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Forecasting parcel deliveries in an urban freight simulator for the province of Zuid Holland

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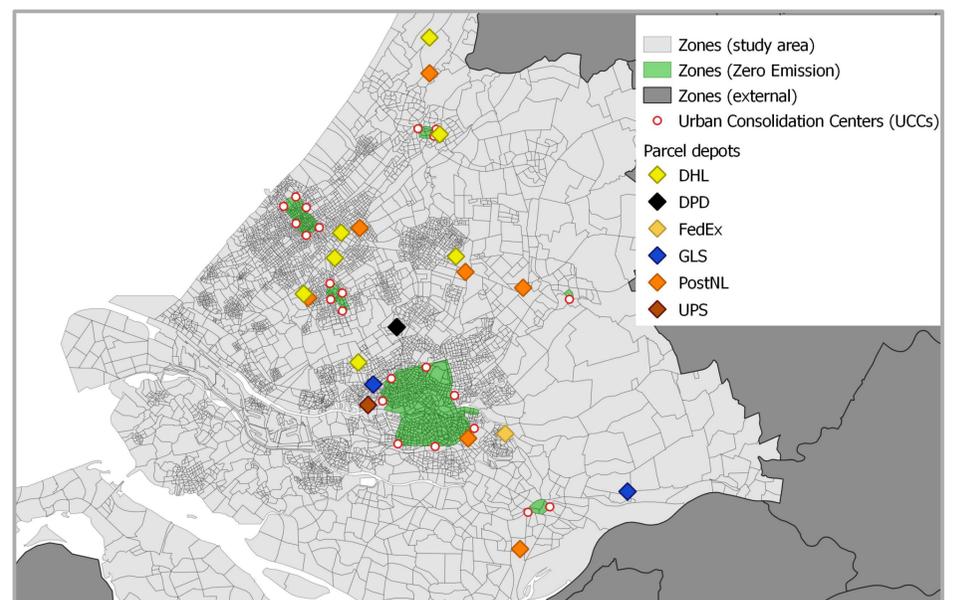
Forecasting parcel deliveries in an urban freight simulator for the province of Zuid-Holland

Summary

- Delivery traffic grows fast, but is not often included in strategic transport models
- 5.5% of all van km in the Netherlands are e-commerce (CBS, 2018)
- Unique nature of the segment (e.g., specific depot locations, strong growth rates) requires targeted approach to forecasts van traffic
- We developed a simulation model for parcel deliveries in the context of transportation demand forecasting.

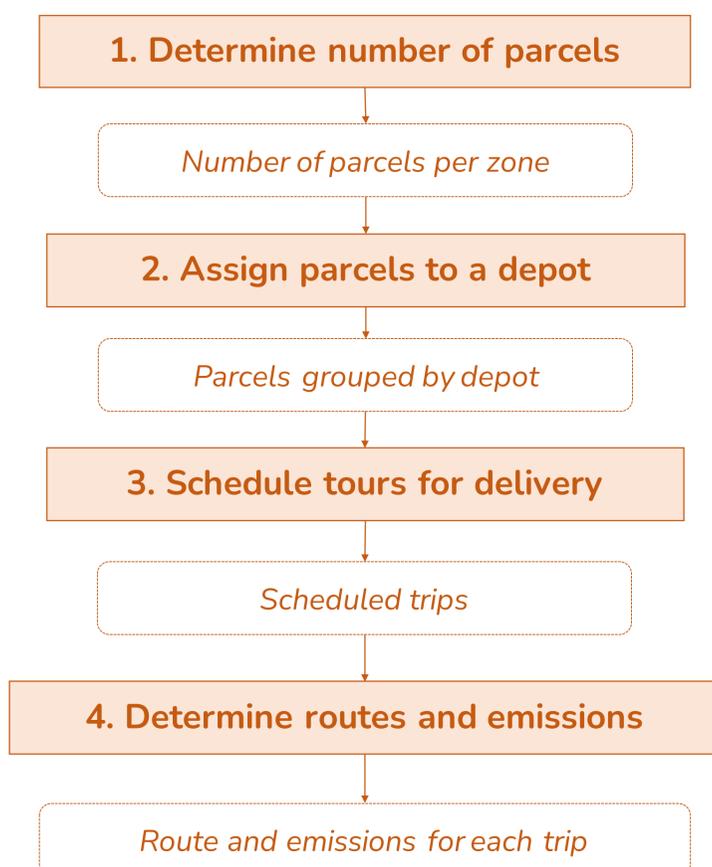
Simulations

- 1) Forecast 2030 with increased parcel demand (+11% annually)
- 2) Horizontal collaboration between couriers with shared use of depots
- 3) A zero-emission zone in several cities in combination with Urban Consolidation Centers at city outskirts



Methodology

1. Determine for each zone the number of B2B and B2C parcels. For B2B a generic factor for number of parcels per job is used. For B2C we estimated an Ordered Logit Model based on the number of inhabitants by age and income.
2. Parcels are assigned to different couriers based on observed market shares and then assigned to the nearest depot of the respective courier.
3. Tours are scheduled by forming spatial clusters and determining the route sequence with a nearest-neighbor and 2-opt approach.
4. Each tour is assigned to the road network and emissions are calculated based on vehicle type, road type and loading rate.



Results

	Ref.	(1) Forecast	(2) Hor. coll.	(3) ZEZ
No. of parcels	356,197	+339%	-0.1%	+5.3%
Distance [km]	123,673	+188%	-58.2%	+116.7%
CO ₂ [kg]	22,937	+203%	-55.7%	-0.05%

- 1) In the forecast scenario, we see a smaller increase in driven kilometers than in number of parcels. This is due to economies of scale in the tour scheduling.
- 2) Under constant demand, shared use of depots could reduce the vehicle kilometers of the last-mile deliveries with more than 50%.
- 3) While emissions are reduced by 100% inside the Zero Emission Zones, at regional level the emission reduction is minimal due to rerouting of trucks and vans.

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