

Greening urban logistics: the role of hyperconnected urban logistics networks

10/11/2021

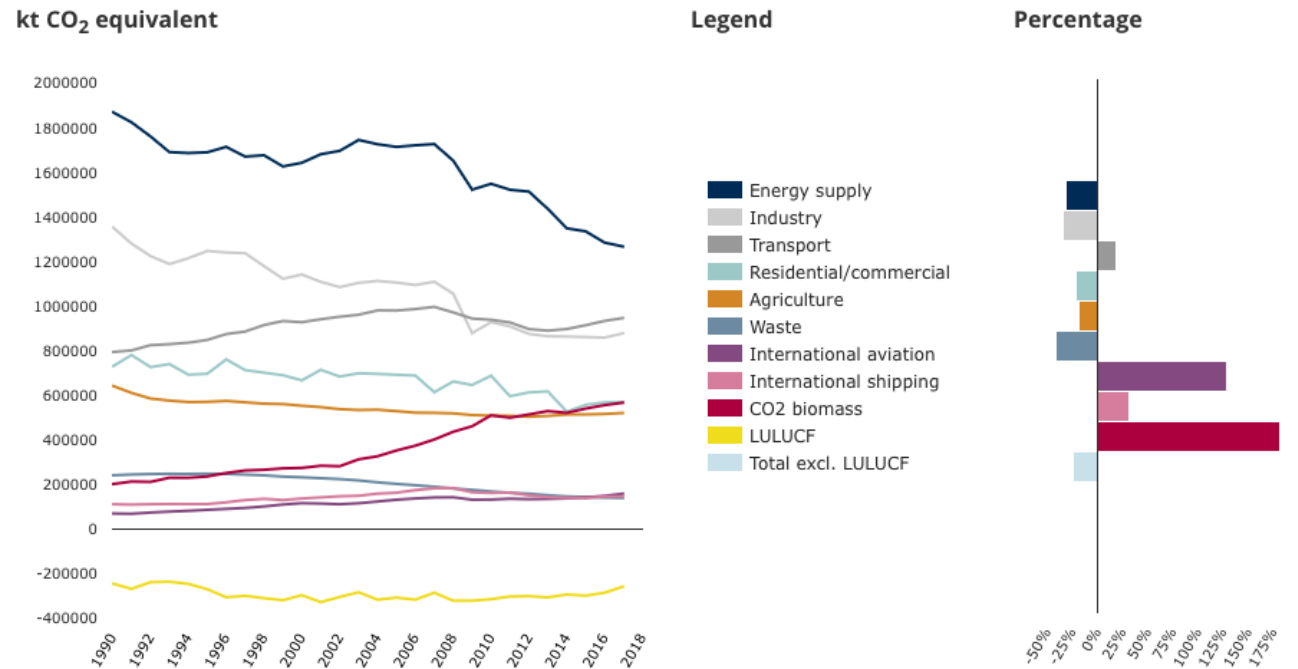
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Climate & Transport

- Urgency
- IPCC report & COP26
- Transport responsible for around a quarter of total CO₂ emissions globally
- The transport sector lacks behind compared to other sectors in terms of GHG emission reductions
- Increase compared to the 1990 levels

EU Greenhouse gas emissions by aggregated sector



Source: EEA (2021)

Fit For 55: road

- Road ETS
- CO2 standards for new cars/vans
- Energy Tax Directive & Renewable Energy Directive
- Alternative Fuel Infrastructure Directive

ROAD ETS

- Separate ETS
- Phased in between 2026-2028
- Upstream system (regulating fuel suppliers)
- No free allocation
- Contribution: -43% GHG reductions by 2030 to 2005

CO2 STANDARDS FOR NEW CARS & VANS

- = ICE phase-out
- Vans (new): 50% CO2 reduction target in 2030 and 100% in 2035.
- Cars (new): 55% CO2 reduction target in 2030, 100% in 2035 (15% CO2 red by 2025 remains te same)
- Exception for small volume manufacturers (till 2030)
- Removal of regulatory incentive mechanism for zero en low emission vehicles (ZLEB) from 2030 onwards

