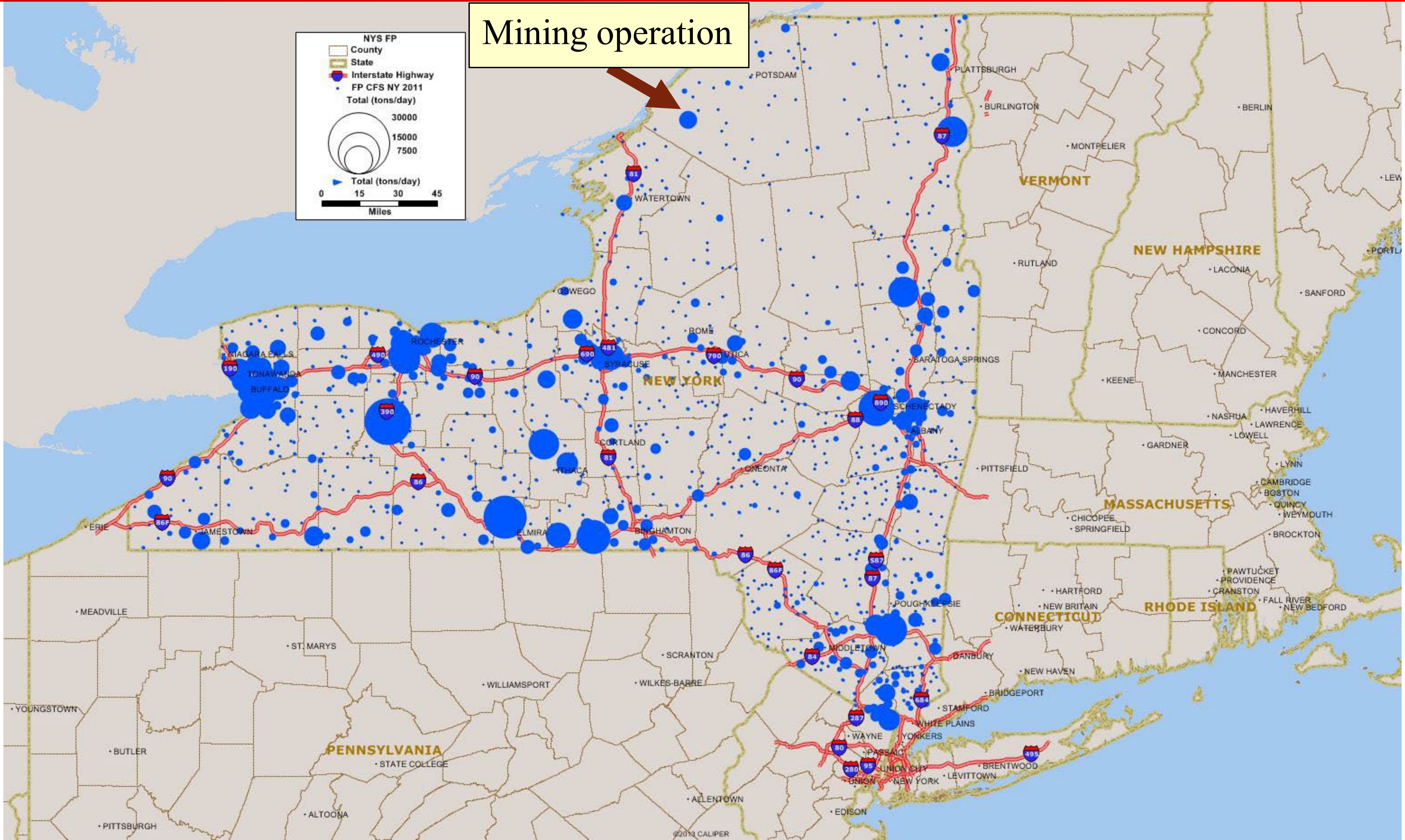
Application #2: Estimating Freight Production Using Freight Production Models

New York State: Freight Production Patterns

Freight Production by ZIP Code 2007

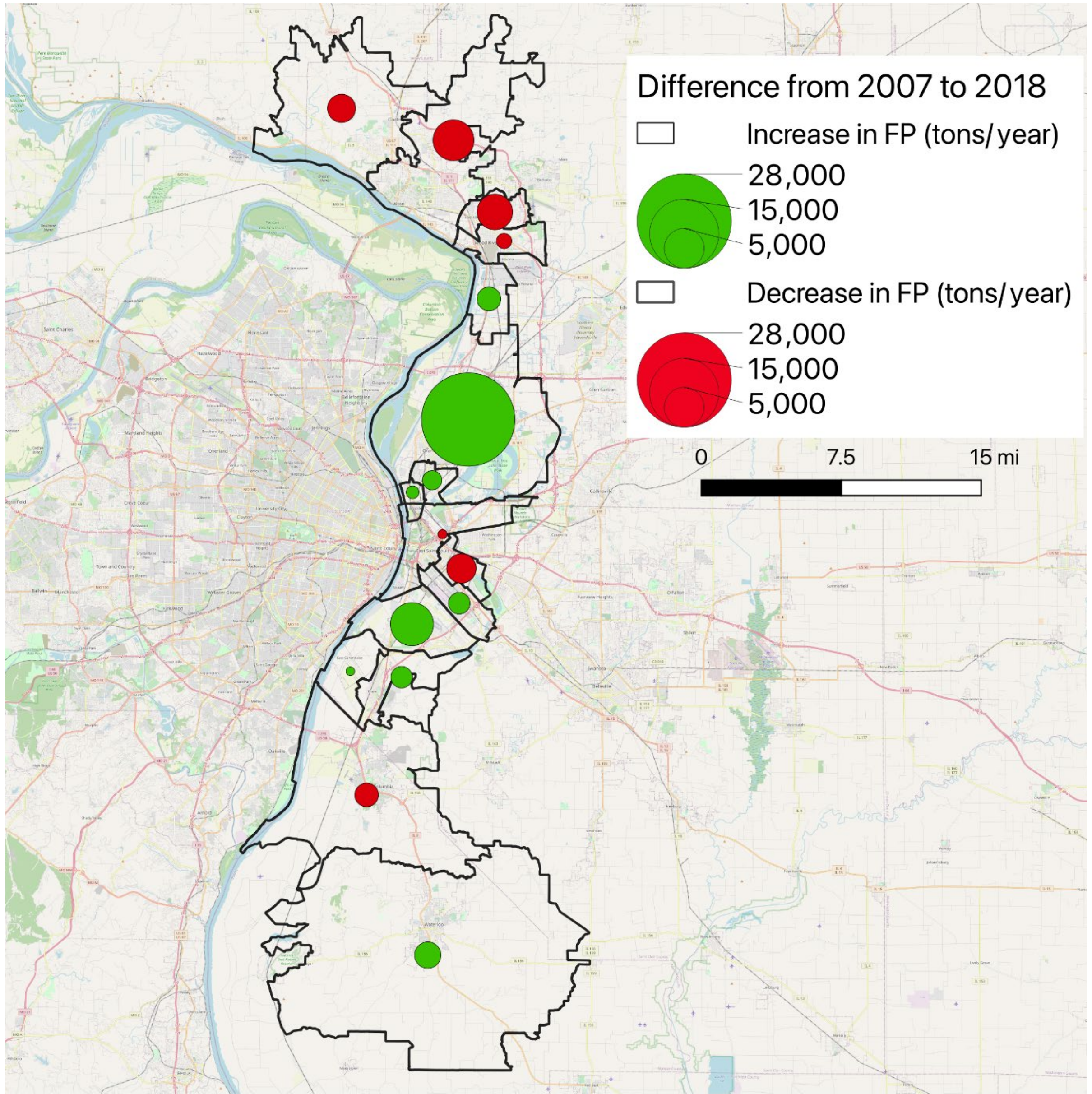


Freight Production by ZIP Code 2011

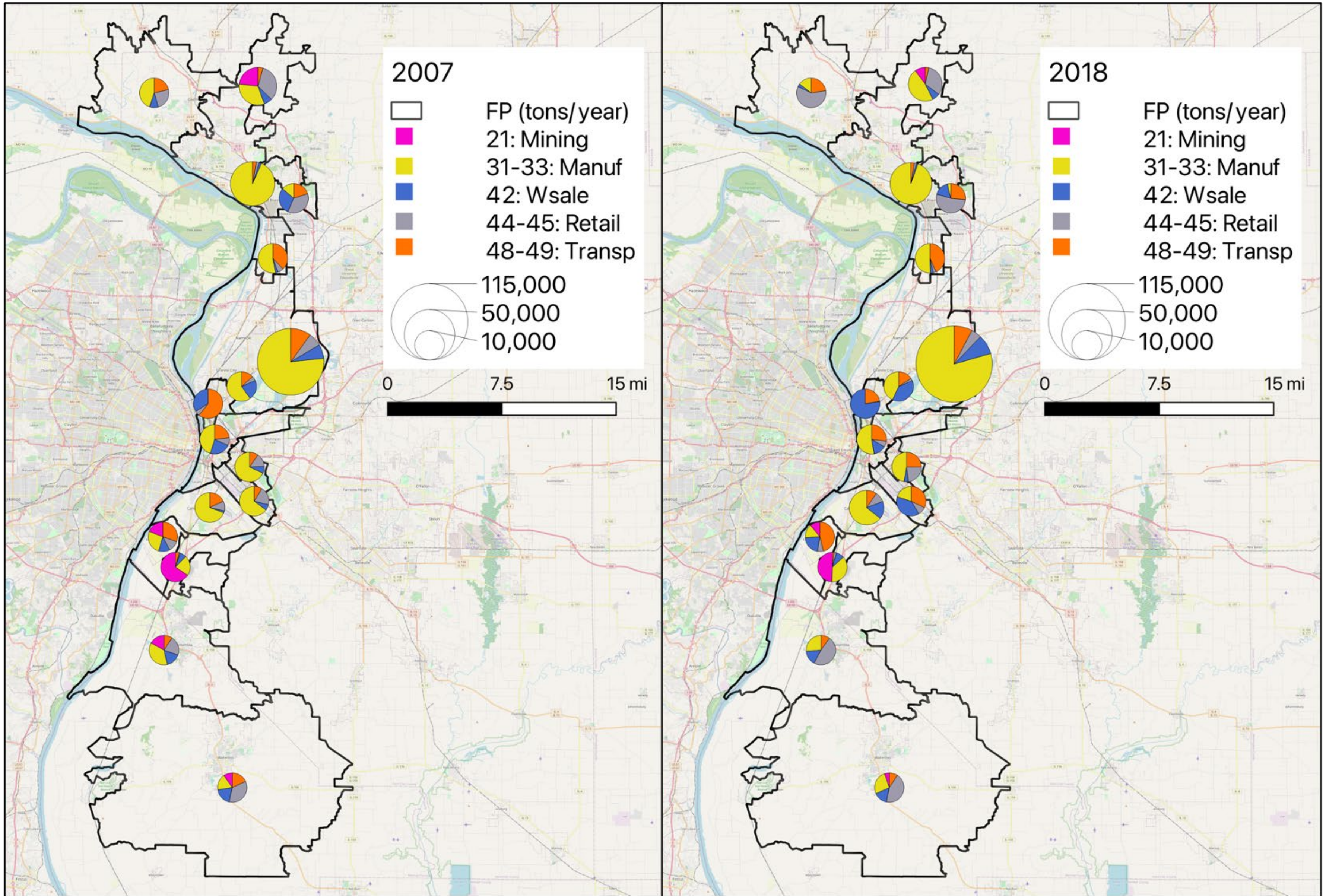


St. Louis

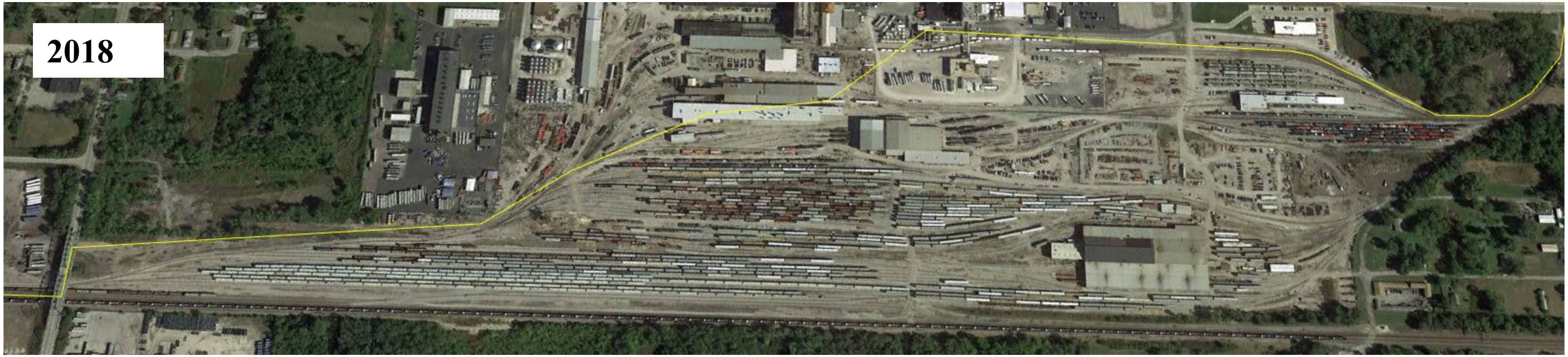
Changes in Freight Production by ZIP Code 2007 vs 2018



