Delivering Last Mile Solutions: A feasibility study on microhubs and cyclelogistics in the GTHA

Carolyn Kim and Janelle Lee
Transportation and Urban Solutions, Pembina Institute
July 30, 2019
The Pembina Institute

The Pembina Institute is a non-profit think-tank that advocates for strong, effective policies to support Canada's clean-energy transition.
Our freight program

Support the freight industry and governments in achieving a deep decarbonization of freight while remaining profitable and building better communities.
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Presentation Outline

- Urban freight challenges
- Research objectives and approach
- Key findings
- Recommendations for action
Today's presentation

Delivering Last-Mile Solutions
A feasibility analysis of microhubs and cyclelogistics in the GTHA

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June 2019

https://www.pembina.org/pub/delivering-last-mile-solutions
Urban freight challenges

- E-commerce, changing consumer preferences
- Increased congestion, curbside conflicts
- High cost of last-mile distribution
Transportation Emissions

GHG Emissions in Canada by Economic Sector (2017)
Source: Pembina Institute analysis of data from 2019 NIR

Change in annual passenger and freight GHG emissions in Canada
Source: Pembina Institute analysis of data from Environment and Climate Change Canada
New opportunities to improve last mile deliveries and save money

- Micro-consolidation
- Low- and zero-emission delivery vehicles
Photo: Janelle Lee. Pembina Institute.
Research Objectives

- Examine feasibility of microhubs and cyclelogistics
- Identify conditions under which these solutions can be viable and implemented at scale
- Recommend actions to support implementation of low-carbon alternative delivery systems
Research Approach

**Business as usual**
- Suburban consolidation
- +
- package car

**Alternative**
- Micro-consolidation
- +
  - electric cargo van
  - large e-assist cargo bike
  - small e-assist cargo bike
Part 1: Determine candidate microhub locations

- Locations are based on the following criteria:
  - Household and employment density
  - Zoning (permitted uses)
  - Road network (not on residential-only streets or highways)
Hamilton
Toronto
Part 2: Compare different delivery scenarios for microhub locations

<table>
<thead>
<tr>
<th></th>
<th>Business as usual (package car)</th>
<th>Microhubs with electric van</th>
<th>Microhubs with large cargo bike</th>
<th>Microhubs with small cargo bike</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Higher volume</strong></td>
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<td>(downtown cargo volumes)</td>
<td>Off-peak</td>
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<td>Normal congestion</td>
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<td>Higher congestion</td>
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<td><strong>Lower volume</strong></td>
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<tr>
<td>(suburban cargo volumes)</td>
<td>Off-peak</td>
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<td>Higher congestion</td>
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</table>
• For each delivery scenario, determine:
  o VKT
  o Travel time
  o Optimal fleet size

• Use these outputs to calculate (for each delivery scenario):
  o Operational costs (labour, fuel consumption, and fleet maintenance)
  o Emissions
Microhubs and cargo bikes are viable and practical

• Efficient operations
• High asset utilization
• Cost effective
• Lower freight emissions
Key Findings

Compared to business-as-usual operations, microhubs and cargo cycles have the potential to be more efficient.

Total operational time under high congestion, high demand conditions
Key Findings

Compared to business-as-usual operations, microhubs and cargo cycles have the potential to have higher asset utilization.

<table>
<thead>
<tr>
<th>Higher delivery demand</th>
<th>Number of trips*</th>
<th>Optimal fleet size*</th>
<th>Routes per vehicle*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small e-assist cargo cycle</td>
<td>28</td>
<td>6</td>
<td>4 to 5</td>
</tr>
<tr>
<td>Large e-assist cargo cycle</td>
<td>6</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Small electric van</td>
<td>5</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Package car</td>
<td>6</td>
<td>6</td>
<td>1</td>
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</tbody>
</table>

* Results under high delivery demand conditions. Numbers are the same for each microhub location.
Key Findings

Compared to business-as-usual operations, microhubs and cargo cycles have the potential to be more cost effective.

Average scenario costs under high demand conditions
Key Findings

Compared to business-as-usual operations, microhubs and cargo cycles have the potential to be **greener**.

**Average GHG savings using microhubs and cyclelogistics:**

- **24 kg CO₂/day**
  - Low demand conditions
- **53 kg CO₂/day**
  - High demand conditions
Conditions for success

- **Relevance**: high current and potential demand
- **Suitability**: favourable service area characteristics
- **Feasibility**: supporting institutional and economic context

*From Janjevic et al. (2014)*

Weather? Safety?
Turning ideas into action: Industry

- **Set** targets for incorporating low- to zero-emission vehicles in commercial delivery fleets

- **Pilot** cargo cycles/other zero-emission vehicles and microhub operations in areas with high delivery density

- **Explore** the potential of shared microhub space and using pooled ordering to consolidate deliveries
Turning ideas into action: Gov’t

- **Explore** policies and incentives to support establishment of microhubs and uptake of zero- or low-emission delivery vehicles

- **Harmonize** and clarify e-bike/cargo cycle legislation, regulations, and policies

- **Invest** in cycling infrastructure

- **Develop** or modernize land use and transportation plans and strategies
Questions?

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