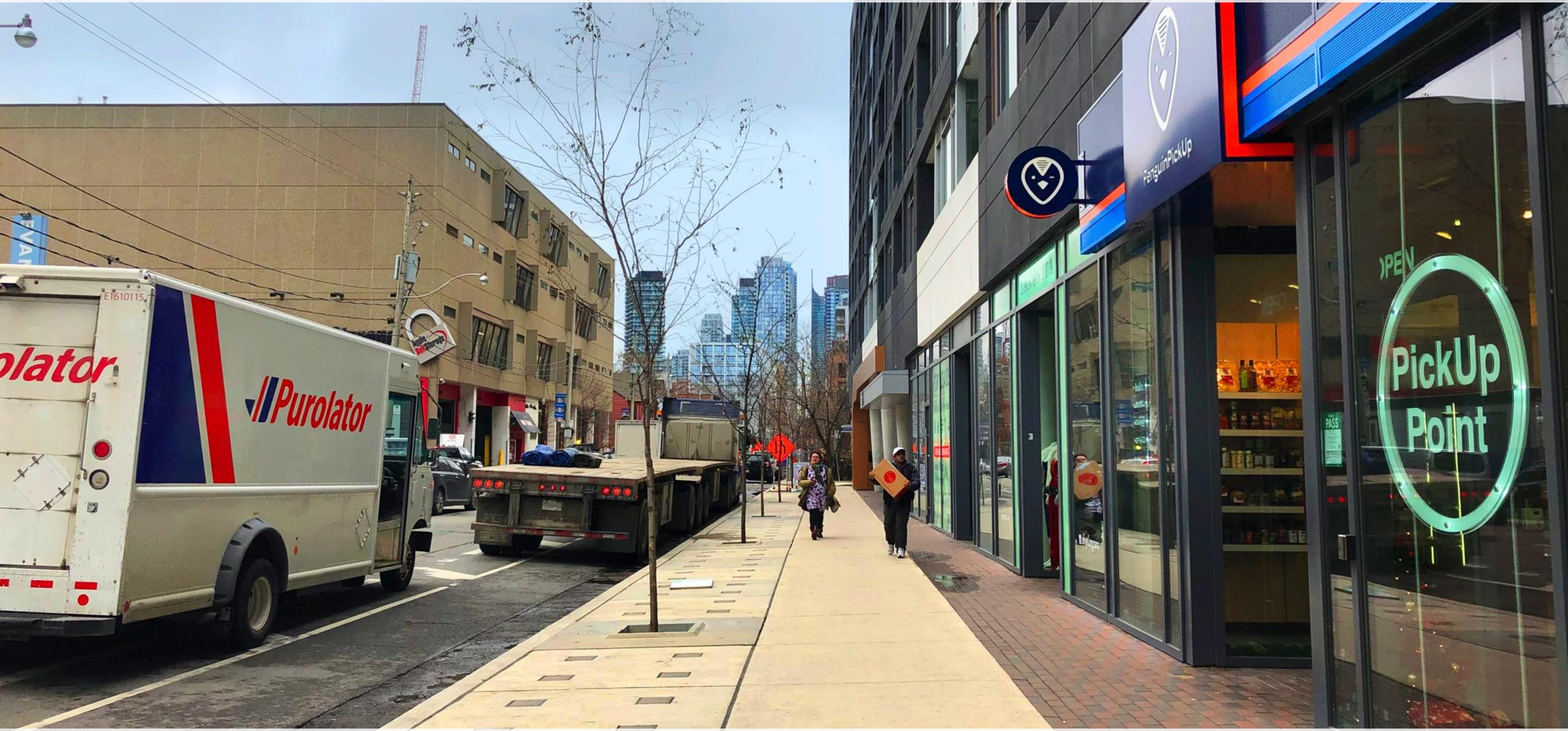
Delivering Last Mile Solutions:
A feasibility study on microhubs and cyclelogistics in the GTHA



