E-COMMERCE
AND
TRANSPORTATION INFRASTRUCTURE
IN THE
NEW YORK CITY REGION:
KEY FINDINGS FROM METROFREIGHT RESEARCH

Alison Conway
Associate Professor of Civil Engineering
The City College of New York

NYMTC PFAC Meeting, November 21, 2019
Mission:

to develop solutions for urban freight problems that are collaborative and integrative with larger sustainability goals

Dr. Jean-Paul Rodrigue, Department of Global Studies and Geography

Dr. Alison Conway and Dr. Camille Kamga, Department of Civil Engineering

The City College of New York

Dr. Jean-Paul Rodrigue, Department of Global Studies and Geography

Dr. Alison Conway and Dr. Camille Kamga, Department of Civil Engineering

The City College of New York
HOW DO WE MEASURE E-COMMERCE?

Traditional Retail

Establishment Survey

Household Survey
HOW DO WE MEASURE E-COMMERCE?
HOW DO WE MEASURE E-COMMERCE?

- Number of Packages
- Parking Demand
- VMT

Traffic Congestion, Emissions, and Safety Impacts
E-COMMERCE
BIG QUESTIONS

• How is e-commerce changing the organization of supply chains and warehousing?

• How is e-commerce changing the organization of local delivery activities?

• What tradeoffs are being made between passenger and freight activities?

• How are these changes impacting travel demand, parking demand, traffic congestion, and related externalities?
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<thead>
<tr>
<th>Supply Chain</th>
<th>Local Activity</th>
<th>Trade-Offs</th>
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<tbody>
<tr>
<td>The Distribution Networks of E-commerce: Emergence of a Geography of City Logistics&lt;br&gt;&lt;em&gt;Rodrigue&lt;/em&gt;</td>
<td>Home-Based Delivery Supply Chains: The Digitalization Paradigm&lt;br&gt;&lt;em&gt;Rodrigue&lt;/em&gt; Characterizing Residential Freight Activity in NYC&lt;br&gt;&lt;em&gt;Conway and Kamga&lt;/em&gt; Parking for Residential Freight in NYC&lt;br&gt;&lt;em&gt;Conway and Kamga&lt;/em&gt;</td>
<td>Delivery Behavior of New York City Residents&lt;br&gt;&lt;em&gt;Conway&lt;/em&gt;</td>
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<td>OUR DATA SOURCES</td>
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| - Inventory of all the Amazon facilities in the United States (excluding Pantry Fresh and Whole Foods) | - Fort Lee  
  - Delivery records: 300 unit building  
  - Parcel deliveries per day by carrier (excludes direct deliveries)  
  - 5 years of observations (2 partial)  
  - NYC  
  - Field Observations: 8 buildings/4 boroughs  
  - Arrival and departure time, carrier & shipper (if observable), vehicle type, parking location, shipment size & package type  
  - USPS Package Delivery Rates  
  - US Census Demographics  
  - NYCDOT STATUS Database for Parking Analysis | - NYCDOT Citywide Mobility Survey  
  - Trip Diary  
  - Stated frequency of deliveries  
  - Grocery  
  - Prepared Food  
  - Personal Items  
  - Other Packages  
  - NYCDCP MapPluto  
  - NYS Grocery Store Licenses  
  - NYCDOH Restaurant Ratings |
HOW IS E-COMMERCE CHANGING THE ORGANIZATION OF SUPPLY CHAINS AND WAREHOUSING
AMAZON E-COMMERCE FACILITIES, 2019

441 Facilities
Total Footprint: 168,992,400 sq ft

Facility size
- Less than 150,000 sq. ft
- 150,000 to 300,000 sq. ft
- 300,000 to 600,000 sq. ft
- 600,000 to 900,000 sq. ft
- More than 900,000 sq. ft

Average Size | Facility
--- | ---
591,400 sq. ft | Inbound cross-dock (N=10)
762,900 sq. ft | Fulfillment center (N=180)
330,600 sq. ft | Sortation center (N=46)
93,700 sq. ft | Delivery station (N=130)
43,100 sq. ft | Prime hub (N=52)
148,600 sq. ft | Air hub (N=4)
ANNUAL FOOTPRINT ADDED IN AMAZON DISTRIBUTION FACILITIES