Comparison in Freight Production by Sector 2007 vs 2018



#1 ZIP 62207 Metro East Industries



#2 ZIP 62207 e

2007

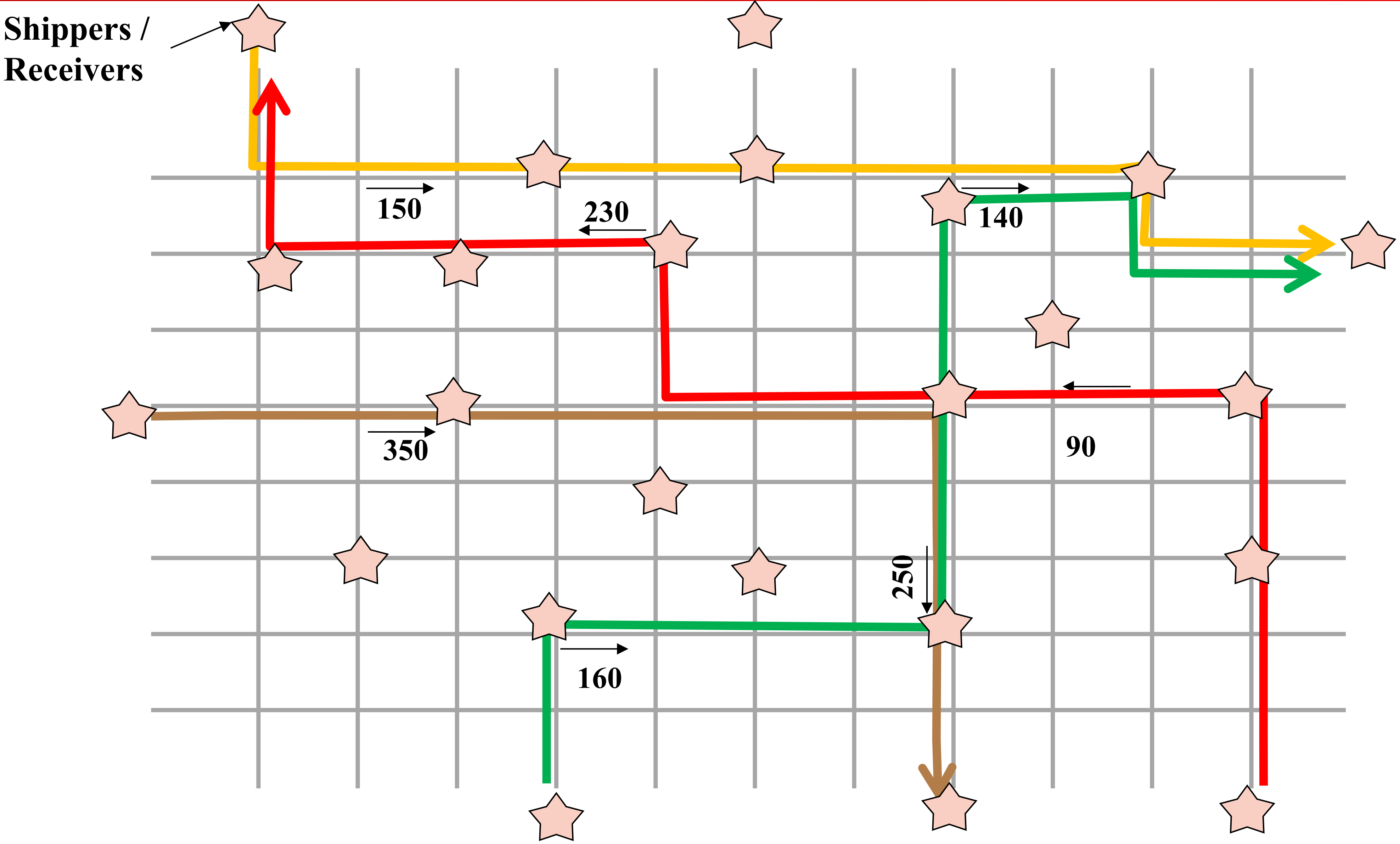
2018 with addition of CoPart – auto salvage yard

Freight Demand Synthesis

Freight Demand Synthesis

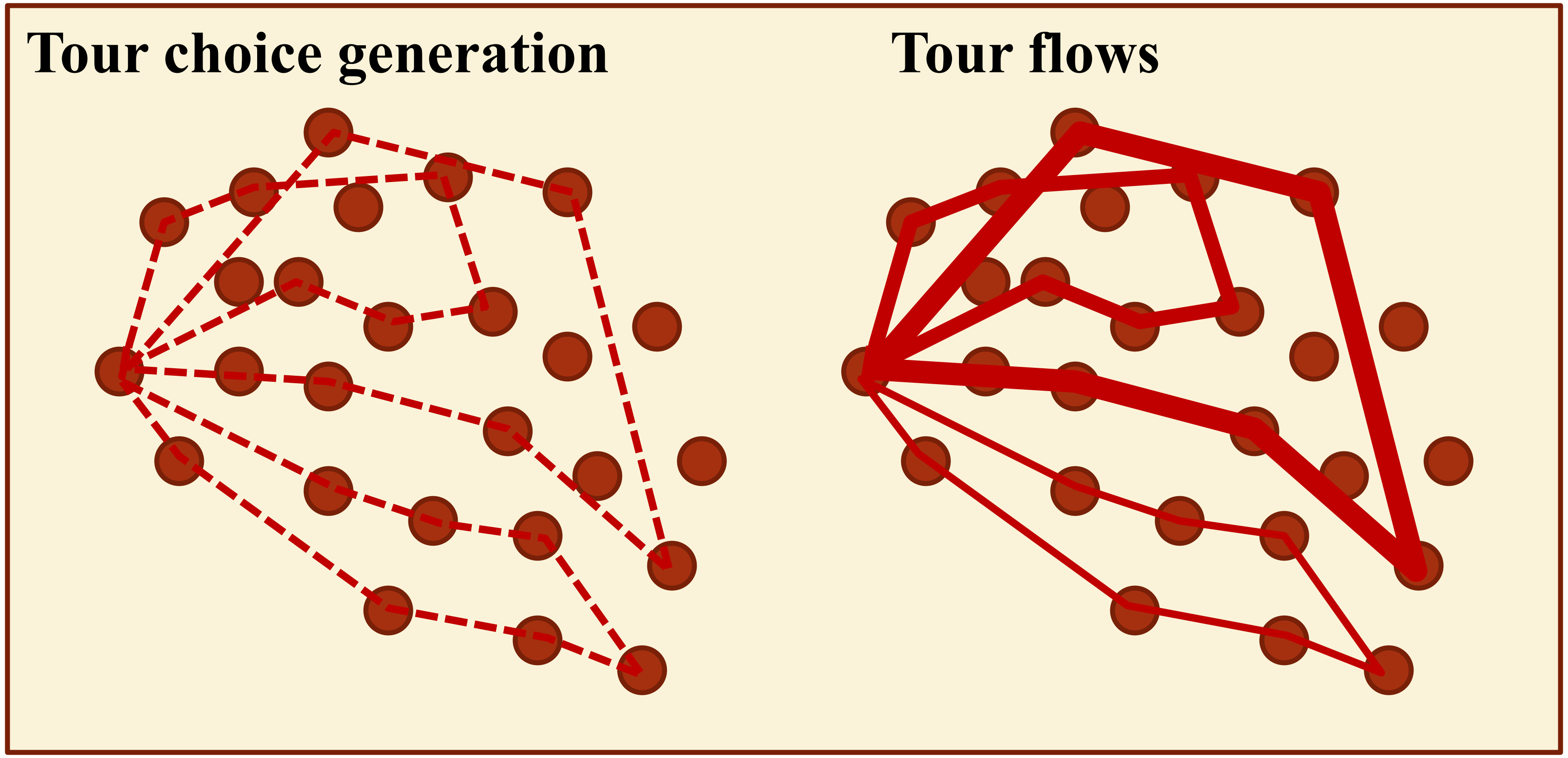
- Lack of data about freight demand is a major issue
  - Costly, time consuming, requires a lot of effort
  - Gets out of date very quickly
  - Old way to develop freight demand models:
    Generation → Distribution → Mode Split → Traffic Assignment
- Instead of collecting expensive/time-consuming data FTS uses advanced models to infer demand from easy-to-get secondary sources such as traffic counts
  - Inexpensive, quick to obtain, easy to collect
  - Could be updated as needed
  - New way to develop freight demand models:
    Generation & Observed Traffic → Distribution (or FTS)

Objective: Infer the Truck Trajectories that Match Traffic Counts



Entropy Maximization Tour Flow Model

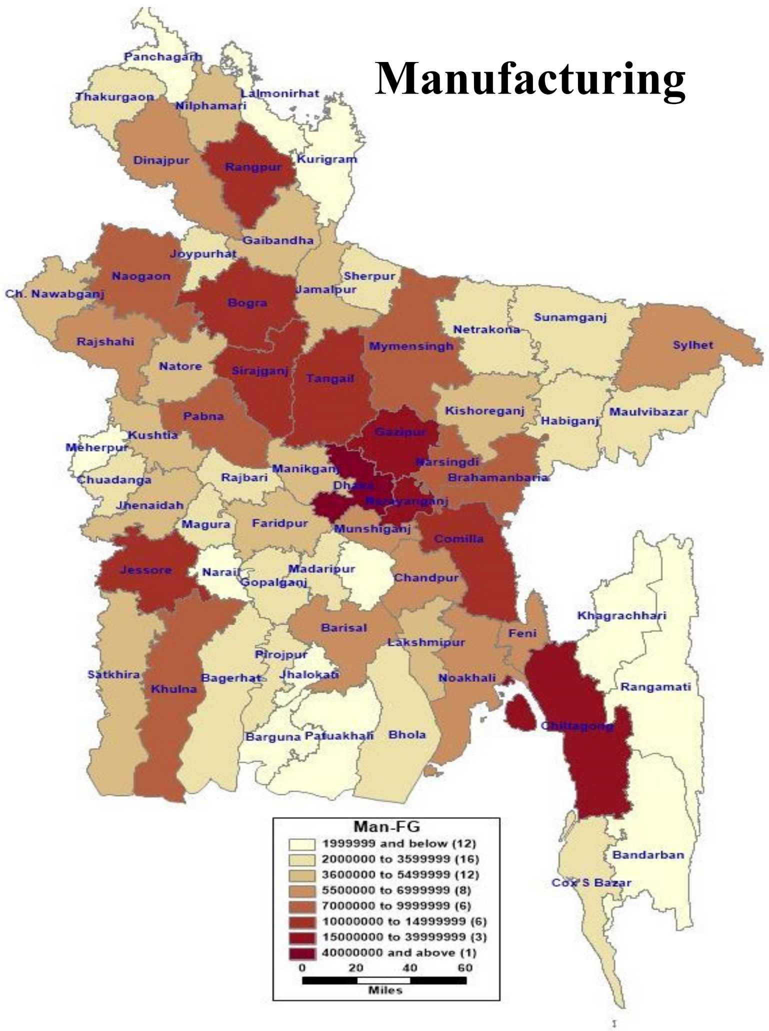
- Tour choice: To estimate sensible node sequences
- Tour flow: To estimate the number of trips traveling along a particular node sequence