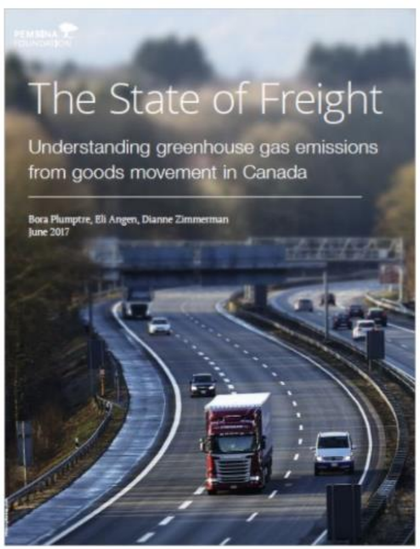
Carolyn Kim and Janelle Lee
Transportation and Urban Solutions, Pembina Institute
July 30, 2019

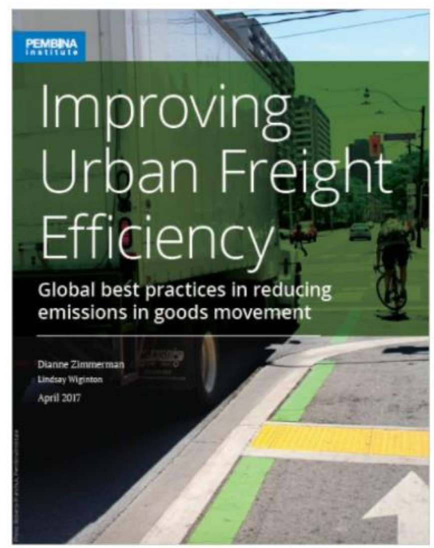
The Pembina Institute

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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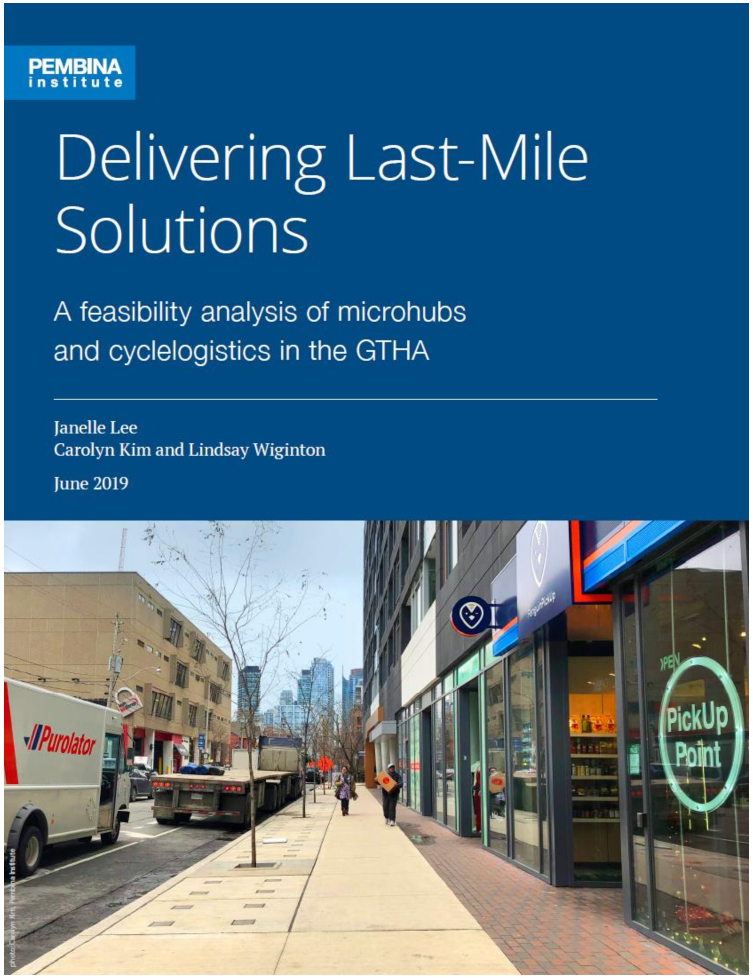
Presentation Outline

- Urban freight challenges
- Research objectives and approach
- Key findings
- Recommendations for action