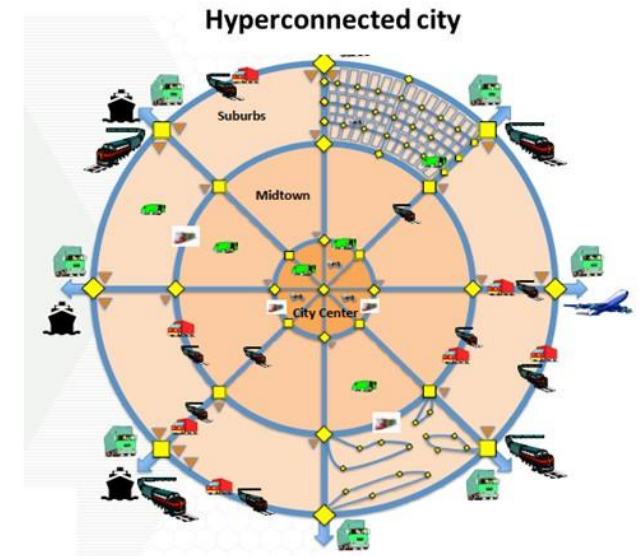
E-commerce

- Rise in e-commerce in the last years
 - Covid-19
 - Stress in the parcel delivery systems
- Parcel market currently relies on hub-spoke networks
 - Highly optimized for long distance operations
 - Local2Local (L2L) operations go to regional consolidation centres → Unnecessary extra km

Hyperconnectivity

- Part of the physical internet vision
- Interconnectivity of nodes between organizations
 - Vertical integration: expansion of services
 - Horizontal integration: collaboration between competitors
- Relies on open nodes, but beyond city distribution centres

Can hyperconnectivity help to avoid L2L unnecessary km?



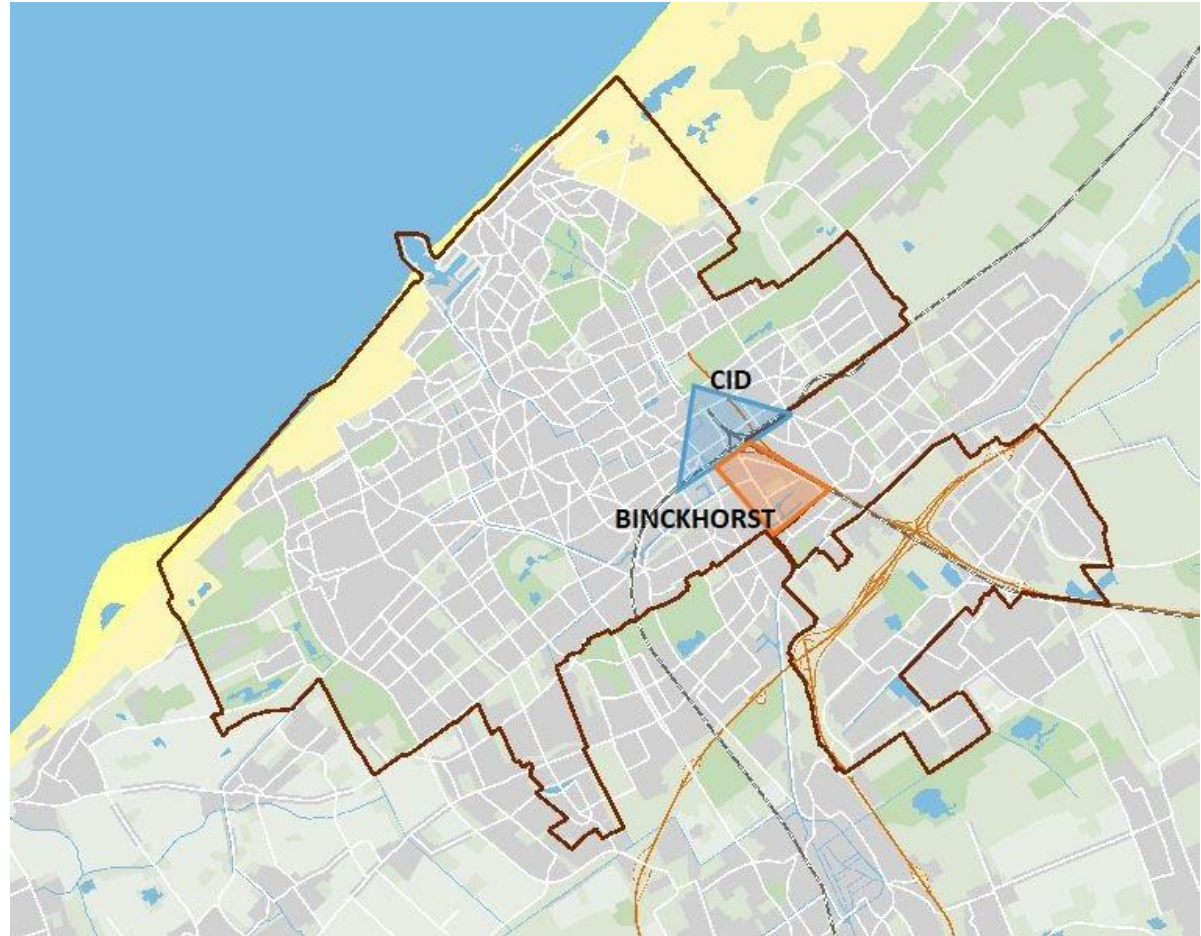
Source: Crainic & Montreuil (2016)