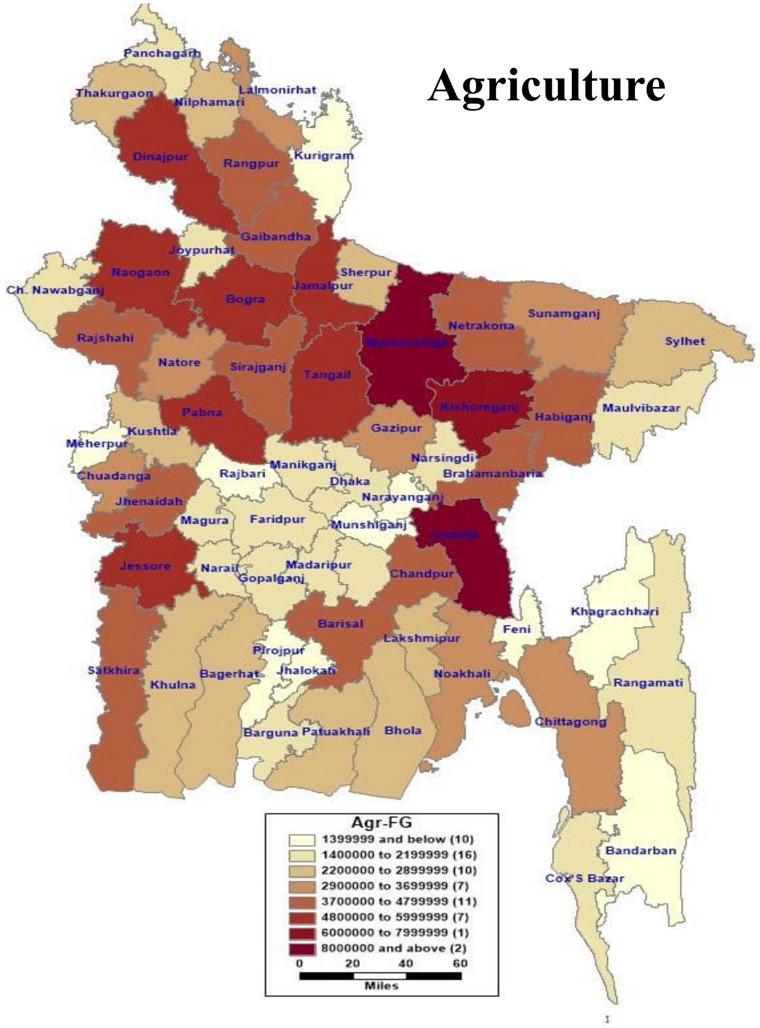


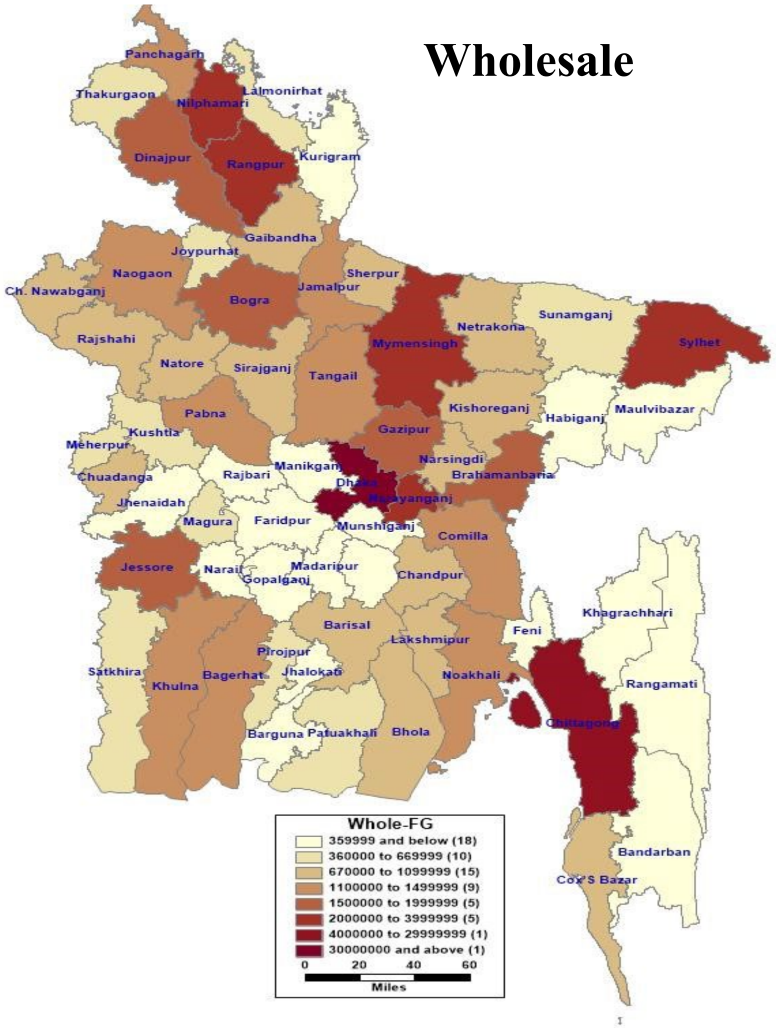
Applications of Freight Demand Synthesis: Bangladesh Freight Demand Model, Super Truck 3 Model

FG Estimates: Bangladesh Freight Demand Model (World Bank)

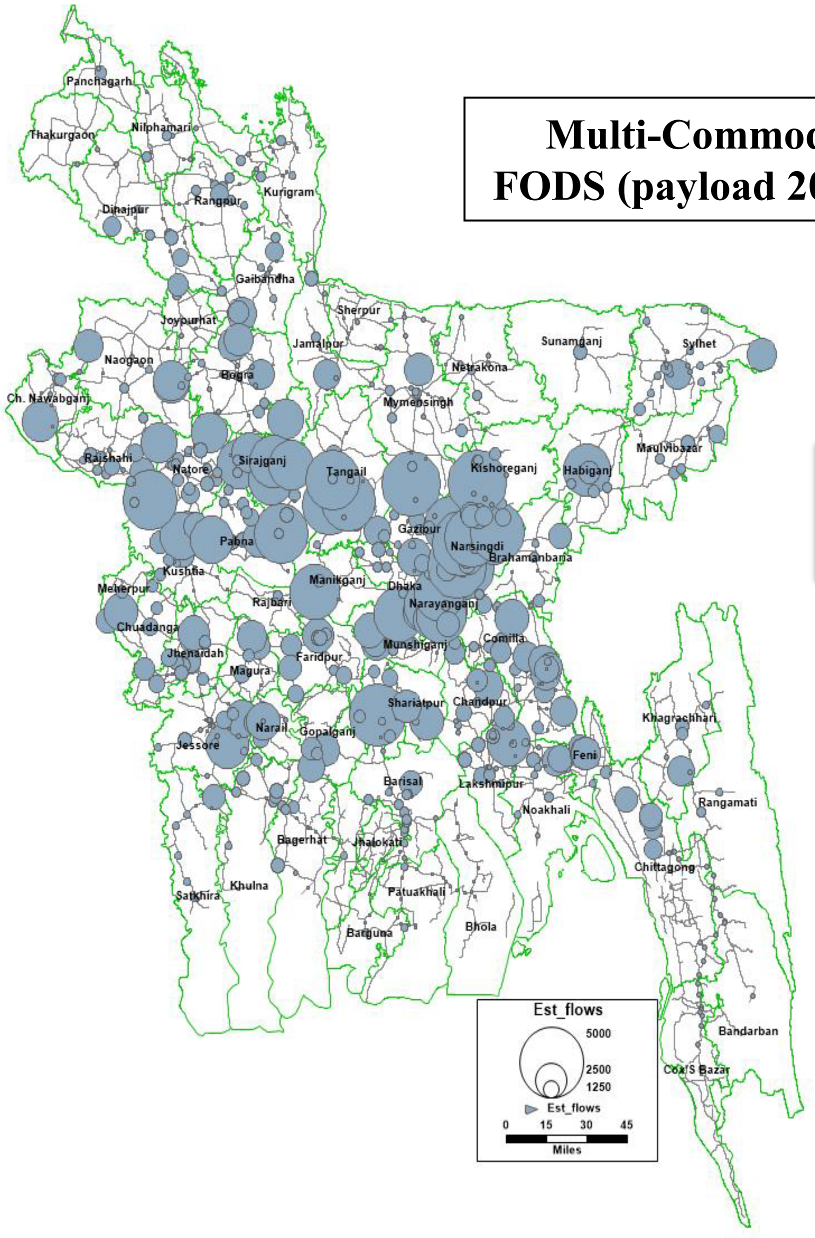
- FG: Spatial distribution by industry cluster







Estimated Traffic Flows: FODS



Concentrated more in the central core (ports of entry/exit flows are removed)

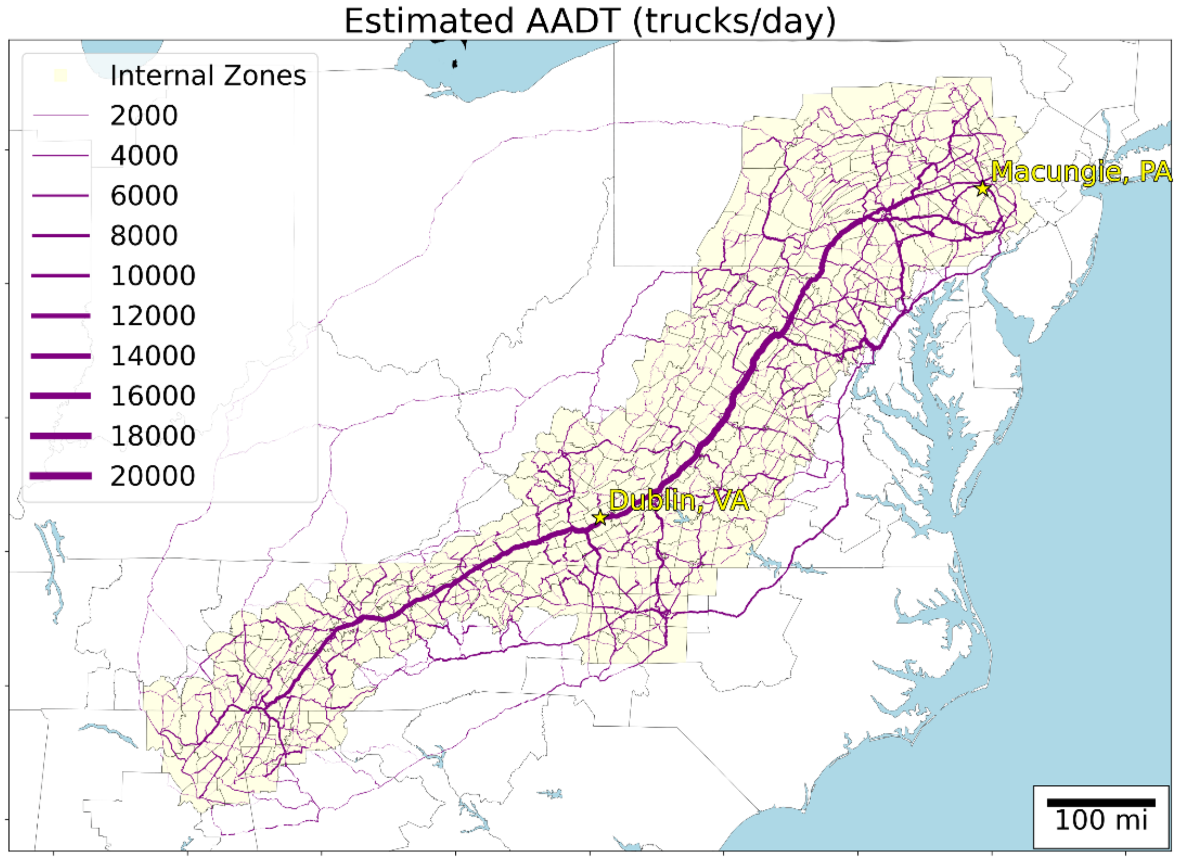
Model Application

- Benefits for various scenarios

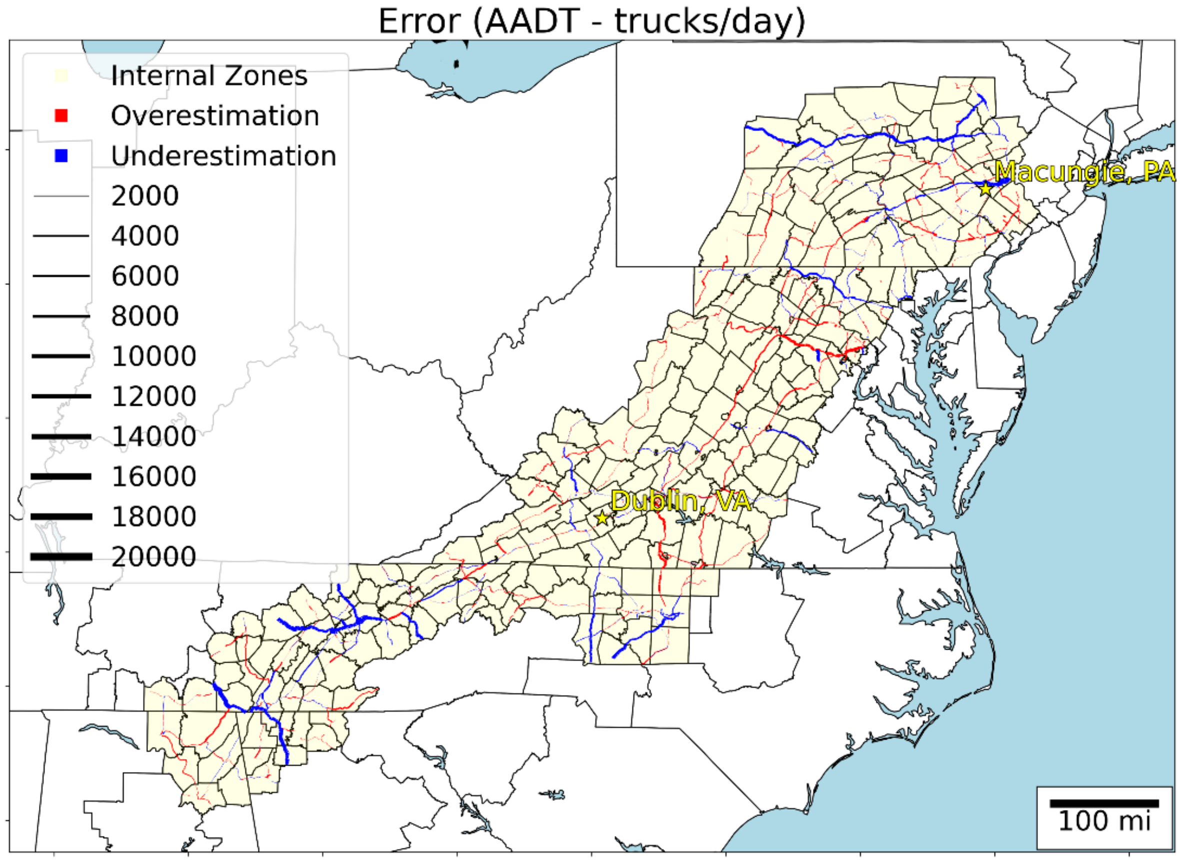
Scenario	Impacts on Intercity Freight Traffic						Economic Impacts		
	Domestic		Import / Export		Total		Savings ($ million/year)		
	Veh-hr	Veh-km	Veh-hr	Veh-km	Veh-hr	Veh-km	Veh-hr	Veh-km	Total
Base Case	138,594	4.789E+06	136,844	4.960E+06	275,438	9.749E+06	-	-	-
BC+Padma Bridge	133,106	4.669E+06	132,761	4.790E+06	265,867	9.459E+06	14.787	27.817	42.604
BC + PB + Ferry 1	132,346	4.651E+06	132,692	4.789E+06	265,038	9.440E+06	16.068	29.690	45.757
BC + PB + Ferry 2	132,575	4.642E+06	132,688	4.784E+06	265,263	9.426E+06	15.719	31.007	46.726
BC + PB + Ferry 4	133,017	4.666E+06	132,760	4.790E+06	265,776	9.456E+06	14.927	28.084	43.011
BC + PB + Ferry 5	133,097	4.668E+06	132,761	4.790E+06	265,858	9.458E+06	14.801	27.944	42.745
BC + PB + Ferry 6	132,799	4.674E+06	132,333	4.819E+06	265,132	9.493E+06	15.923	24.563	40.486
BC + PB + Ferry 4 & 5	132,896	4.660E+06	132,751	4.789E+06	265,647	9.448E+06	15.127	28.867	43.994
BC + PB + Ferry 4 & 5 & 6	132,538	4.664E+06	132,270	4.816E+06	264,808	9.480E+06	16.422	25.805	42.227
BC + PB + Ferry 1 & 2	131,804	4.623E+06	132,624	4.782E+06	264,428	9.405E+06	17.010	32.993	50.003
BC+Padma Bridge (N-40Kmph)	115,896	4.657E+06	121,974	4.769E+06	237,870	9.425E+06	58.042	31.061	89.103