1. Niche e-commerce
2. Diversification into an e-commerce platform
3. Horizontal integration
4. Vertical integration of e-commerce

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HOW IS E-COMMERCE CHANGING THE ORGANIZATION OF LOCAL DELIVERY ACTIVITIES?
FORT LEE
MONTHLY DELIVERY FREQUENCY OF PARCELS, 2016-2018

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NEW YORK CITY
DELIVERY FREQUENCIES

- 295 total deliveries recorded
  - 148 “other” deliveries
  - 147 meal deliveries (excluded from analysis)
- 1240 packages recorded

- Daily Vehicle Trips (12-hours)
  - Max $\rightarrow$ 7 units = 1 trip
  - Min $\rightarrow$ 21 units = 1 trip

- Package Deliveries
  - Max $\rightarrow$ 1.3 units = 1 package
  - Min $\rightarrow$ 6 units = 1 package

- Inconsistency in temporal patterns across buildings
PARKING

- Parking Duration (min) Percent of Observations
  - Single Deliveries: 13.76
  - Microdistribution: 39.45
  - Double Parked: 13.76
  - No Parking/No Standing: 12.84
  - Fire Hydrant: 19.27
  - Driveway: 0.92

- Legal Curbside Parking: 39.45

- Graph showing distribution of parking duration with a peak at 10 minutes.

- Pie chart showing the distribution of parking reasons.
<table>
<thead>
<tr>
<th>Vehicle Type</th>
<th>Count</th>
<th>Parcels</th>
<th>Total Parking Duration (min)</th>
<th>Est. Vehicle Length (ft)</th>
<th>Total Time-Space Consumption (ft*hour)</th>
<th>Time-Space Consumption per Parcel (ft*hour/parcel)</th>
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<tbody>
<tr>
<td>PC</td>
<td>10</td>
<td>27</td>
<td>51</td>
<td>19.00</td>
<td>16.15</td>
<td>0.60</td>
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<td>CV</td>
<td>24</td>
<td>54</td>
<td>115</td>
<td>18.68</td>
<td>35.80</td>
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<td>SV</td>
<td>48</td>
<td>627</td>
<td>791</td>
<td>22.60</td>
<td>297.94</td>
<td>0.48</td>
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<tr>
<td>SU</td>
<td>12</td>
<td>151</td>
<td>265</td>
<td>30.00</td>
<td>132.50</td>
<td>0.88</td>
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<tr>
<td>ST</td>
<td>2</td>
<td>5</td>
<td>44</td>
<td>45.50</td>
<td>33.37</td>
<td>6.67</td>
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<tr>
<td>Sum</td>
<td>96</td>
<td>864</td>
<td>1266</td>
<td></td>
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PARKING SUPPLY-DEMAND MISMATCH
EXPECTED FUTURE CONDITIONS (2022)
WHAT TRADEOFFS ARE BEING MADE BETWEEN PASSENGER AND FREIGHT ACTIVITIES?
GROCERY ACTIVITY BY AGE

- Manhattan Core
- Northern Manhattan
- Outer Queens
- Southern Bronx
- Northern Bronx
- Staten Island

Respondents | Trip Makers | Frequent Receivers
Grocery Density

Retail Density

SHOPPING ACCESS
SUMMARY OF FINDINGS

Key Findings So Far
- Supply chains
  - Growth in number of logistics facilities
  - Diversification in function and size
- Local Activity
  - Shift in carrier roles over last 5 years
  - Shift to smaller (less efficient) vehicles in dense areas
  - Stable monthly and weekly distributions
  - Delivery frequencies vary by building
  - Time of day distributions vary by building
- Parking
  - Durations vary with off-vehicle operations
  - Shift in temporal and spatial distribution

Ongoing Research
- Continuing to monitor delivery trends over time
- Investigating relationship between:
  - Stated Delivery Frequencies by Type
  - Demographics
  - Built Environment Factors

Future Research Needs
- Vehicle fleets and load factors
- Improved understanding of trip replacement/supplement behavior
  - Detailed trip diary information, including deliveries
- Improved visibility of supply chain activity
  - Origins and Destinations
  - Routes
  - Time-of-day
- Impacts of carrier/labor shifts on performance
QUESTIONS?

Alison Conway
aconway@ccny.cuny.edu

Jean-Paul Rodrigue
Jean-paul.Rodrigue@Hofstra.edu