Design Project – SIE 2022

Environmental Impact of Logistical Microhubs and Traffic Optimization to Reduce CO_2 Emissions

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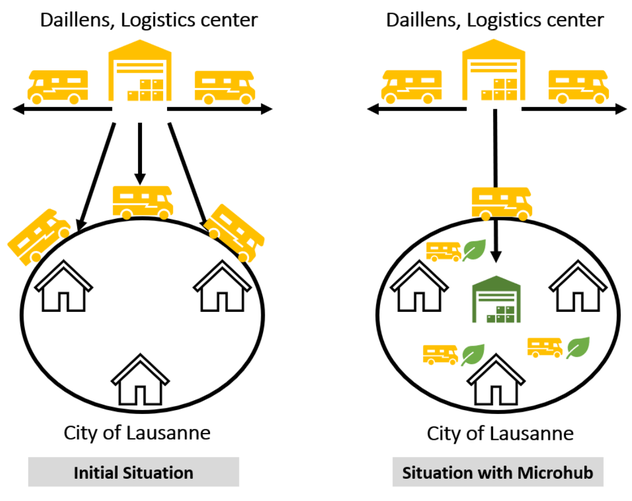
Context

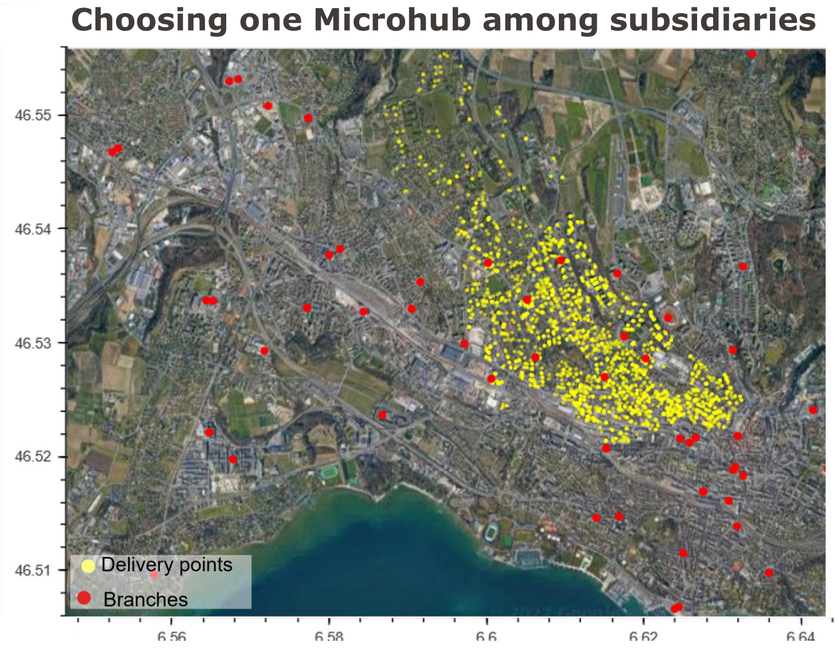


Today, the Swiss Post delivers packages to Lausanne from the nearest **sorting center in Daillens** (about 20km North of Lausanne). These packages could be brought to a **Microhub in the city-center** and then be delivered to the customers using **electric vehicles**.

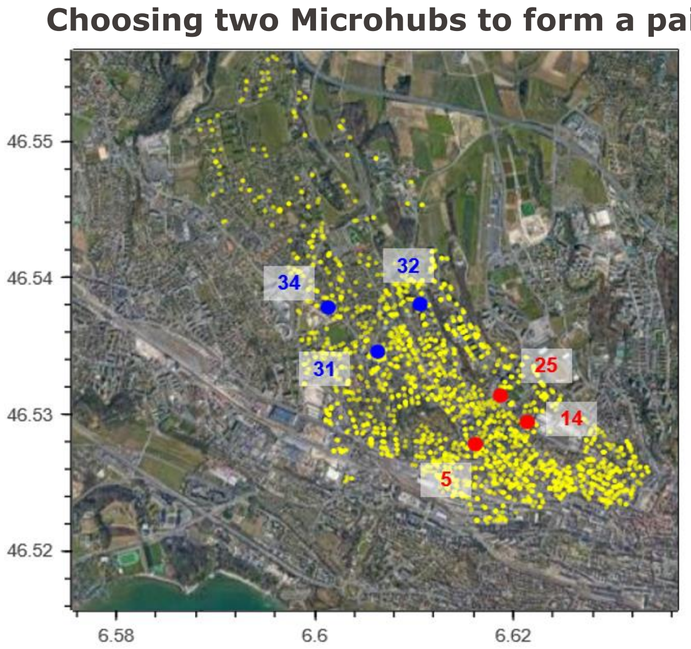
Using five days of **real delivery data**, route simulations were made using the *RaaS* routing software. Scenarios with **one or two microhubs** chosen among the Post's subsidiaries were compared to find the solution with the lowest carbon impact.