LEAD project: The Hague LL

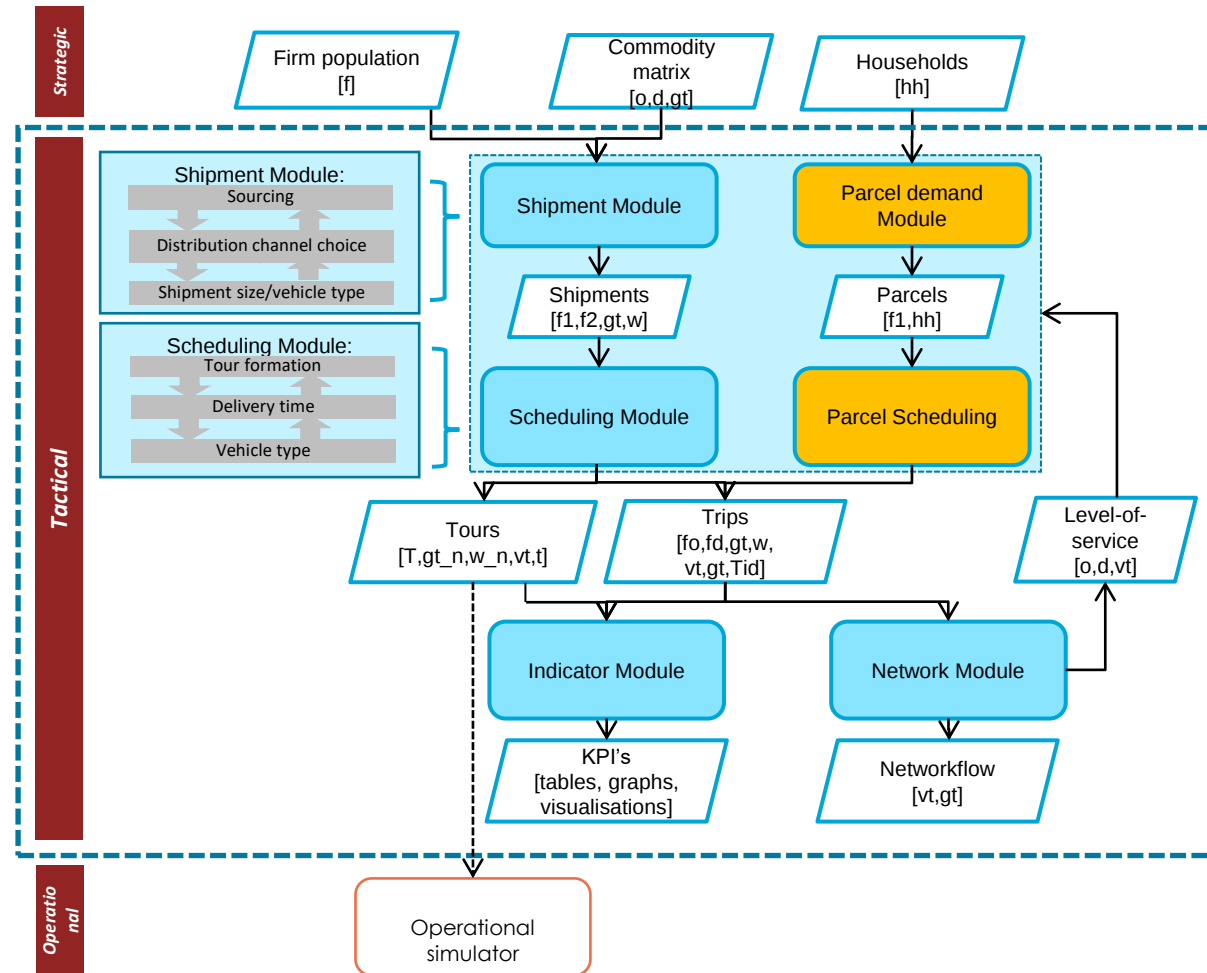
Context: Central Innovation District (CID), with the re-development of nearby area with new housing, high value industry & services, in a densely used location.

