TPR
Department of Transport and Regional Economics
University of Antwerp

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UNIVERSITY OF TECHNOLOGY

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Modelling the distribution of e-commerce parcels in the city

City Logistics Conference

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Agenda

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I. Introduction
II. Architecture of the model
III. Pick-up points modelling
IV. Results & Conclusions

Introduction

How many lockers/pick-up points are neccesary?

- **Failed deliveries**
- **Collection**

Working with Amazon and InPost, we also provide parcel lockers at eight Tube stations – Amersham, Finchley Central, Newbury Park, Ruislip, Chalfont & Latimer, Buckhurst Hill, Chorleywood and Ickenham – and Victoria Coach Station. We plan to significantly expand the number of locker facilities provided at our stations. We will launch a new competitive tender exercise this year,

partners to expand the network of collection points in London. We are making small parcels of land available to courier companies.

Pick-up points proliferation

Pick-up networks in Europe

	DHL	UPS	Hermes	DPD	Royal Mail	GLS	Mondial Relay	PostNord	PostNL	bpost	Collect+	Colissimo	Total
NL	2000	950		750		700			2850	1430			8680
BE	1250	900		800*		500	600		1000	2370			6620
FR	4300	4000	6300	8300		4800	6300			6500		17500	58000
DE	28000	3400	15000	6000		5000							57400
IT	1900	2800											4700
PL	6000	1300		1100		1500							9900
ES	1250	1500		1600			1700***						4350
SE	1600	200						1900					3700
UK	2200	2800	4500	5000	11700						7000		33200
Total	**48500**	**17850**	**25800**	**22750**	**11700**	**12500**	**6900**	**1900**	**3850**	**10300**	**7000**	**17500**	**186550**

* Including Luxemburg
**10,500 post office branches and 1,200 customer service points
***Puntos Pack®

paazl

Objective of the model

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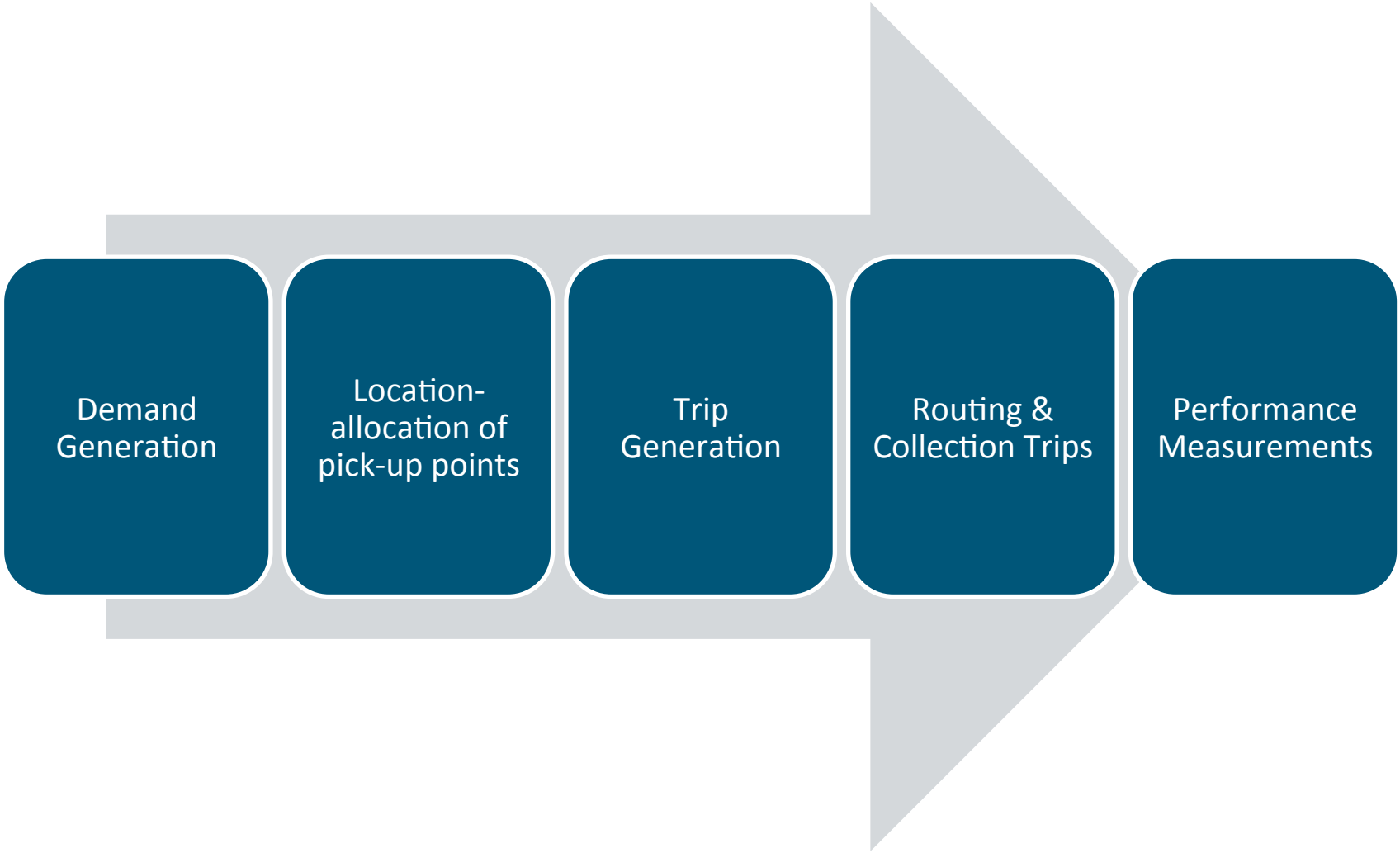
To estimate the effect of the network of pick-up points on the distances travelled associated to the distribution of e-commerce parcels in an urban area.