Freight Demand Modeling I-81 Corridor
Super Truck 3 Volvo Team

In progress…



Estimated AADT (trucks/day)
Internal Zones
2000
4000
6000
8000
10000
12000
14000
16000
18000
20000
Macungie, PA
Dublin, VA
100 mi



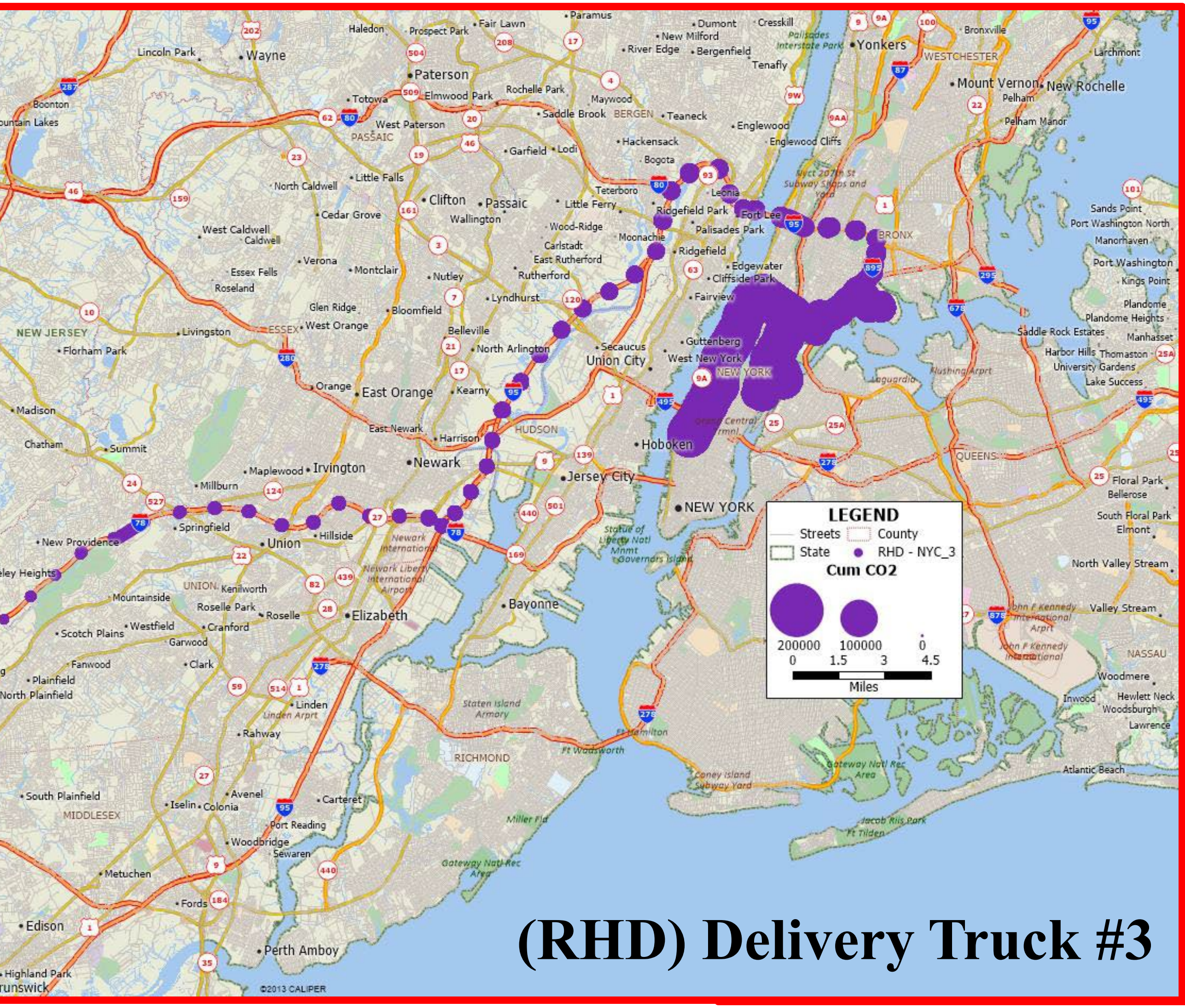
Error (AADT - trucks/day)
Internal Zones
Overestimation
Underestimation
2000
4000
6000
8000
10000
12000
14000
16000
18000
20000
Macungie, PA
Dublin, VA
100 mi

Part 3
Tools and Software

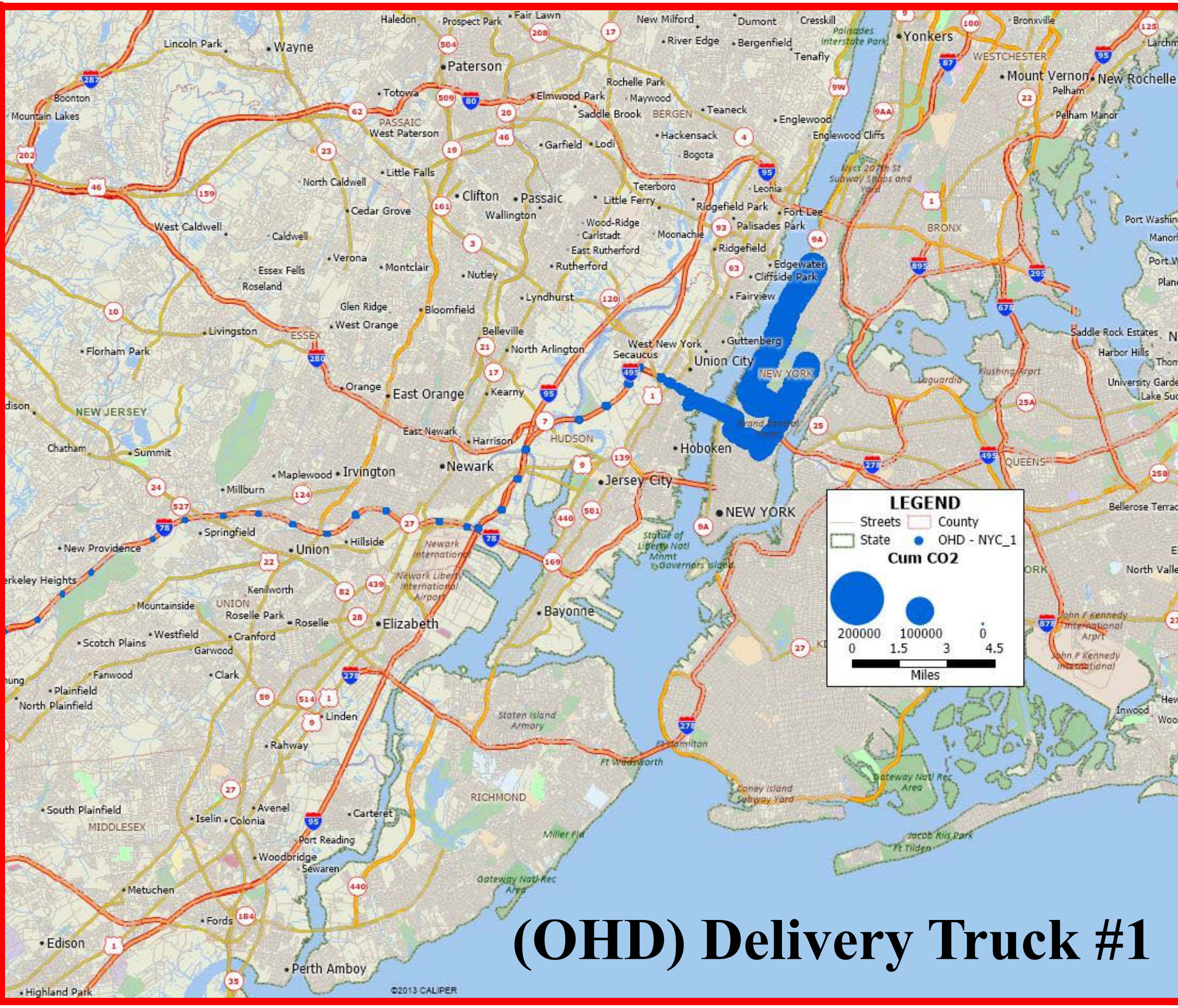
Digital Solutions for Urban Freight: Tools to Support MPO Decision-Making

