Urban Freight: Transitions and Opportunities

Anne Goodchild
Professor, Department of Civil & Environmental Engineering
Director, Supply Chain Transportation & Logistics Center
University of Washington
Western Seattle Neighborhoods

West Seattle
- Alki
- Delridge
- Fairmount Park
- Fauntleroy
- Gatewood
- Genesee
- Industrial District
- North Admiral
- Seaview
- South Park

East of Duwamish
- Georgetown
- Harbor Island

Port terminals
- T-5
- T-18
- T-30
- T-46
- T-115
Mix of Residential, Industrial, and Manufacturing Land Uses

- Main land-use type in the WS peninsula is residential (86.17% residential buildings).
- Highest industrial / manufacturing land use:
  - Industrial District (77.33%)
  - Georgetown (82.54%)
  - South Park (69.71%)
  - Harbor Island (100%)
Population Distribution

• Delridge has the highest population (34,131 residents).
• The neighborhoods with the lowest population are:
  • Industrial District (2,351 residents)
  • Georgetown (1,306 residents)
  • South Park (4,996 residents)
  • Harbor Island (0 residents)
Land Use

Commercial

Commercial Trip Generation model previously estimated by Holguin-Veras et al. (1)

<table>
<thead>
<tr>
<th>Land Use</th>
<th>Trip rate (daily trips/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial/manufacturing</td>
<td>3.61</td>
</tr>
<tr>
<td>Retail/commercial</td>
<td>14.25</td>
</tr>
<tr>
<td>Public building</td>
<td>0.4</td>
</tr>
</tbody>
</table>

Industrial

2015 Container Terminal Access Study (2)
Daily truck trips at port terminals

Port

PSRC Household Travel Survey (3)
# of deliveries received

<table>
<thead>
<tr>
<th>Residence type</th>
<th>Trip rate (daily trips/unit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-unit</td>
<td>0.48</td>
</tr>
<tr>
<td>Multi-unit</td>
<td>0.38</td>
</tr>
</tbody>
</table>
Total deliveries by neighborhood

Tot. deliveries/acre of building area
Total Freight Trip Generation by Land Use Type

Study area (tot: 27,696 del./day)
- Residential: 70.4%
- Commercial: 4.1%
- Industrial: 25.3%

West Seattle peninsula (tot: 20,505 del./day)
- Residential: 93.6%
- Industrial: 3.4%
Our Vision

The Urban Freight Lab is an innovative partnership bringing together private industry, academic researchers, and public transportation agencies to solve urban freight management problems bringing benefits to customers, carriers, and community.
How We Work

• Engage with private sector executives and operations staff
• Engage with public sector planning and engineering
• Financial commitment from private sector
• Problems are jointly defined
• Academic analyses and ground-truthed tests
• Ideas and evaluations, analyses, and tests
The UFL is comprised of:

<table>
<thead>
<tr>
<th>Service/Product</th>
<th>UFL Members</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carriers and Shippers</td>
<td>Amazon, Cornucopia, PepsiCo, UPS</td>
</tr>
<tr>
<td>Retailers</td>
<td>Amazon</td>
</tr>
<tr>
<td>Infrastructure and operations technology providers</td>
<td>REEF, Grid Smarter Cities, Automotus, Lacuna</td>
</tr>
<tr>
<td>Real estate</td>
<td>Terreno</td>
</tr>
<tr>
<td>Vehicle and vehicle components manufacturers</td>
<td>Ford, GM, Coaster Cycles, Michelin, URB-E</td>
</tr>
</tbody>
</table>

It is necessary to engage these stakeholders as their decisions all influence urban freight operations and outcomes. By engaging each of these sectors, we are able to understand and solve urban freight challenges efficiently and holistically.
Areas of Research

1. Urban Goods Delivery
2. Sustainable Urban Freight
3. Curbspace Management
4. Zero Emissions Freight
Collaborations

We engage with numerous public, private, and nonprofit entities and individuals on a regular basis—more than we could possibly list here.

A few examples of our active research collaborators and partners (excluding academic colleagues):

- U.S. Department of Energy and national laboratories
- Sensors and parking management solutions providers
- City, regional, and state governments
- Global nonprofit research organizations
- Transportation/mobility consultancy firms
Thought Leadership in Urban Freight

Originated the “Final Fifty Feet” – it started here
› Coined the term “Final Fifty Feet”
› Demonstrated this is a costly and understudied area with time studies
› Inspired follow-on research and exploration

Defined and quantified benchmarks
› Commercial vehicle parking cruising, vehicle queueing and re-routing
› Commercial and service vehicle categories and counts in categories

Defined the Urban Freight load/unload network and estimated capacity
› Curbspace, off-street, and alleyways

Changed the phrase “illegal parking” to “insufficiency of alternatives”
Thought Leadership in Urban Freight

- Defined the unique characteristics of urban freight as separate from heavy freight
- Raised the profile of urban freight at the international, national, and regional level
- Framed freight transportation as interconnected with passenger travel
- Demonstrated that a long lasting collaboration between academia, private and public sectors is possible, and results in mutual benefit and accelerates testing and adoption of solutions
- Brought rigorous experimental design to the evaluation of empirical urban freight solutions
Quantifying Urban Freight

- First to quantify parking cruising for commercial vehicles
  - On average a commercial vehicle spent 2.3 minutes cruising per trip. This corresponds to a 28% of the total trip time on average. A parcel delivery vehicle spends on average 1.1 hours a day cruising.