Today’s presentation

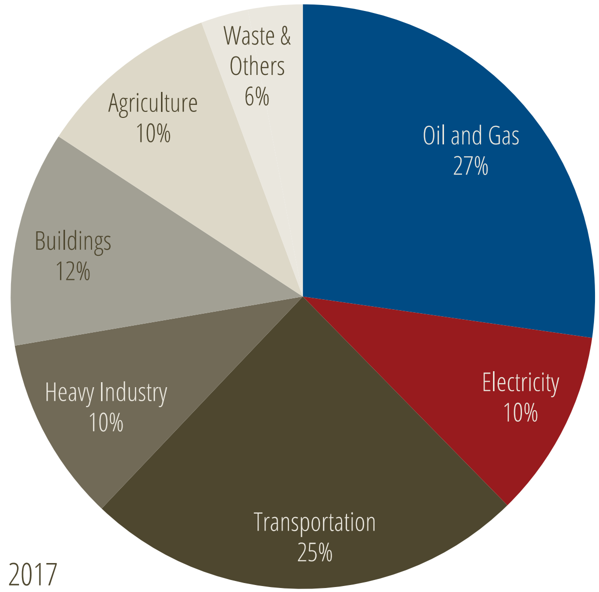


https://www.pembina.org/pub/delivering-last-mile-solutions

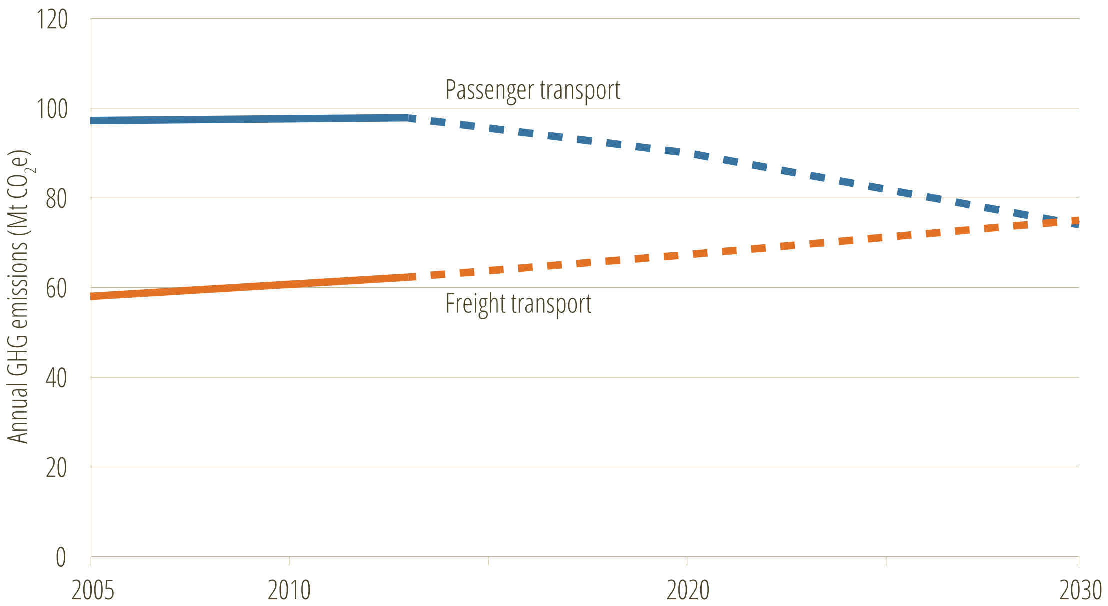
Urban freight challenges

- 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

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Photo: Janelle Lee. Pembina Institute.

Photo: The Drop.

Photo: Not Far From The Tree.

Photo: Steve Russell. Toronto Star.

