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Are electric-assisted cargo bicycles the solution for urban freight?

A study compared the delivery route cost trade-offs between box delivery trucks and electric-assisted (EA) cargo bikes that have the same route. It concludes that the delivery trucks are more cost-effective for greater distances from distribution centres and for large volume deliveries to one destination. However, EA cargo bikes may be well suited for traffic congested cities with designated bike paths and truck parking challenges.

To combat the growing pressures of freight in major urban areas, some European and North American cities have responded by deploying alternative transport modes for delivering goods (e.g. EA cargo bikes). EA cargo bikes could provide a feasible technology to meet the increased demand for the movement of goods.

According to the European Cycle Logistics Federation, up to 50% of all light goods and 25% of all goods could be moved by bike. However, the capabilities and limitations of EA cargo bikes are poorly understood. Increased knowledge about them could empower the reform of the urban freight sector.

This study compared the delivery route cost trade-offs between box delivery trucks and EA cargo bikes that have the same route and delivery characteristics. It explores what conditions EA cargo bikes perform at lower cost than typical delivery trucks.

An increase in e-commerce activity by city residents means there are more delivery vehicles on city streets. However, urban freight infrastructure is unlikely to change significantly to accommodate the increase in vehicle numbers. Traffic congestion, idling trucks and the lack of sufficient commercial vehicle load zones (designated freight curb space) are key issues.

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Current freight infrastructure is unable to meet the diverse and dynamic delivery needs of the last mile. This is where goods are transported between a distribution centre and a recipient's location, and is considered to be the most costly part of the supply chain. To address urban freight delivery challenges, EA cargo bikes are being used for last-mile deliveries in several urban cities.

The study used a delivery route in North America (Seattle) as a base case. The same route was modelled using EA cargo bikes. Four separate scenarios were modelled to evaluate how independent route characteristics would impact delivery route cost – distance between a distribution centre and a neighbourhood, number of stops, distance between stops and number of parcels per stop.

Advantages and disadvantages of EA cargo bikes

Anticipated advantages of EA cargo bikes	Anticipated disadvantages of EA cargo bikes
Small enough to manoeuvre through narrow streets	Lower economies of scale due to lower carrying capacity of an EA cargo bike
Time saved as easier to park	Limitations in some areas due to inability to climb steep slopes
Money saved on parking tickets because it would not be parking illegally	In some cities, EA cargo bikes are illegal
Increase in delivery reliability because EA bikes can avoid congested roads and use the bike lane to meet delivery deadlines	Urban design barriers such as bollards or limited bicycle infrastructure
Improved road safety for pedestrians and cyclists	Other limitations – driver fatigue, depleted battery charge, extreme weather conditions (e.g. wind, rain, snow and ice). Injuries suffered as a result of collisions may be more severe for the EA cargo cyclists compared to those for truck drivers

The analysis showed that EA cargo bikes are more cost-effective than delivery trucks for deliveries in close proximity to a distribution centre where there is a high density of residential units and low delivery volumes per stop. This is less than 3 kilometres for the observed delivery route with 50 parcels per stop and less than 10 kilometres for a delivery route with 10 parcels per stop.

Delivery trucks are most cost-effective for greater distances between distribution centres and for large volume deliveries to one stop. For example, the observed route had a large volume of deliveries to one major office tower. Due to the truck's large carrying capacity, the route could be completed by one truck, instead of deploying at least 10 EA freight bicycles to complete the same delivery. By delivering a greater number of packages per stop to office towers or any high-rise building with designated loading docks, trucks are able to legally park for longer periods of time. Therefore, EA cargo bikes may well be suited for traffic congested cities that have designated bike paths and truck parking challenges.

The number of deliveries within city areas is increasing. The study concludes EA cargo bikes have the potential to optimise specific parts of the supply chain, but is not a one size fits all solution for urban freight.