- First to quantify required space around commercial vehicles required for safe operations
  - 3 feet at front and sides of vehicle
  - 3 feet beyond extension of ramp or lift-gate at rear of vehicle
Quantifying Urban Freight (Cont’d)

• Bring fleet data to inform policy makers:
  • In Seattle, the vast majority of commercial vehicles are relatively small:
    • 54% are commercial pick-ups and work-vans
    • Additional 30% are single-unit 2-axle vehicles
  • Services account for 30% of all commercial vehicle traffic

• Measuring parking capacity:
  • There is about as much capacity in off-street loading bays and loading docks as there is at the curb in Greater Downtown Seattle
Measuring Urban Freight Solutions

- Carried out the first pilot of a common locker, and the only studies of common carrier lockers and their impact on regional transportation.
  - 50% drop in average time spent in the building
  - 33% drop in delivery vehicles' dwell time at the curb

- Quantify the benefits of cargo bike deliveries replacing truck deliveries
  - E-bikes halved VMT per package compared to trucks
  - E-bikes reduced tailpipe emissions by 30% compared to trucks
  - E-bikes maintained time spent per package
  - 10 trucks could be replaced by seven e-bikes
Final Fifty Feet Toolkit: Built from tools developed for our own research and packaged for easy use by others, these tools help you understand and solve urban freight challenges in your area.

Research Reports: All our research projects result in publicly available reports on our website. We want our work to be useful.

Big Ideas: Our proximity to both public and private sectors allows us to see boundary breaking solutions. Our technical expertise gives us the tools to figure out how they can work.

Pilot Tests: We are committed to implementing practical tests and trials of new solutions. We believe this is an essential component of research in applied engineering.
As one of the nation's first zero-emissions last-mile delivery pilots, the Seattle Neighborhood Delivery Hub served as a testbed for innovative sustainable urban logistics strategies on the ground in Seattle's dense Uptown neighborhood.
Background/Motivation

- UFL Members voted in early 2020 and collaboratively chose the microhub as next pilot project
- Opportunity to test and evaluate urban logistics strategies on the ground in Seattle’s Uptown neighborhood
- Identify the benefits and costs of hubs in urban delivery systems:
  - Does the hub reduce CO2 emissions per package?
  - Does the hub reduce the number of truck miles required for delivery?
  - Is the hub’s shared cost model cost effective?
- Guide the future development of similar sustainable city logistics solutions around the world
Partners and Products

• Common Carrier Parcel Lockers: UFL
  ✓ Available for neighborhood residents and commuters

• Ghost Kitchen and MicroHub infrastructure: REEF
  ✓ On-site food preparation and delivery staging

• Last Mile Deliveries: AxleHire
  ✓ Provides last mile services using Microhub as a transshipment point

• Electric-Assist Cargo Bike Fleet: Coaster Cycles
  ✓ Customized electric-assist cargo bikes to carry electric pallets

• Electric Pallet (EP1): Bright Drop (GM)
  ✓ Provides a propulsion-assisted electric pallet for moving goods from a delivery vehicle to a customer's door.

• MUST Sensors: UW STAR Lab
  ✓ Comprehensive edge-computing based sensing and communication device for data collection

• Data Sharing: SDOT
  ✓ 30% zero emission delivery by 2030
Site Selection Process & Criteria

- Surveyed partners on requirements and preferences for participation
- Identified top requirements:
  - Height Clearance
  - Infrastructure: electricity, WiFi, security, signage
- Identified top preferences:
  - Customer access
  - Proximity to transit, located in mixed use neighborhood
- Utilized information from surveys to conduct site analysis from existing REEF Seattle real estate portfolio
Microhub Site

Location: 130 5th Avenue North, Seattle, WA
Neighborhood: Uptown
Surrounding Area: Residential/Tourist
Lot Type: Surface Lot
Number of Stalls: 30
Additional Benefits:
  - REEF Ghost Kitchen live on site
  - Access to Queen Anne/Seattle Center/Uptown area
  - Access to 99 Ramp (North & South)
Project Timeline

**Summer 2020**
Project partners established & site selected

**Early 2020**
UFL members identify project

**March 2021**
UFL locker started operation

**April 5, 2021**
E-bike deliveries started

**May 26, 2021**
Microhub Launch

**July 23, 2021**
Closing date
Objective of Analysis

- Objectives set by microhub project team
- Assess the performance of delivery microhubs and cycle logistics when compared with truck deliveries in terms of:
  1. VMT per package,
  2. Tailpipe CO$_2$ emissions,
  3. Time spent per package.
Empirical Results from the Pilot Test

50% E-bike solution produces half the ICE vehicle miles travelled per package
Empirical Results from the Pilot Test (cont’d)

*If e-bikes were operating 8 hours a day (completing 4 routes)

1 bike mile = 1.4 truck miles
Empirical Results from the Pilot Test (cont’d)

30%

Reduction in tailpipe emissions per package using E-bike solution.
Empirical Results from the Pilot Test (cont’d)

0

Increase in time per package

* excludes the trip duration to and from the microhub
Summary

• There has been a tectonic shift in how freight moves in our cities and neighborhoods
• Cities, transportation agencies, and planners are unprepared to manage this change
• The Supply Chain Transportation and Logistics Center’s Urban Freight Lab is a Washington State innovation that has
  • Engaged private sector and community groups
  • Produced results to get us ahead of this change
  • Supports more sustainable communities and a more vibrant freight system
Policy Recommendations

• The legislature should provide annual funding on the order of $250K to:
  • Support cities and regions as they manage and mitigate urban freight impacts
  • Align approaches with business interests and growth
  • Support locations outside of densest urban areas
  • Engage communities and to improve equity and access
Questions?

Anne Goodchild
annegood@uw.edu
http://depts.washington.edu/sctlctr/
@SCTLatUW
@SCTLCenter
linkedin.com/school/uwsupplychain