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

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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)

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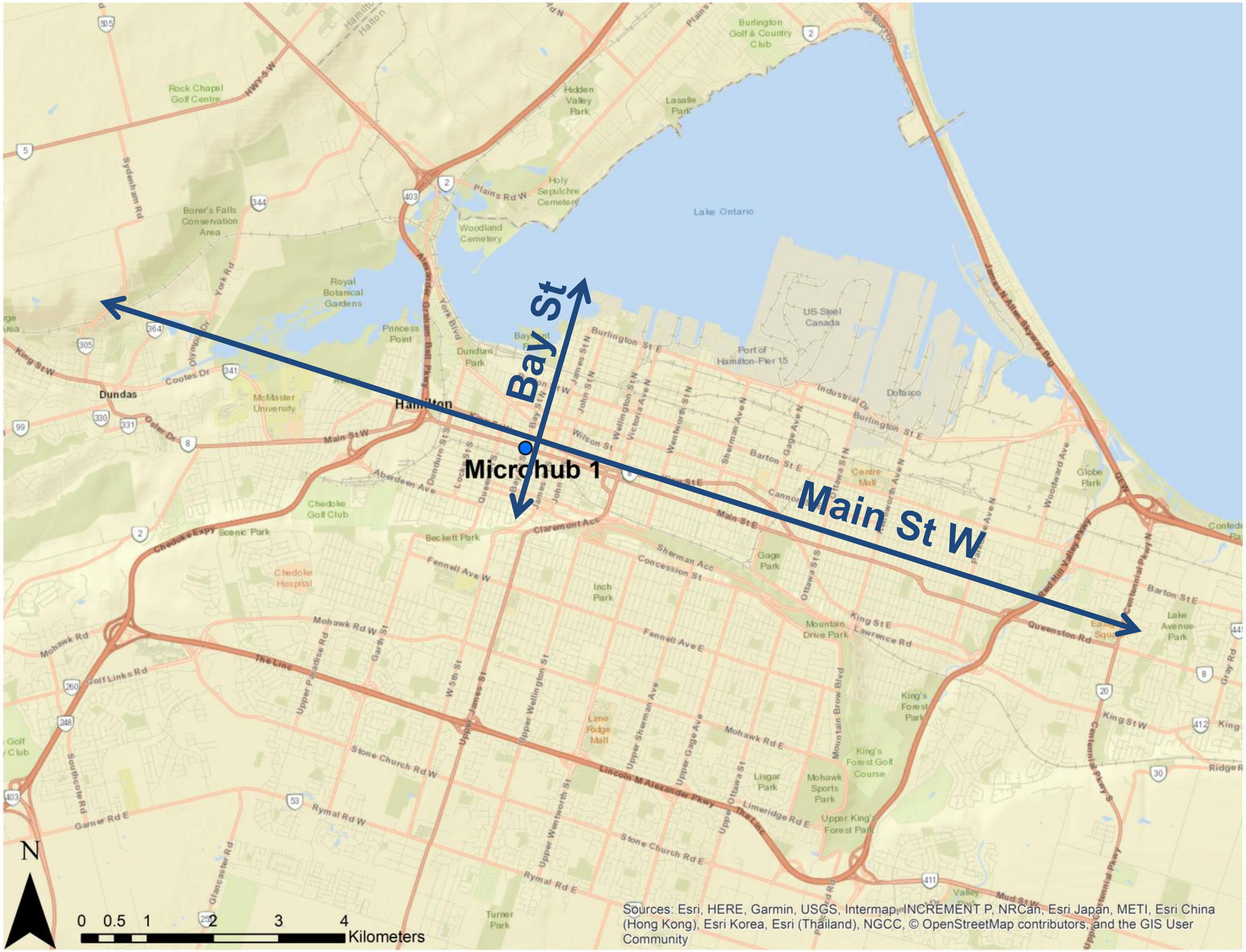
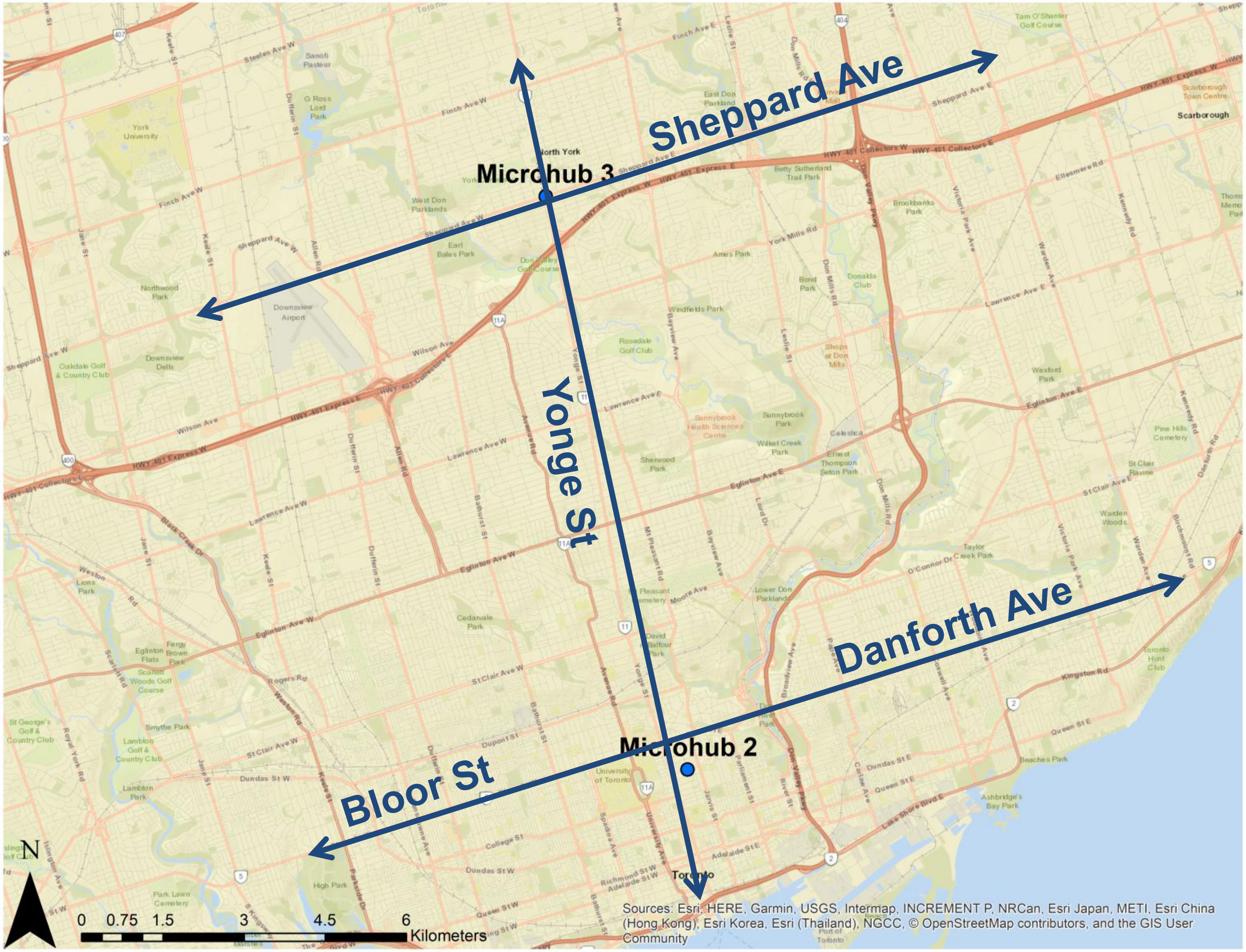
Hamilton