GPS Data Collection and Processing

GPS Computer Systems: CO2 Emissions Day vs. Night



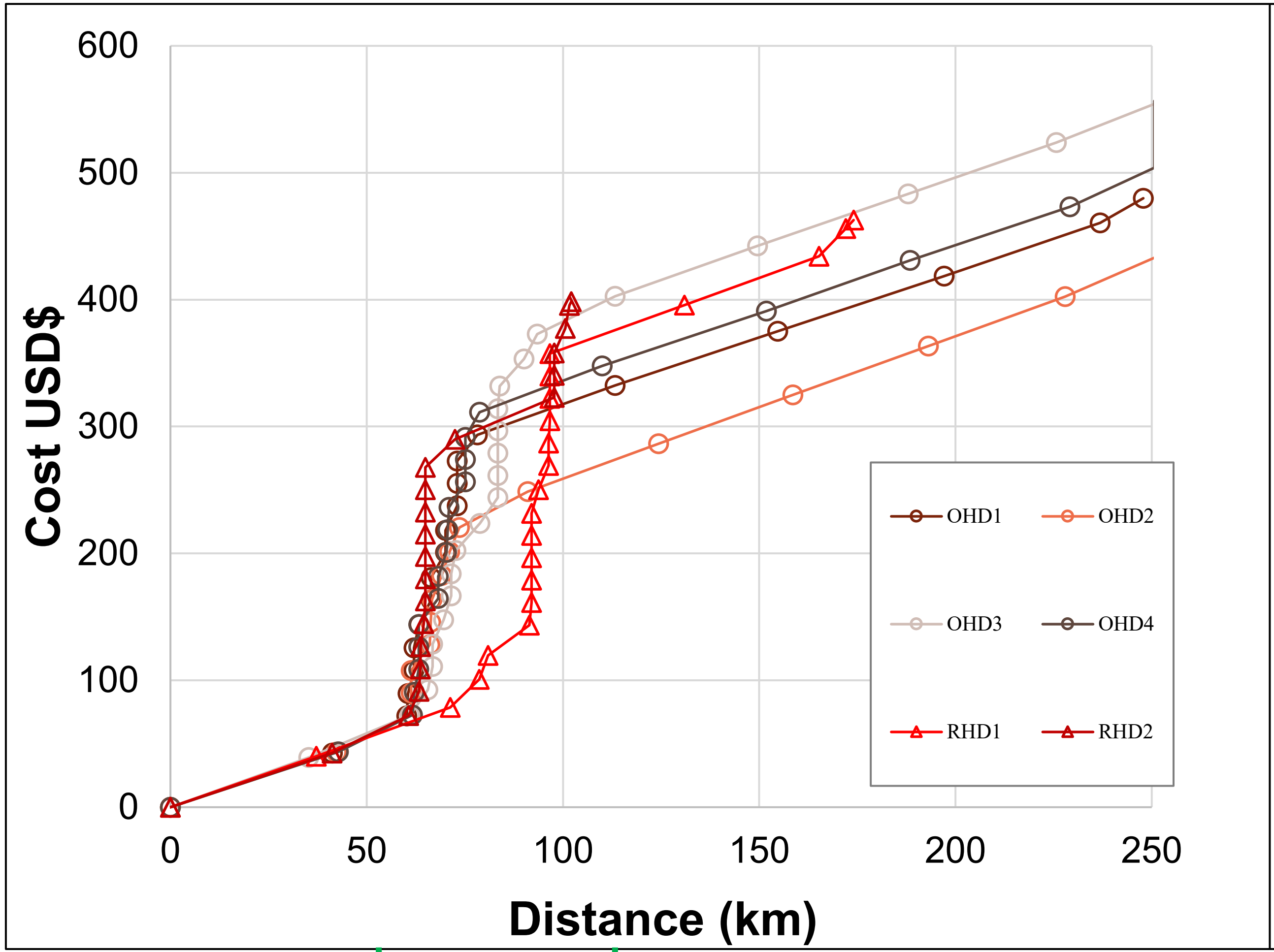
(RHD) Delivery Truck #3



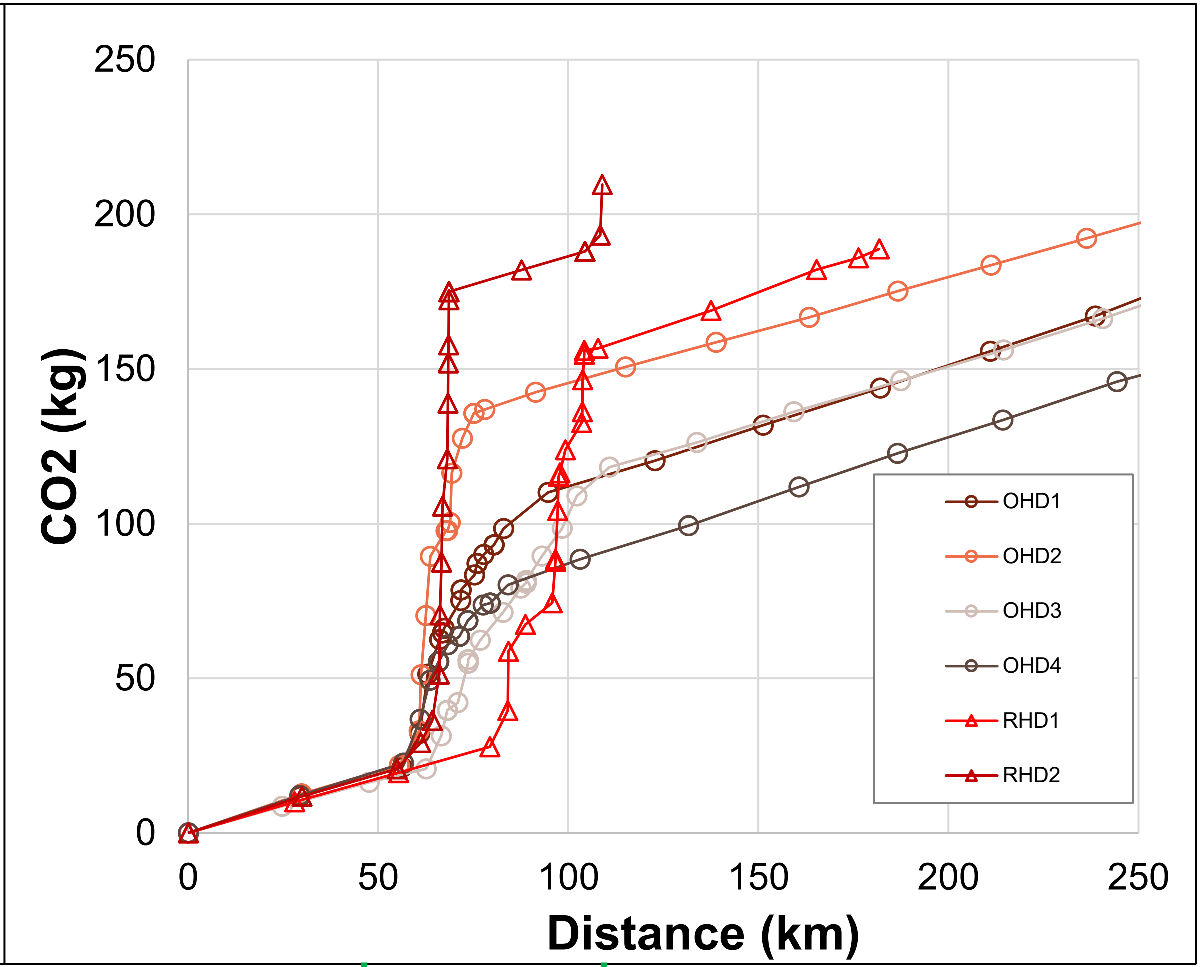
(OHD) Delivery Truck #1

Costs vs. Emissions

Transportation Cost



CO_2 Emissions



Hudson River Crossings

Freight And Service Trip Generation Software (FASTGS)

Freight And Service Trip Generation Software (FASTGS)

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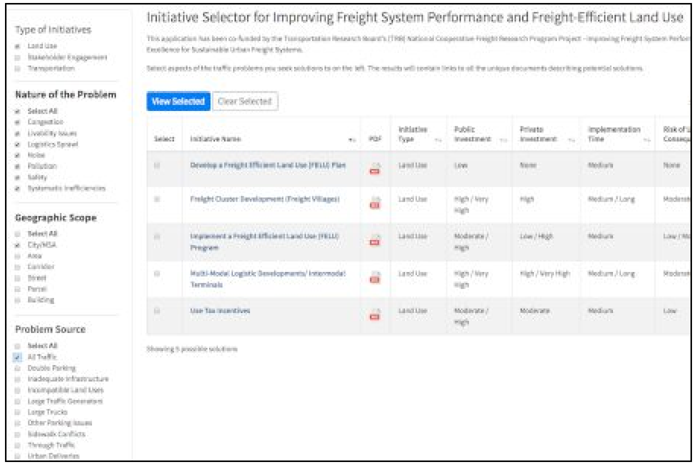
Software & Tools



Ways to improve freight system performance

The **Initiative Selector for Fostering Freight System Performance, Energy Efficiency, and Freight-Efficient Land Use** acts as an easy-to-use web-based tool to suggest potential initiatives for practitioners to fix urban freight problems.

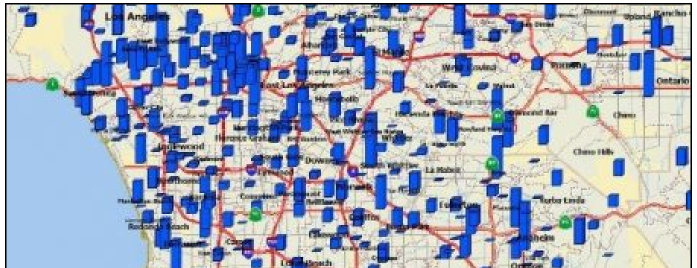
- Presents a decision-support system for solving issues related to urban deliveries
- Proposes several freight demand, parking, and infrastructure management recommendations, and vehicle-related strategies
- Provides solutions that foster energy efficiency and freight-efficient land use Summarizes advantages, disadvantages, and level of costs for various implementation levels and time frames

Estimating freight and service demand

The **Freight and Service Activity Trip Generation Software (FASTGS)** estimates the number of daily freight deliveries, freight shipments, and service trips attracted at the establishment or ZIP Code level.

This software helps to:

- Understand the amount of freight and service activity in a building or an area



Behavioral Micro-Simulation (BMS)

Behavioral Micro-Simulation (BMS) Runner Up of the Edelman Prize

❖ The **BMS** uses as input: initiatives, network, behavior models

Define EEL initiative to be studied

↓

Simulate freight activity and supply chain interactions

↓

Generate base case delivery tours by echelon of the supply chain

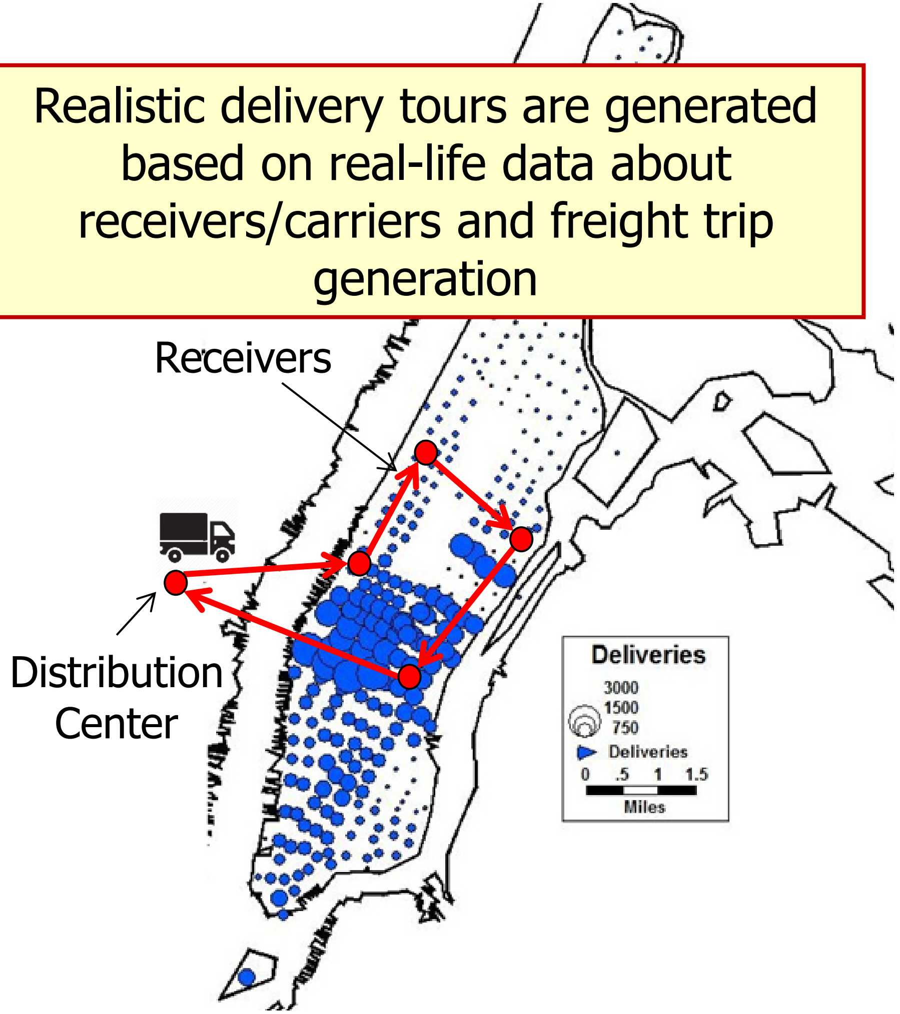
↓

Apply EEL initiative and generate tours

↓

Estimate system-level impacts associated with EEL initiative

Realistic delivery tours are generated based on real-life data about receivers/carriers and freight trip generation



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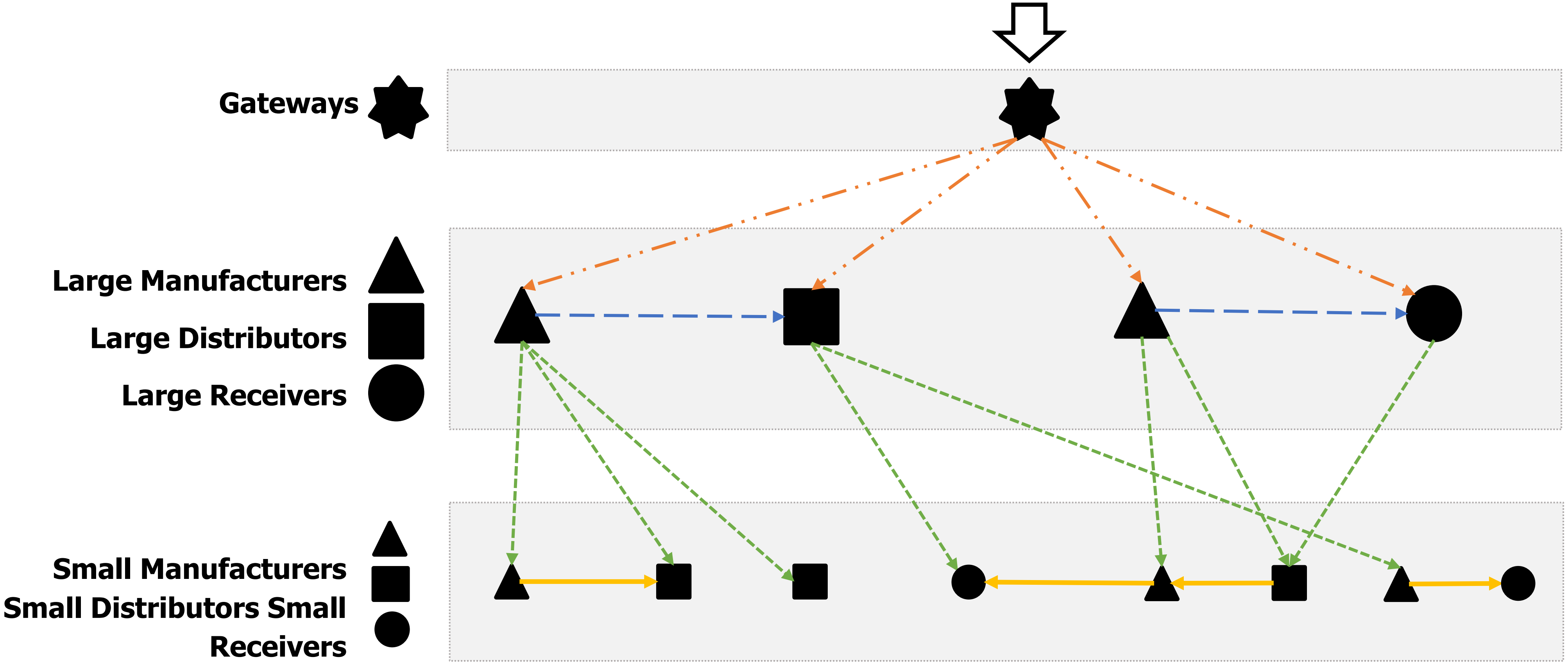
Behavioral Micro-Simulation (BMS) for Deliveries