Mission: to connect **shared freight** movements around mobility hubs via a digital freight fulfillment **platform**.

Modelling: Create digital twins to recreate the shared platforms

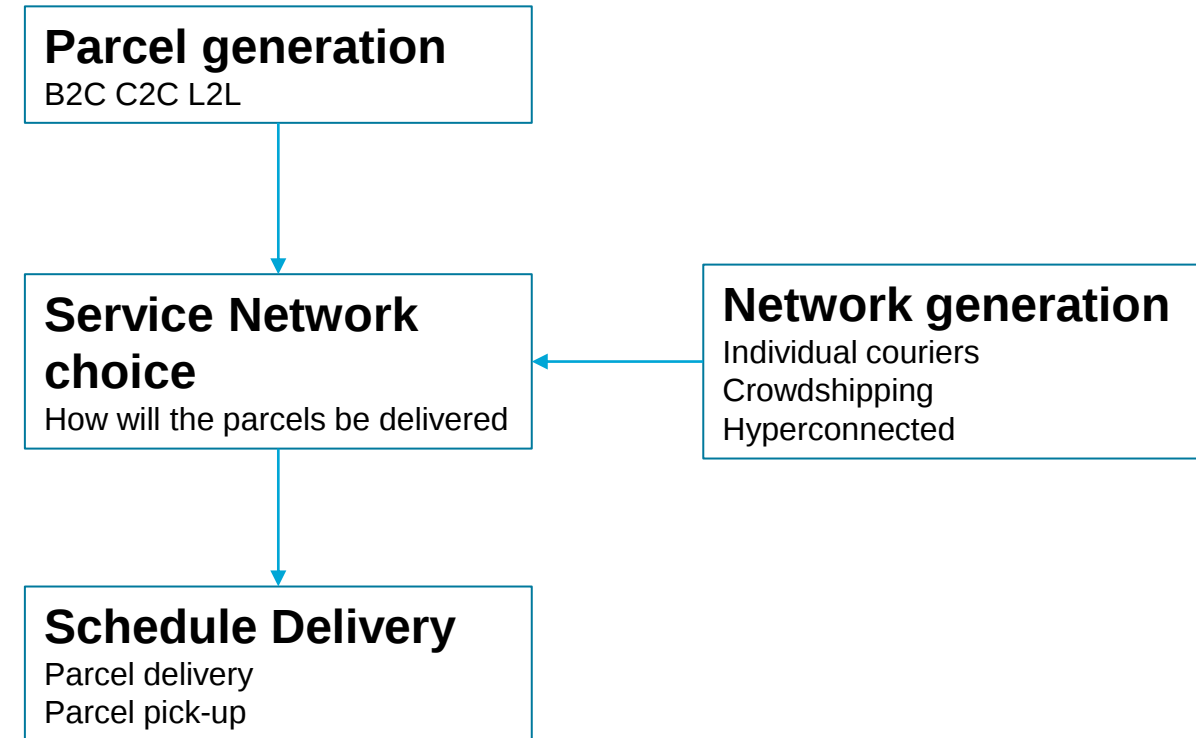


Mass-GT



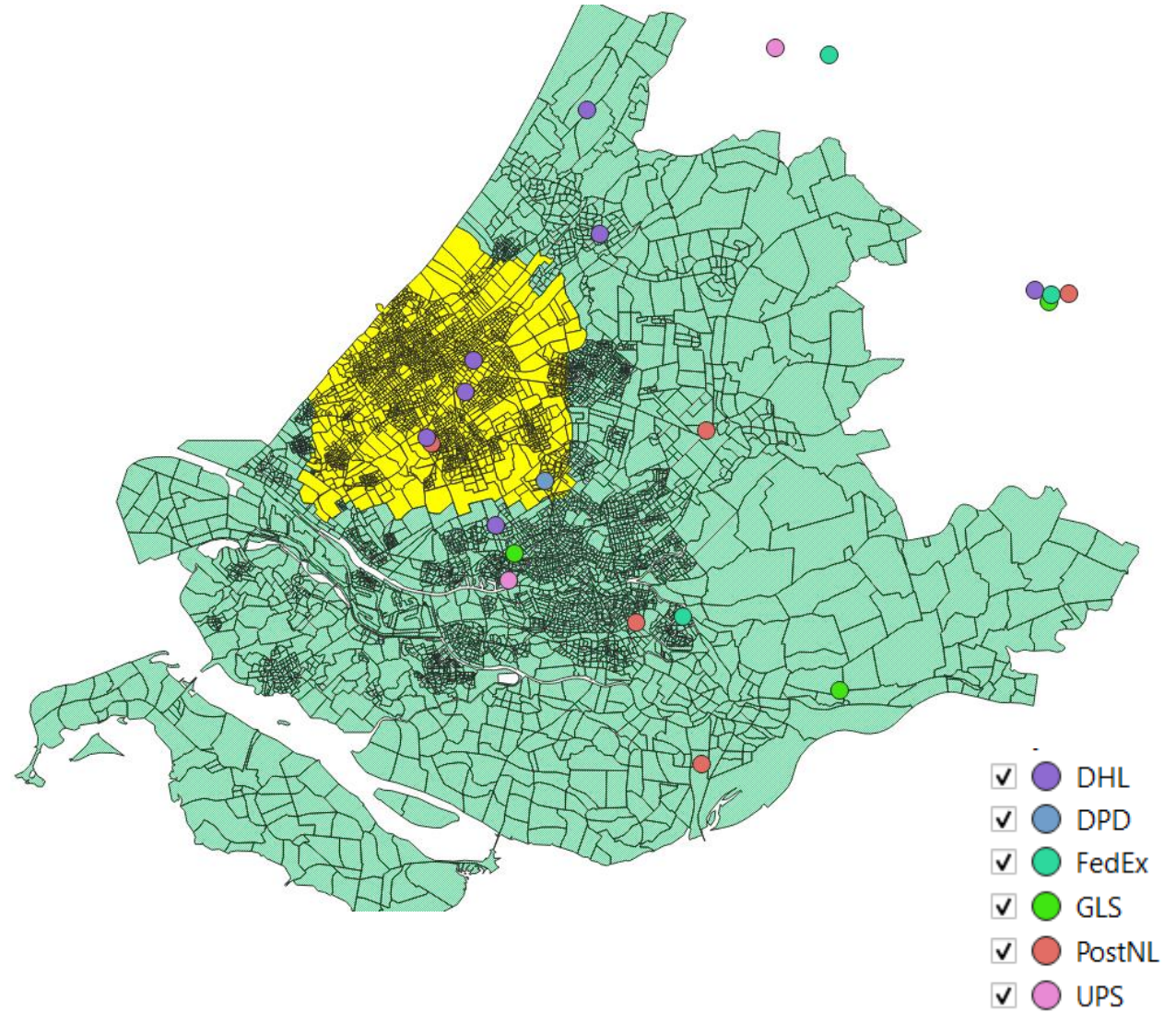
Modelling

- Adaptation of Mass GT parcel generation and scheduling
 - Parcel demand simulation based on generation rates
 - Heuristic parcel scheduling → obtain feasible flows
- Add L2L parcels
- Include pick-ups for parcels with origin in the study area
- Key Assumptions:
 - Parcels go to closest depots
 - Parcels are generated proportional to population
 - Hub-spoke for international parcels
 - Transhipments only in hubs