Bay St
Main St W
Microhub 1
Hamilton
Dundas
Lake Ontario
N
0 0.5 1 2 3 4
Kilometers
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community

Toronto


Sheppard Ave
Microhub 3
Yonge St
Danforth Ave
Microhub 2
Bloor St
N
0 0.75 1.5 3 4.5 6
Kilometers
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community

Part 2: Compare different delivery scenarios for microhub locations

	Business as usual (package car)	Microhubs with electric van	Microhubs with large cargo bike	Microhubs with small cargo bike
Higher volume (downtown cargo volumes)	Off-peak	Off-peak	Off-peak	Off-peak
	Normal congestion	Normal congestion	Normal congestion	Normal congestion
	Higher congestion	Higher congestion	Higher congestion	Higher congestion
Lower volume (suburban cargo volumes)	Off-peak	Off-peak	Off-peak	Off-peak
	Normal congestion	Normal congestion	Normal congestion	Normal congestion
	Higher congestion	Higher congestion	Higher congestion	Higher congestion

- For each delivery scenario, determine:
  - VKT
  - Travel time
  - Optimal fleet size
- Use these outputs to calculate (for each delivery scenario):
  - Operational costs (labour, fuel consumption, and fleet maintenance)
  - Emissions

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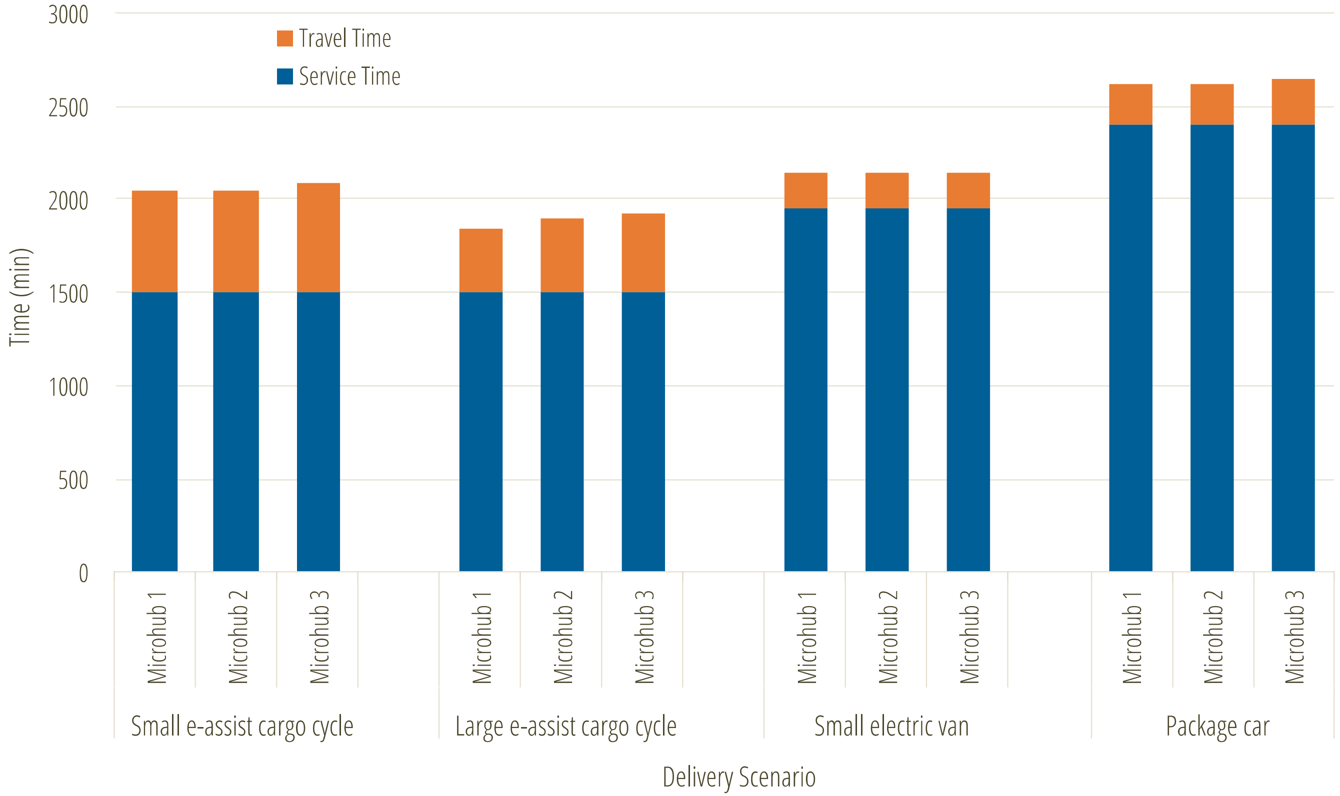
Microhubs and cargo bikes are viable and practical