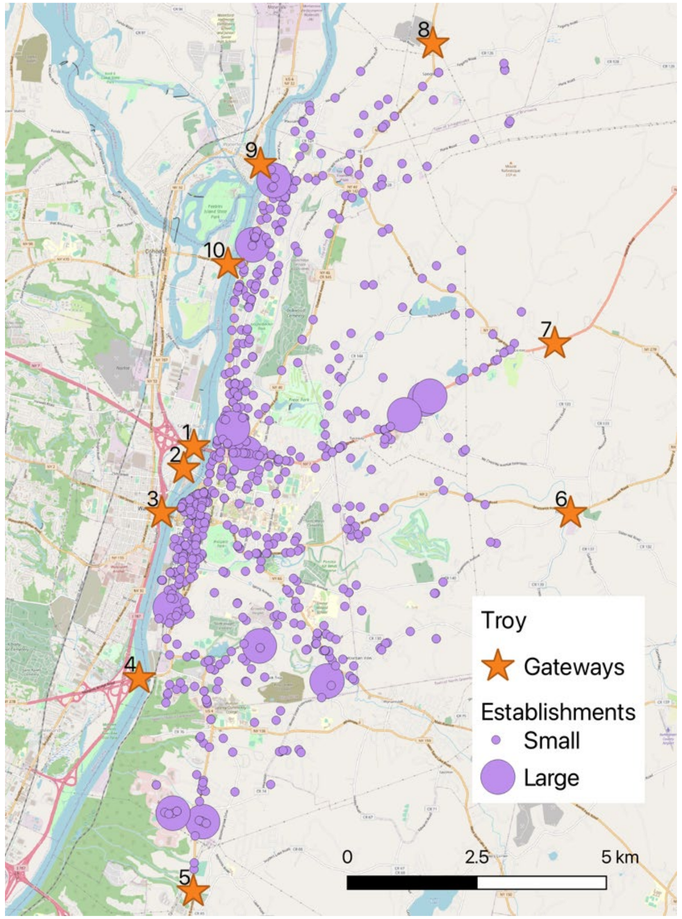
- Behavior along e-commerce logistics
  - Key links in the supply chain
    - Producer to Distributor
    - Distributor to Receiver
    - Producer to Receiver
- Approach: Simulate the tours required for delivering :
  - Supplies to/from commercial establishments (Business-to-Business) → **BMS-B2B**
  - Deliveries to households (Business-to-Consumers) → **BMS-B2C**
  - Estimate emissions, costs, VMT, etc. for the delivery tours

Behavioral Micro-Simulation: B2B

- The BMS-B2B simulates the flows at the various stages of supply chains to analyze effectiveness of different strategies

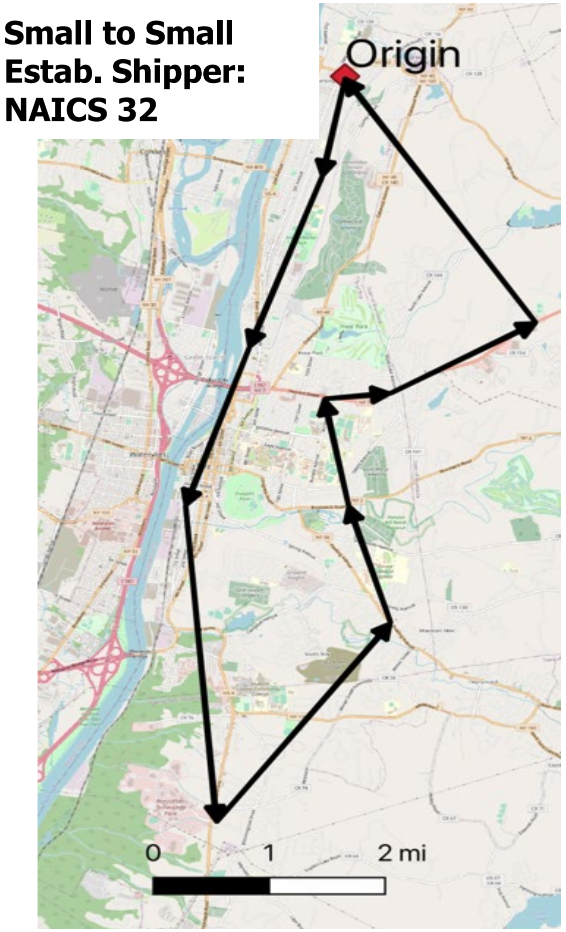


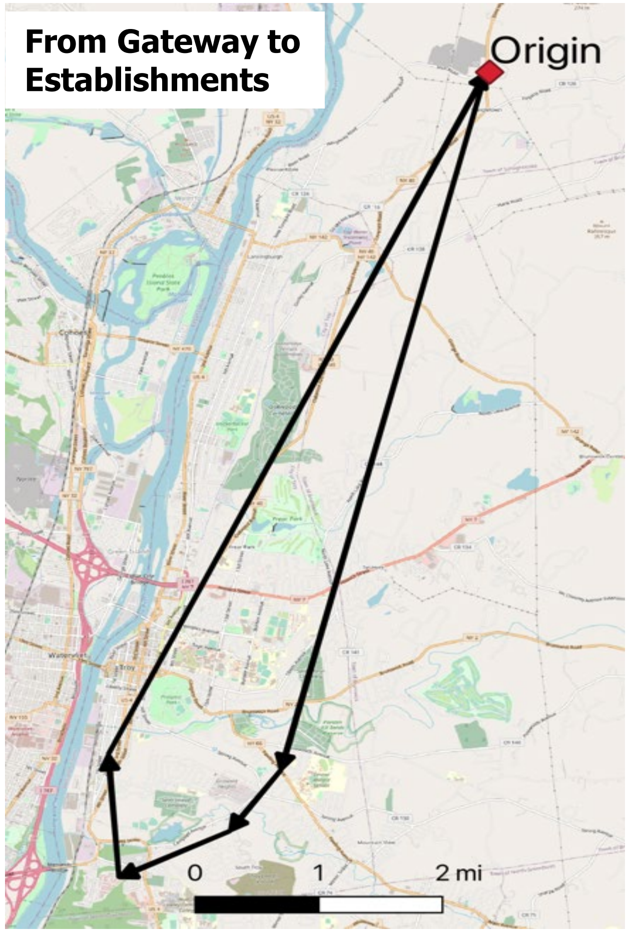
Modeling Delivery Tours in Troy



Establishments were grouped by street segment

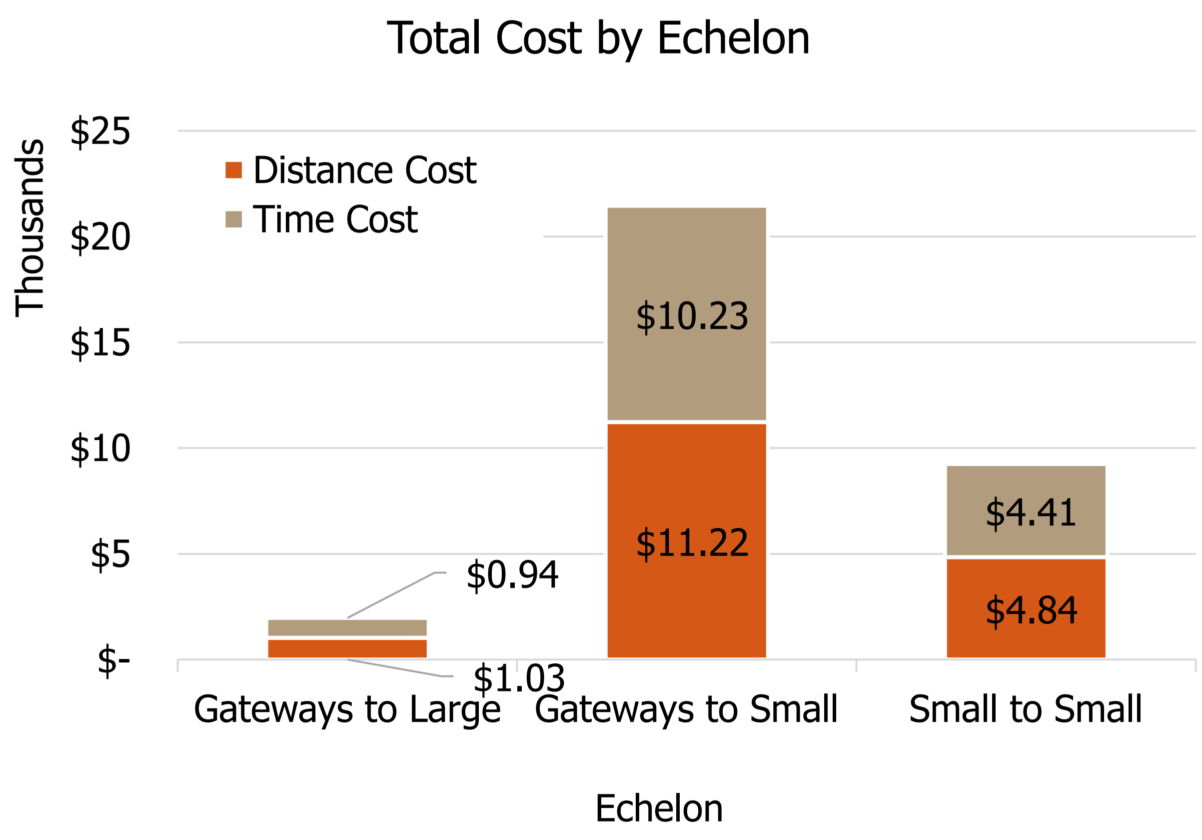
Examples of Tours



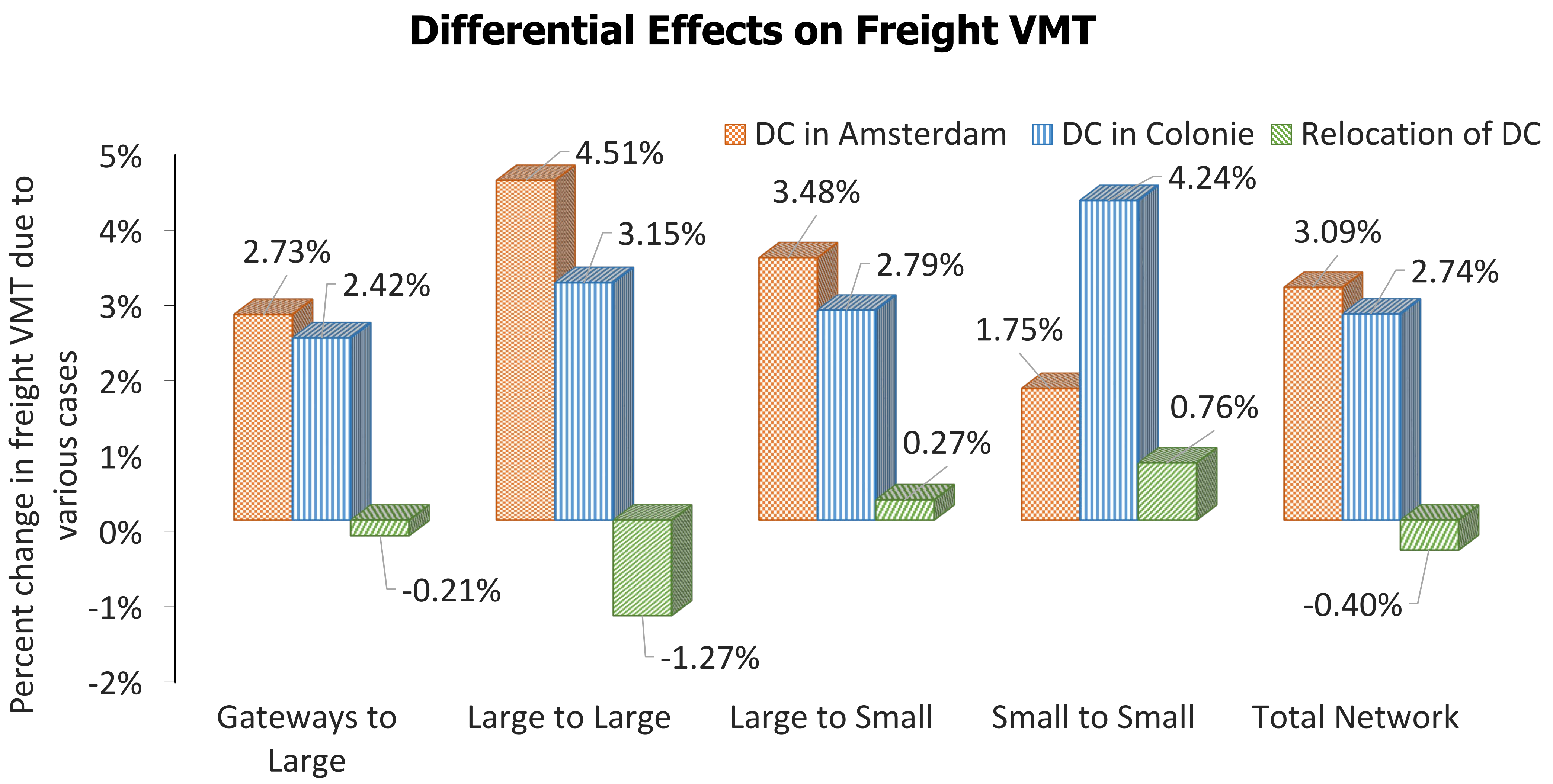


Overall Results of B2B Daily Deliveries in Troy

Echelon		Metric	Baseline
Gateways to Large	**All sectors**	Trips	112
		Tours	112
		VMTs	559
Gateways to Small	**All sectors**	Trips	2,078
		Tours	459
		VMTs	6,098
Small to Small	**All sectors**	Trips	1,385
		Tours	198
		VMTs	2,629
Total Number of Trips			**3,575**
Total Number of Tours			**769**
Total Number of VMTs			**9,286**