Methodology

Choosing one Microhub among subsidiaries



Choosing two Microhubs to form a pair



- **15 m³**
- **7 hours** maximum
- Enough range
- Thermal or electric

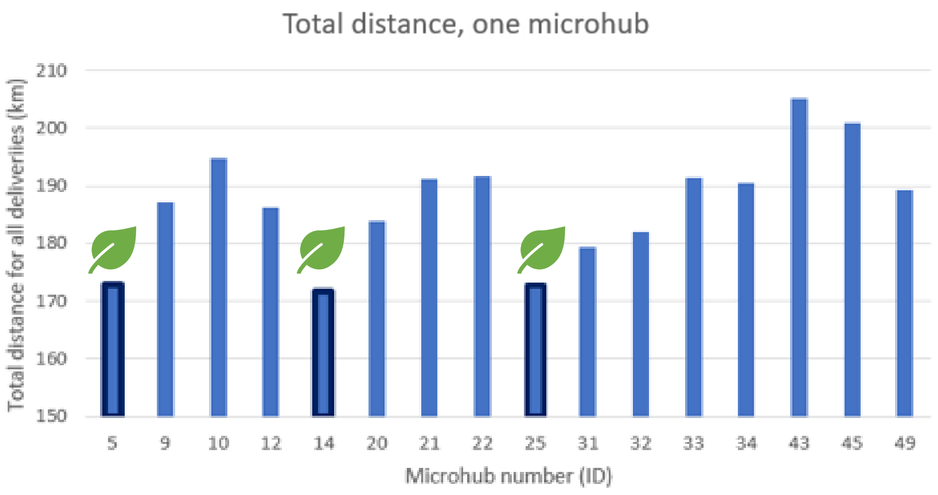
- **190** g CO_2eq/km (fuel)
- **90** g CO_2eq/km (vehicle manufacturing)

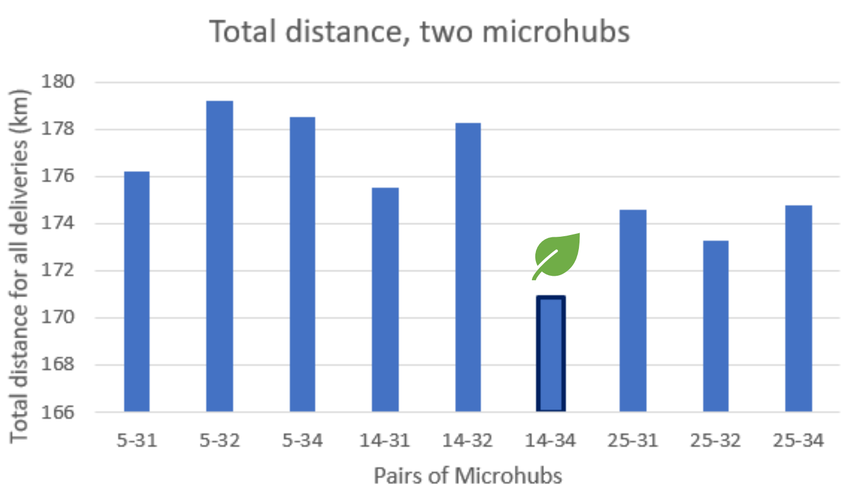
→ **280 g CO_2eq/km**

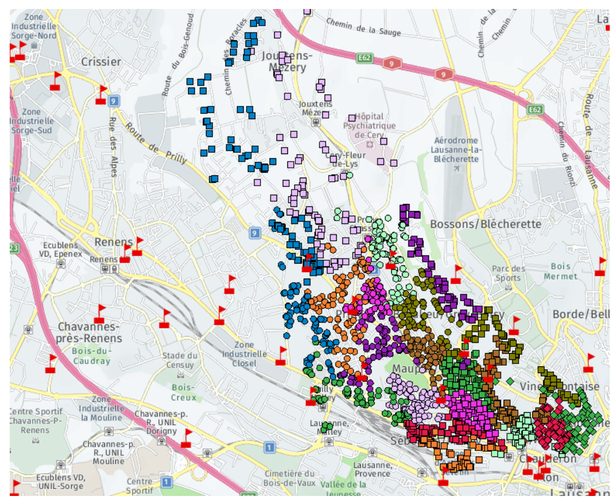
- **7** g CO_2eq/km (Swiss electricity)
- **97** g CO_2eq/km (vehicle manufacturing)

→ **104 g CO_2eq/km (-63%)**

Results







	Initial Situation	With the best Microhub		With the best pair	
Total distance	597,7	324,6	-46%	338,7	-43%
Total time	81:38:00	74:33:00	-9%	74:24:00	-9%
Number of routes	12	11	-8%	11	-8%
CO2e emissions Diesel only	167	90,9	-46%	96,9	-42%
CO2e emissions Diesel then electric		60,2	-64%	66,8	-60%
CO2e emissions Electric only		33,8	-80%	36	-78%

There are **two ways** to reduce the carbon footprint of delivering packages in Lausanne. The first is to implement a microhub: **optimized logistics** mean less distance travelled and less CO_2 emissions. The second is to use **electric vehicles**. Combining these two options allow for **80% reduction** in CO_2 emissions.

Using two microhubs is **not efficient** in such a small delivery area.

Bottom Line

The Post committed to reduce its **CO_2 emissions** by **93%** by 2040[1].

Concerning package deliveries in city centers, our results show that combining optimized deliveries using microhubs and electric vehicles allow for **only 80% reduction** in carbon footprint.

Alternative solutions must be considered to reach this 93% goal in the package delivery sector.

Electric cargo bikes could be an interesting solution to deliver effectively urban and **dense areas**. These vehicles have a much smaller carbon footprint than delivery vans but have **space limitations**.

Smaller delivery vans could be considered to deliver dense urban areas. This could help limit as much as possible the carbon footprint of package delivery in urban centers.

Sciences et ingénierie de l'environnement

Special Thanks to Patrick Stokkink, Linda Heini and Markus Steinman

[1]: Anne Wolf, Head of Corporate Responsibility at Swiss Post, 12.02.2021, https://www.post.ch/en/about-us/news/2021/there-are-business-opportunities-in-climate-change