- 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

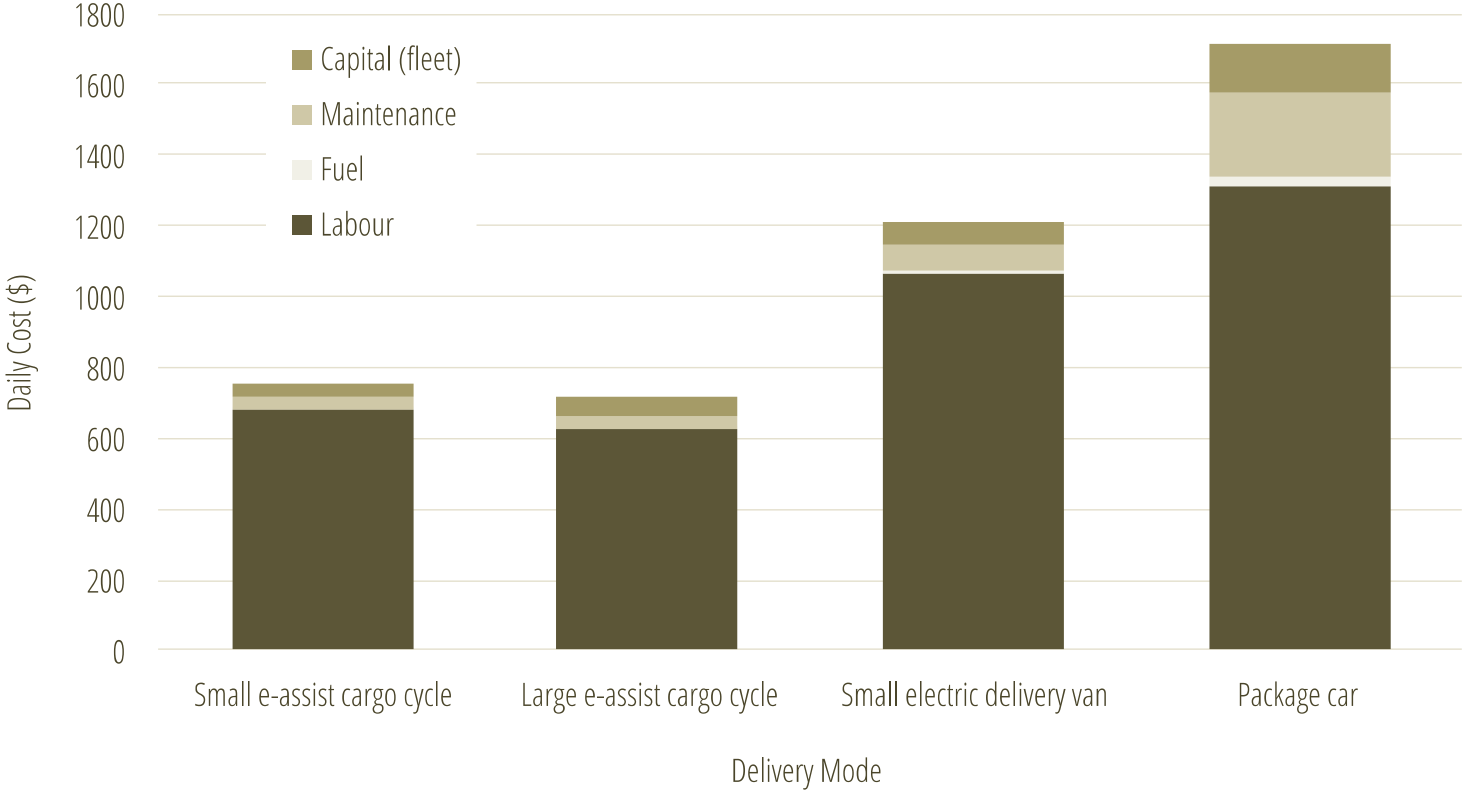
Compared to business-as-usual operations, microhubs and cargo cycles have the potential to have **higher asset utilization.**

		Number of trips*	Optimal fleet size*	Routes per vehicle*
Higher delivery demand	Small e-assist cargo cycle	28	6	4 to 5
	Large e-assist cargo cycle	6	6	1
	Small electric van	5	5	1
	Package car	6	6	1

* 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

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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	53
kg CO_2/day	kg CO_2/day
Low demand conditions	High demand conditions

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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

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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

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Questions?

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