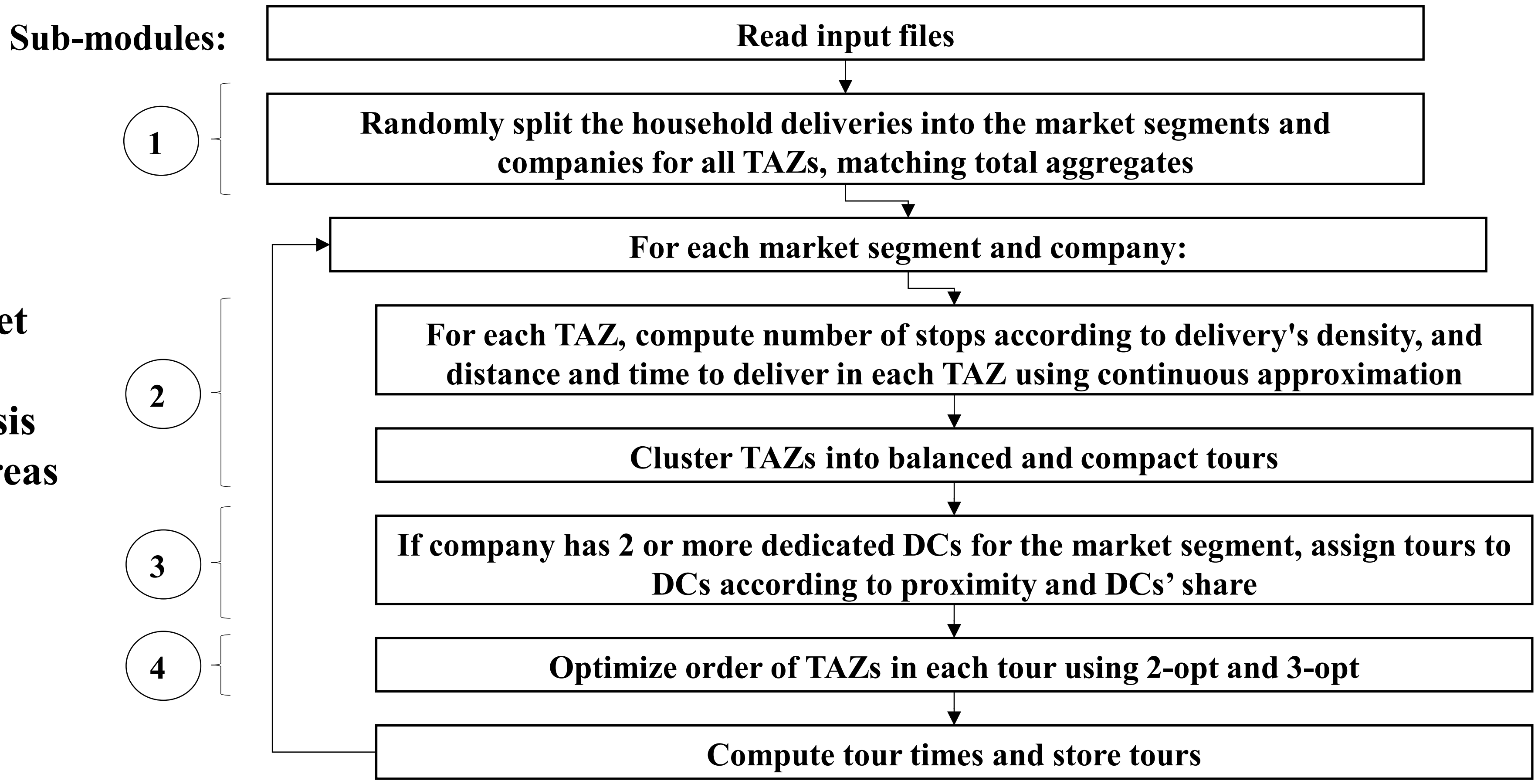


Development of Logistical Facilities

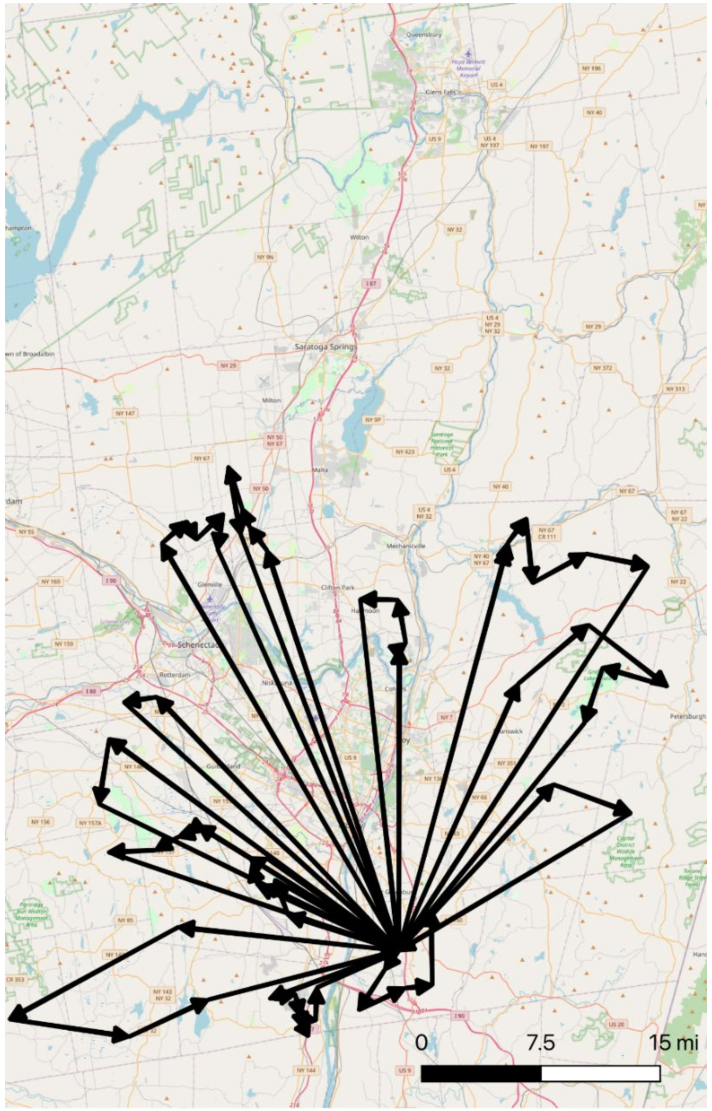


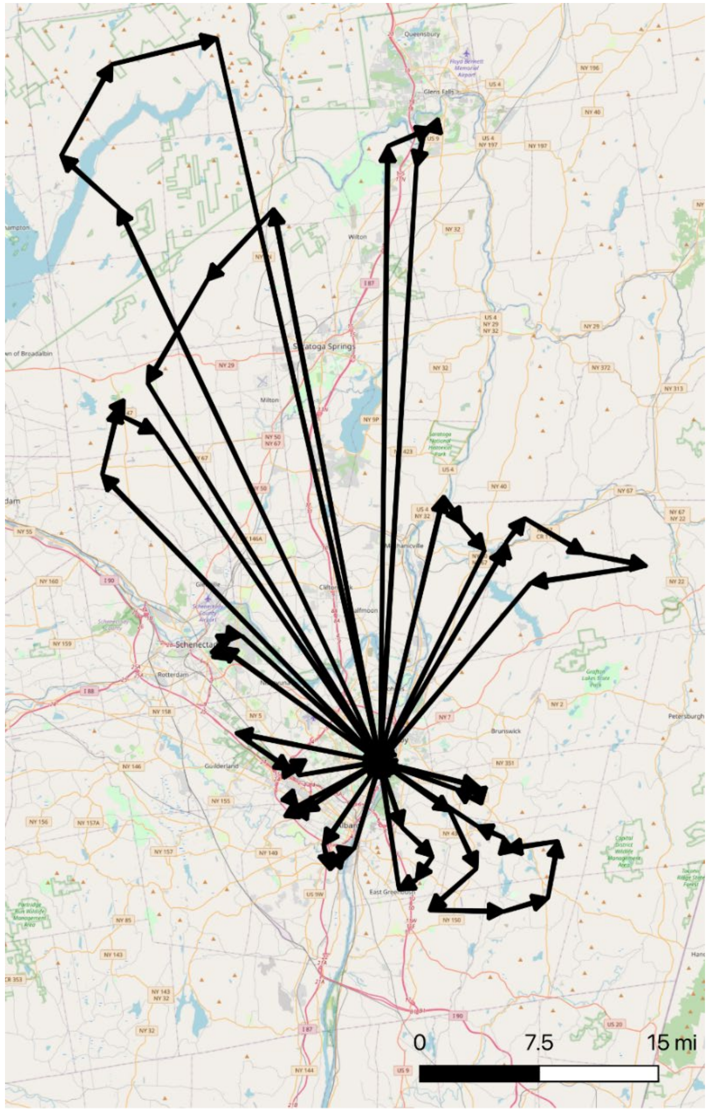
Behavioral Micro-Simulation: B2C Module

Key inputs:
- **Household deliveries estimates**
- **Distribution Centers (DCs): location, market shares etc.**
- **Transportation Analysis Zones (TAZs) data (areas and travel speeds)**



Examples of B2C Delivery Tours





Method: Assessing Patterns and Sensitivity of E-commerce Delivery Tours with Microsimulation

Description: Patterns of delivery tours, as well as their sensitivity to changes in parameters, could help evaluate the impacts of different policies on e-commerce delivery activities. Simulation models can be used to examine the various stages of freight tour generation, and to analyze the effects that different initiatives would have on delivery activity and externalities generated in a study area. These analyses can be conducted at various geographic scales, ranging from metropolitan areas to towns, and can be done at different levels of detail, depending on the data available. The type of freight tours simulated will depend on the tool being used, which could focus on business-to-business or business-to-consumer tours.

Data:

- Freight trip generation by TAZ (for households, and by freight industry sector for commercial establishments)
- Interconnections between industry sectors (e.g. using Use Tables built from the Commodity Flow Survey (CFS) from the US Census Bureau and the Input-Output (IO) account from the US Bureau of Economic Analysis)
- Statistical distribution of the number of delivery stops by industry sector
- Parcel carrier mark

Example: A Strategy of Household Delivery Consolidation in the

General Process:

	Base	**1x**	**2x**
Tours	5,285	4,587	4,722
Deliveries	1,178,004	1,026,473	1,025,590
Stops	877,388	785,640	784,123
Interzonal Cost	$681,409	$613,351	$616,058
Intrazonal Cost	$2,681,724	$2,409,092	$2,404,974
Total Cost	**$3,363,133**	**$3,022,442**	**$3,021,032**

policies that focus on reducing intrazonal costs, such as demand-side strategies, would have a greater impact on overall e-commerce delivery costs.

Web-based Interactive Guide

Once you specify the issue(s), you get suggestions…

Rensselaer **Please give it a try at: https://cite.rpi.edu/iselector/** SEARCH

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Type of Initiatives

- ☐ Energy
- ☑ Land Use
- ☐ Stakeholder Engagement
- ☐ Transportation

Nature of the Problem

- ☐ **Select All**
- ☐ Congestion
- ☐ Livability Issues
- ☑ Logistics Sprawl
- ☐ Noise
- ☐ Pollution
- ☐ Safety
- ☐ Systematic Inefficiencies

Geographic Scope

- ☐ **Select All**
- ☐ City/MSA
- ☐ Area

Initiative Selector for Fostering Freight System Performance, Energy Efficiency, and Freight-Efficient Land Use

This application has been co-funded by the Transportation Research Board's (TRB) National Cooperative Freight Research Program Project - Improving Freight System Performance in Metropolitan Areas and the VREF Center of Excellence for Sustainable Urban Freight Systems.

Select aspects of the traffic problems you seek solutions to on the left. The results will contain links to all the unique documents describing potential solutions.

View Selected | Clear Selected | Search within results

Select	Initiative Name	PDF	Initiative Type	Public Investment	Private Investment	Implementation Time	Risk of Unintended Consequences	Group
☐	Co-Location of Auxiliary Facilities Near Major Gateways	PDF	Land Use	Low / High	Low / High	Medium / Long	Low	Long-Term Planning
☐	Create Logistic-Focused Land Banking	PDF	Land Use	Low / High	None	Medium / Long	Low	Long-Term Planning
☐	Create Special Purpose Districts	PDF	Land Use	Low	Low / High	Short	Moderate	Zoning
☐	Densify Logistic Activities Towards the Urban		Land Use	Moderate / Very	High	Medium / Long	Low / Moderate	Long-Term

Part 4
Strategies and Initiatives

From Insight to Action: Strategic Approaches for Managing E-Commerce Traffic

On-street: New York, London, Paris
Off-street: a handful of cities…

All cities…

ITS: New York, London
Paris
Last mile: a handful of cities…

ON-STREET PARKING AND LOADING
- Freight Parking and Loading Zones
- Loading and Parking Restrictions
- Peak-Hour Clearways
- Vehicle Parking Reservation Systems

OFF-STREET PARKING AND LOADING
- Enhanced Building Codes
- Timeshare of Parking Space
- Upgrade Parking Areas and Loading Docks
- Improved Staging Areas
- Truck Stops/ Parking Outside of Metropolitan Areas

ACCESS AND VEHICLE-RELATED RESTRICTIONS
- Vehicle Size and Weight Restrictions
- Truck Routes
- Engine-Related Restrictions
- Low Emission Zones
- Load Factor Restrictions

TIME ACCESS RESTRICTIONS
- Daytime Delivery Restrictions
- Daytime Delivery Bans
- Nighttime Delivery Bans

TRAFFIC CONTROL AND LANE MANAGEMENT
- Restricted Multi-Use Lanes
- Exclusive Truck Lanes (Dedicated Truck Lanes)
- Traffic Control

CARGO CONSOLIDATION
- Urban Consolidation Centers

INTELLIGENT TRANSPORTATION SYSTEMS (ITS)
- Real-Time Information Systems
- Dynamic Routing
- Vertical Height Detection Systems

LAST MILE DELIVERY PRACTICES
- Time Slotting of Pick-Ups & Deliveries at Large Traffic Generators
- Driver Training Programs
- Anti-Idling Programs
- Pick-up/Delivery to Alternate Locations

