MEASURING THE COST TRADE-OFFS BETWEEN ELECTRIC-ASSIST CARGO BIKES AND DELIVERY TRUCKS IN DENSE URBAN AREAS

Polina Butrina (pbutrina@uw.edu), Manali Sheth (manalijs@uw.edu), Anne Goodchild (annegood@uw.edu), Edward McCormack (edm@uw.edu)

Urban Freight Lab, University of Washington
Seattle, Washington

Study Objectives

- Compare costs (wages, operations, CO2) of deliveries completed by cargo bikes and delivery trucks in urban areas.
- Estimate route costs associated with each transportation mode in eight different delivery scenarios.

What is an Electric Assist (EA) Cargo Bike?

An EA Cargo Bike is a transportation mode that can be used to complement freight operations.

EA Cargo Bikes are battery supported and can generally carry between 300-600 lbs. of cargo depending on the vehicle's design.

Delivery companies such as UPS, FedEx, DHL, and others are beginning to incorporate EA Cargo Bikes into their fleet.

Methodology

1. *Interviews* conducted with cargo bikes manufacturer, cargo bike courier, and cargo bike messenger service.
2. *Data collection* completed by shadowing a courier company in order to develop a better understanding of a typical truck delivery in Downtown Seattle.

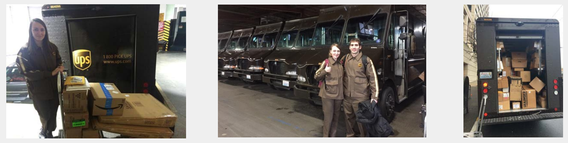
   Following information about delivery characteristics was collected:
   - distance between distribution center (DC) and neighborhood
   - number of stops
   - distance between stops
   - total number of parcels delivered
3. *Modeling* of eight delivery scenarios performed by truck and EA Cargo Bikes.

UNIVERSITY of WASHINGTON

Results

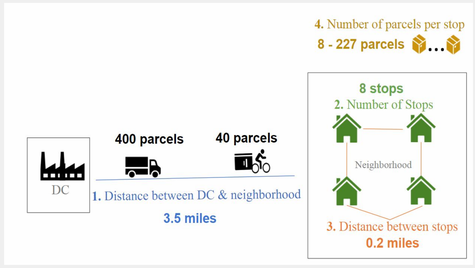
1. Data Collection

A well-known courier company was shadowed for a day in order to develop a better understanding of a typical truck delivery in Downtown Seattle.



During this process, information about the observed delivery route's characteristics were included in the study:

- 3.5 miles - distance between distribution center (DC) and neighborhood(L_{nb})
- 8 - number of stops in the route (N)
- 0.2 miles - average distance between each stop (L_s)
- 40 parcels - average number of parcels delivered per stop(n)



2. Interviews

Three interviews with a cargo bike manufacturer (Truck Trike), cargo bike courier (Freewheel Cargo), and cargo bike messenger service (Fleetfoot Messenger) were conducted to better understand costs associated with owning, operating, and maintaining an EA Cargo Bike. This information was used to develop assumptions and operational costs associated with EA cargo bikes. In this research project, the EA Cargo Bicycle and truck has the following characteristics:

Metric	Delivery Truck	EA Cargo Bike
Capacity (cu. ft.)	865	77
Capacity (parcels)	400	40
Maximum load (lbs)	5930	600
Fuel economy (mpg)	10	N/A
Idling (gallon/hour)	1	N/A
Fuel tank capacity (gallons)	40	N/A
Speed (mph)	20	15
Wage ($)	25.17	25.17

3. Modelling - Cost Function

Step 1: Calculate number of EA Cargo Bikes / trucks needed for the route

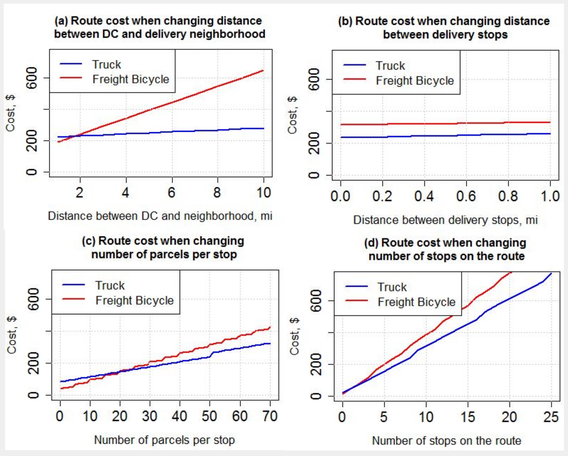
Constraints:

Constraints	Delivery Truck	EA Cargo Bike
Working day (hrs.)	10	10
Capacity (parcels)	400	40
EA Cargo Bike battery capacity (miles)	18	N/A

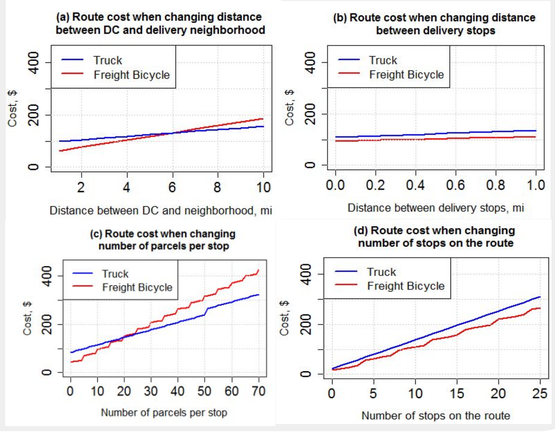
Step 2: Calculate total route operating cost as

Costs associated with driver, $ + Costs associated with vehicle, $+ Costs associated with CO2 emissions, $

4. Modelling Results - Observed Delivery Route



5. Modelling Results - Hypothetical Delivery Route



Advantages & Disadvantages of Cargo Bikes

Advantages	Disadvantages
• Zero Emission • Quiet • Nimble • Parking with ease • Money saved on parking (tickets) • Increased reliability • Improved road safety	• Topographic challenges • Higher transloading costs • Lower economies of scale • Road regulations • Urban design barriers • Weather • Driver Fatigue

Future of EA Cargo Bikes in Urban Areas

Based on modelling results, we can conclude that EA Cargo Bikes were not the most cost efficient vehicle type for the observed route. This is mainly due to the cargo capacity restrictions associated with an EA Cargo Bike.

However, EA Cargo Bikes can operate more efficiently with:

- Shorter DC to neighborhood distances
- Small, time sensitive deliveries
- 1-2 hour deliveries
- Support from policies and master plans

Delivery scenarios and solutions are diverse, and there is no one size fits all solution.

Sustainable solutions must be multimodal and collaborative.

Acknowledgments

We would like to thank PacTrans for providing travel support.