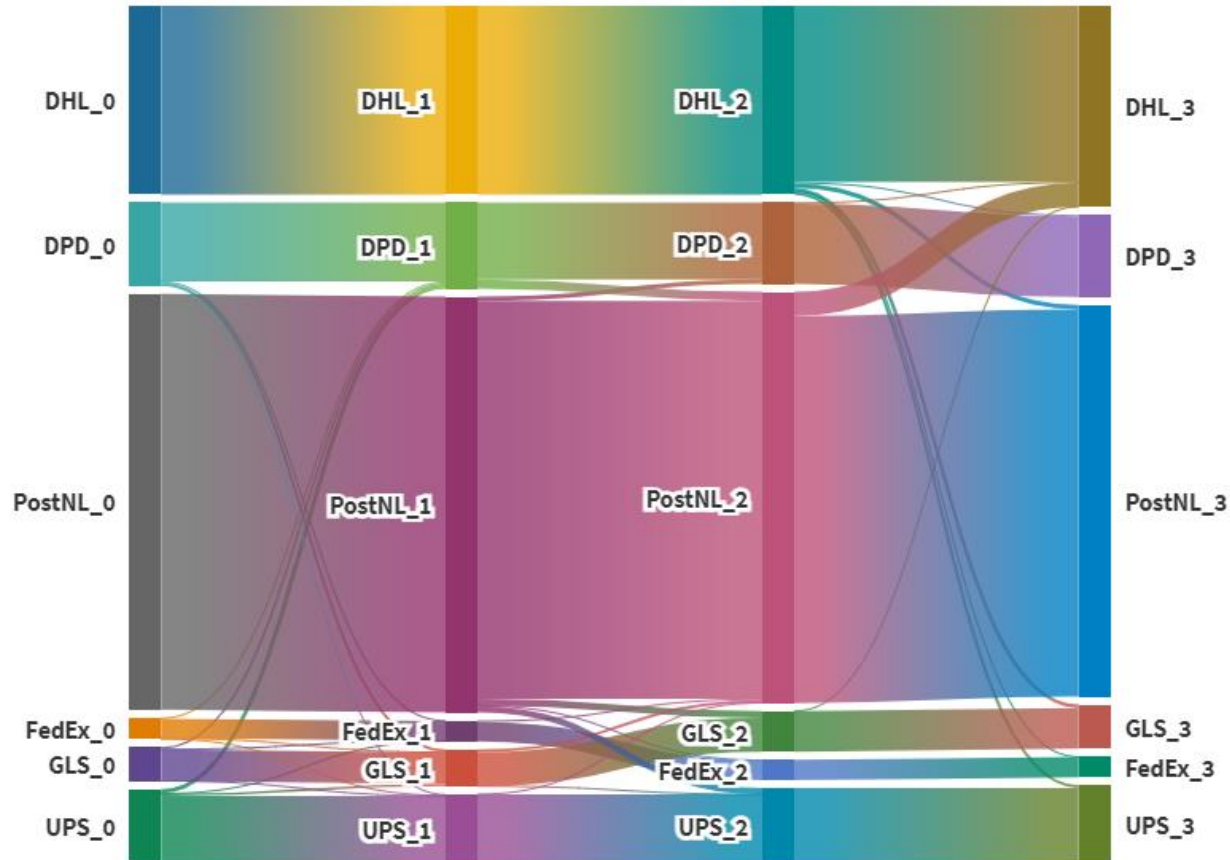


Scenarios

- 4% of parcels are L2L
- Networks tested:
 - Hub and spoke network (current)
 - GLS, DPD, FedEx & UPS
 - GLS, DPD, FedEx & UPS + PostNL
 - GLS, DPD, FedEx & UPS + PostNL + DHL



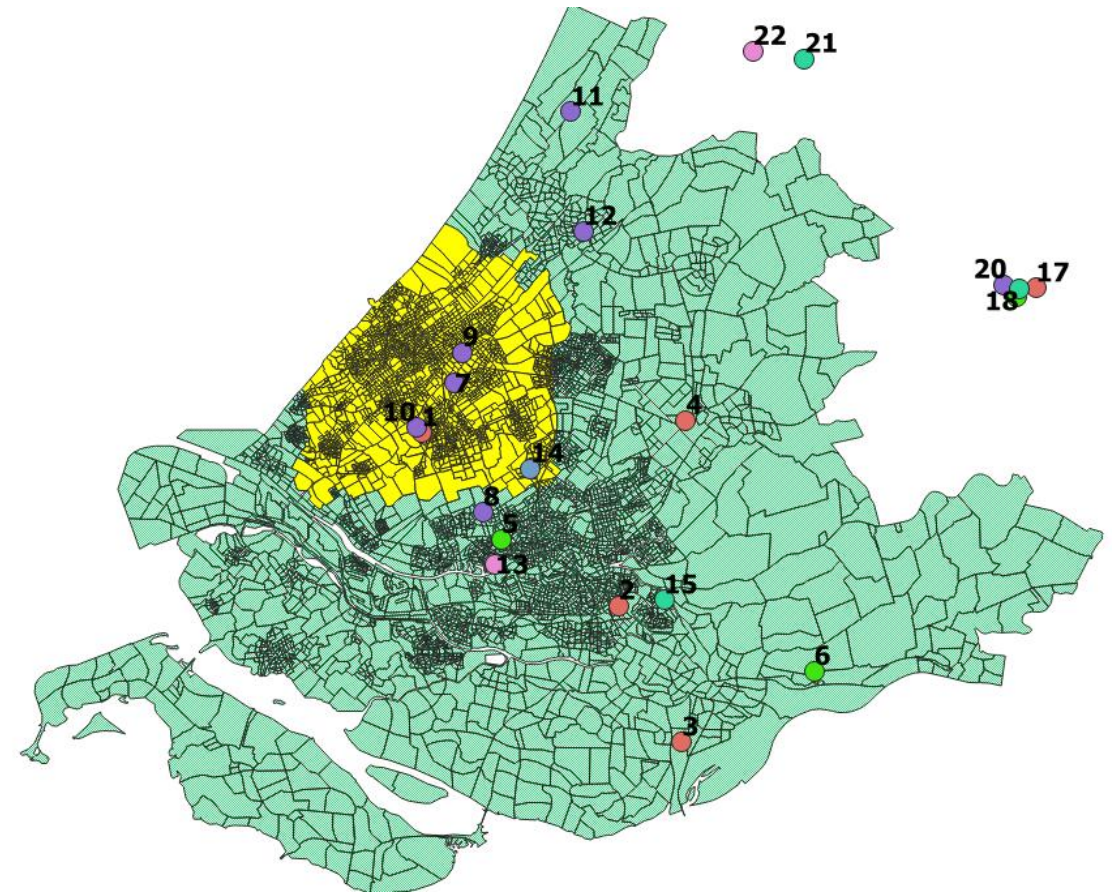
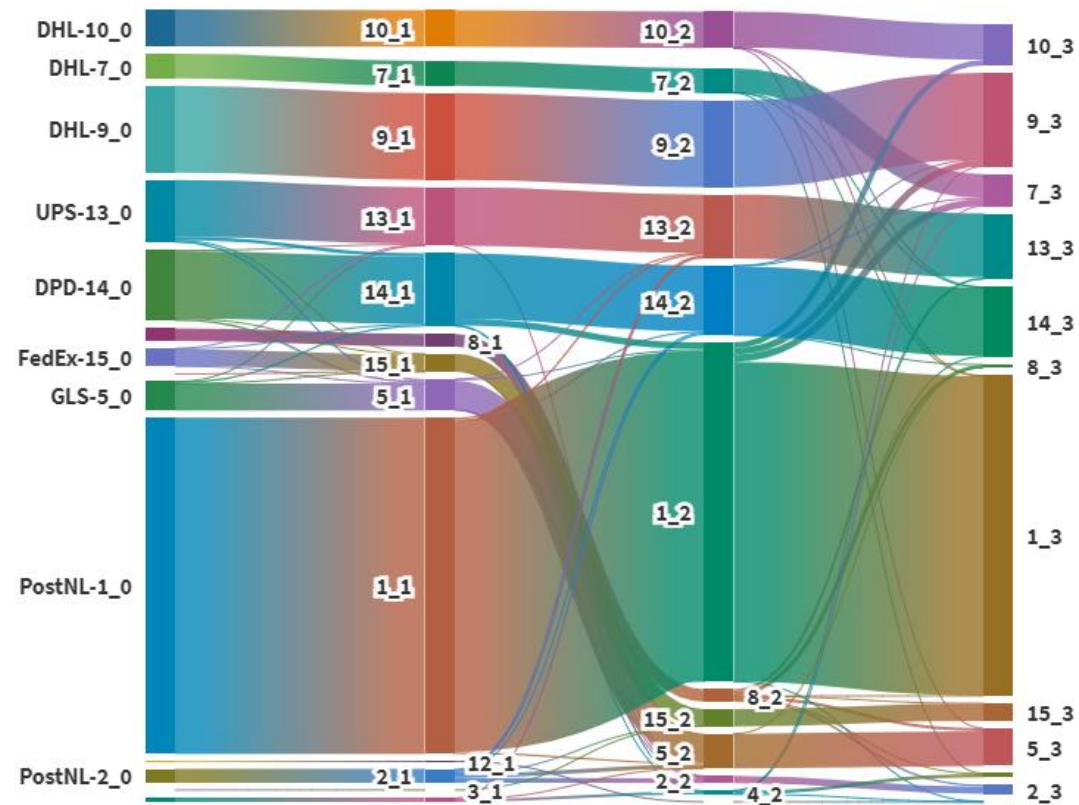
Results



- Reduced overall km
 - From 4% for small connection to 13% in the full connection
 - High reduction of tour-based km
 - More expensive
 - More pollutant
- Increased consolidation

Total km	78.995	75.570	72.678	69.838
Consolidated	5.582	5.758	6.177	6.798
Tour	73.413	69.813	66.500	63.040

Results



Discussion

- Significant savings in KM
 - ~ 13% for the most connected
 - Lower than other examples in the literature
 - Kim & Montreuil simulated for large item shipment and obtained 24% reduction in cost
- ETS is unlikely to affect the adoption
 - There is sufficient evidence for km savings already
 - Only marginally increases cost
 - Represent an extra 1% of costs

Discussion

- Why hasn't been implemented yet?
 - Network sharing also implies identifying the L2L parcels
 - PI vision and roadmap relevant in the adoption
 - Competitive strategy
- Future improvements:
 - Introduce vertical integration
 - Improve the pick up algorithm
 - Effect of multiple vehicles types
 - Capacity for depots

Thank you for your attention

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Acknowledgements: This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 861598.