MAJOR IMPROVEMENTS
- Ring Roads
- New and Upgraded Infrastructure, Intermodal Terminals
- Freight Cluster Development (Freight Village)

MINOR IMPROVEMENTS
- Acceleration / Deceleration Lanes
- Removal of Geometric Constraints at Intersections
- Ramps for Handcarts and Forklifts

TECHNOLOGIES AND PROGRAMS
- Emission Standards
- Low Noise Delivery Programs / Regulations

STAKEHOLDER ENGAGMENT
- Designate a 'Freight-Person' at Key Agencies
- Create a Freight Advisory Committee, (FAC)
- Educate Elected Officials
- Create a Technical Advisory Committee (TAC)
- Create a Freight Quality Partnership (FQP)

PRICING
- Road Pricing
- Parking Pricing

INCENTIVES
- Recognition Programs
- Certification Programs
- Operational Incentives for Electric / Low Emission Vehicles

TAXATION
- Taxation

DEMAND MANAGEMENT
- Voluntary Off-Hour Delivery Program
- Staggered Work Hours Program
- Receiver-Led Delivery Consolidation Program
- Mode Shift Programs

LAND USE POLICY
- Relocation of Large Traffic Generators (LTGs)
- Integrating Freight into Land Use Planning Process

Major: typically not possible
Minor: a handful of cities…

Some national governments

Some cities in US and Europe

Some cities in US and Europe

Demand: New York …
Land: Cities in US and Europe

Cargo Bikes and E-Bikes

- **Overview:** Low-emission, compact delivery vehicles ideal for dense urban areas.
- **Benefits:**
  - Reduce emissions and noise pollution
  - Improve curb and sidewalk access
  - Enhance safety for non-motorized users
- **MPO Strategies:**
  - Designate **cargo bike delivery zones** in high-demand districts
  - Provide **micro-mobility support infrastructure** (e.g., loading pads, secure bike lanes)
  - Support pilot programs with data collection to evaluate impacts

B-line in Portland, Oregon

MOVEBYBike in Gothenburg, Sweden

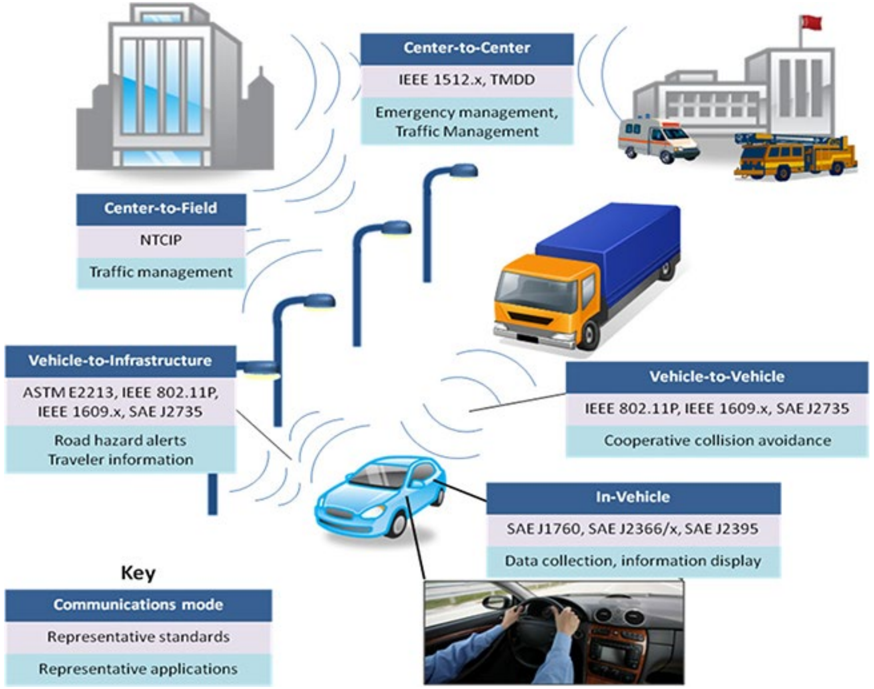
Parcel Lockers and Pickup Hubs

- **Overview:** Centralized locations where consumers retrieve deliveries.
- **Benefits:**
  - Reduce failed delivery attempts
  - Consolidate delivery trips
  - Support contactless and flexible access
- **MPO Strategies:**
  - Incentivize placement at **transit stations, civic buildings, or mixed-use developments**
  - Encourage integration into **zoning and building codes**
  - Partner with logistics providers to test **neighborhood-scale locker systems**

Curb Management Technologies

- **Overview:** Dynamic pricing and digital reservations for loading space.
- **Benefits:**
  - Optimize curb usage across times of day
  - Reduce illegal parking and double-parking
- **MPO Strategies:**
  - Deploy **smart sensors and digital curb platforms** (e.g., CurbIQ, Coord)
  - Coordinate with city DOTs to **standardize curb space policies**
  - Analyze curb usage patterns to inform delivery windows

Source: TfL, Kerbside Loading Guidance (2009)



Zero-Emission Delivery Zones (ZEDZ)

- **Overview:** Zones where only low/zero-emission delivery vehicles are allowed.
- **Benefits:**
  - Reduce greenhouse gas and pollutant emissions
  - Promote investment in electric and active freight modes
- **MPO Strategies:**
  - Identify high-traffic districts for ZEDZ designation
  - Coordinate with local air quality goals and transportation equity plans
  - Offer **grants or incentives** to support fleet transition

Consolidation and Micro-fulfillment Centers

- **Overview:** Small-scale facilities closer to demand centers for faster, batched deliveries.
- **Benefits:**
  - Reduce long-haul urban deliveries
  - Improve routing efficiency and reduce VMT
- **MPO Strategies:**
  - Review **land use and zoning regulations** to allow flexible siting
  - Assess freight impacts using tools like **UrbanSim Freight**
  - Collaborate with local governments to plan **logistics clusters**

Off-Peak and Nighttime Delivery Programs

- **Overview:** Incentives to shift deliveries outside peak traffic hours.
- **Benefits:**
  - Lower congestion and emissions during peak periods
  - Improve reliability for carriers
- **MPO Strategies:**
  - Create **off-peak incentives** (e.g., noise-compliant loading docks)
  - Collaborate with businesses to **opt into nighttime delivery programs**
  - Evaluate impact with **before-and-after traffic and emissions data**
- **Examples:**
  - PierPass Program, California
  - OHD, New York City

Dynamic Distribution Points (DDPs)

- **Overview:**
  - Dynamic distribution points are trucks or containers that serve as temporary, movable hubs for local distribution.
  - They enable localized consolidation and staging of deliveries closer to high-demand zones—without requiring permanent facilities.
- **Benefits:**
  - Increases flexibility and responsiveness to shifting delivery needs.
  - Reduces vehicle miles traveled (VMT) and trip duplication in dense areas.
  - Avoids the need for long-term zoning approvals or new construction.
  - Can be deployed for seasonal surges (e.g., holidays) or special events.
- **MPO Policy Strategies:**
  - Designate staging areas on underused land or during off-peak curb hours.
  - Create a permitting framework for mobile depot deployment.
  - Incorporate mobile hubs into urban freight plans as a low-cost alternative to micro-fulfillment centers.
  - Coordinate with event organizers and local businesses for shared-use scenarios.

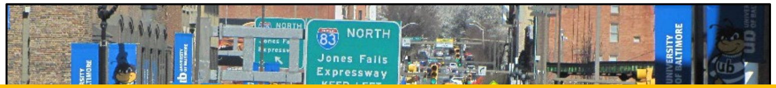
Simplified PUD Markets

	Commercial PUDs (C-PUDs)	Households PUDs (H-PUDs)
Regular	Stable and slighly growing	Fast growing
	Regular and fairly predictable	Irregular, increasingly predictable
	Thousands of suppliers / carriers	Handful of number of carriers
	Specialty suppliers / carriers abound	Parcel carriers dominate
	Large number of PUD / establishment-day	Low number of PUD / household-day
	Relatively large shipment sizes	Relatively small shipment sizes
Express	Relatively small portion of total PUDs	Rapidly growing due to "free deliveries"
	Irregular, hard to predict	Increasingly predictable

Optimal Policy:

- To exploit to the fullest regular mail routes (if permitted by delivery constraints)
- To develop parcel-only (flexible) routes, regular and express, if volumes justify
- For “low volumes” and “unpredictable” express PUDs → DDPs

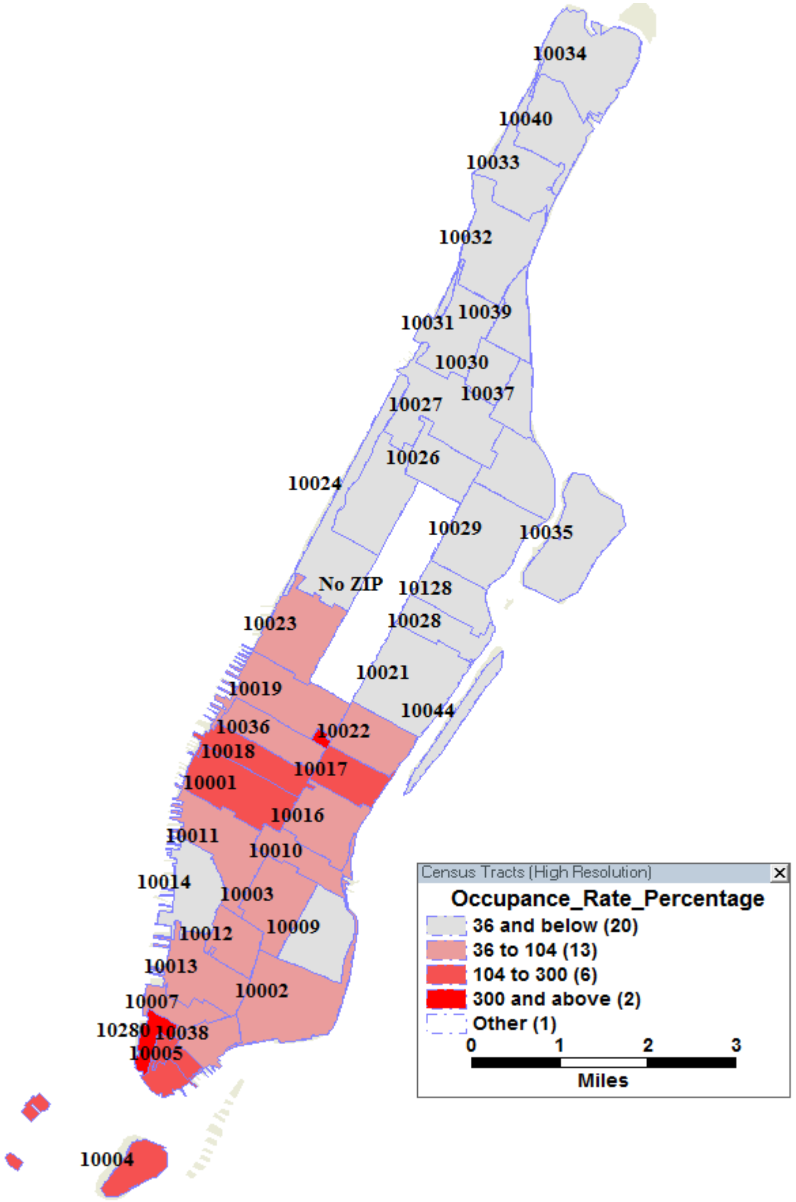
Parking/Congestion Issues: Genesis of Dynamic Distribution Points



Informal DDP in Midtown Manhattan

Parking Demand in Manhattan

- At the ZIP code level:
  - Parking demand at 25% of ZIP codes is larger than the linear capacity of the streets
  - Moving the truck is very expensive and problematic
  - Same situation in all mid-size and large cities



DDPs and NYSERDA Eco-Transfer Project

- Objective: To produce a conceptual design for a system of "Eco-Transfer" Stations where trucks could transfer deliveries to e-bikes, to:
  - Reduce the vehmiles traveled by trucks in congestion
  - Provide a physical market place where trucks could transfer deliveries to e-bikes
  - Foster use of environmentally friendly e-bikes
- NYCDOT is considering this program as part of its freight sustainability plan; parcel carriers support it
- The DDP idea is related to the Eco-Transfer Project

Basic Concept

- Dynamic Distribution Points (DDPs) are small areas that act as informal micro-hubs, where parcels can be transferred to Last-Leg Deliveries (LLD) modes
- The DDPs are flexible → can change the LLDs, or the locations of DDPs to be used in a given time-period
- Two modalities of transfer Truck-LLD:

Synchronous: The truck transfer directly to LLDs

Asynchronous: The LLDs get the PUDs from a container/small trailer

Acknowledgements

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VREF CENTER OF EXCELLENCE FOR SUSTAINABLE URBAN FREIGHT SYSTEMS

CoE-SUFS

Center of Excellence for Sustainable Urban Freight Systems

TRB

Transportation Research Board

TRB National Cooperative Highway Research Program

U.S. DEPARTMENT of ENERGY

United States Department of Energy

National Science Foundation

National Science Foundation

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Discussion

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Understanding and Managing E-commerce’s Impact on Urban Traffic: Insights and Strategies for MPOs

NYSAMPO 2025 Planning Conference
Syracuse, NY
Wednesday, May 14, 2025

Cara Wang
Professor
Civil and Environmental Engineering
Rensselaer Polytechnic Institute
wangx18@rpi.edu

José Holguín-Veras
William H. Hart Professor
Director of the VREF CoE for Sustainable Urban Freight Systems
Rensselaer Polytechnic Institute
jhv@rpi.edu