- Account for distribution and collecting trips
- Disaggregated (milk run)
- Analytical vs Microsimulation

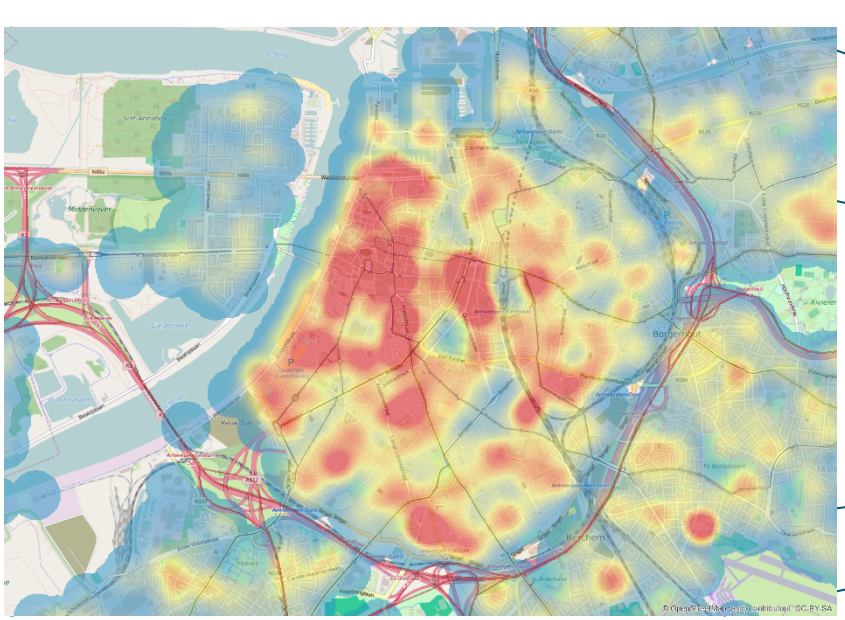
Architecture of the model

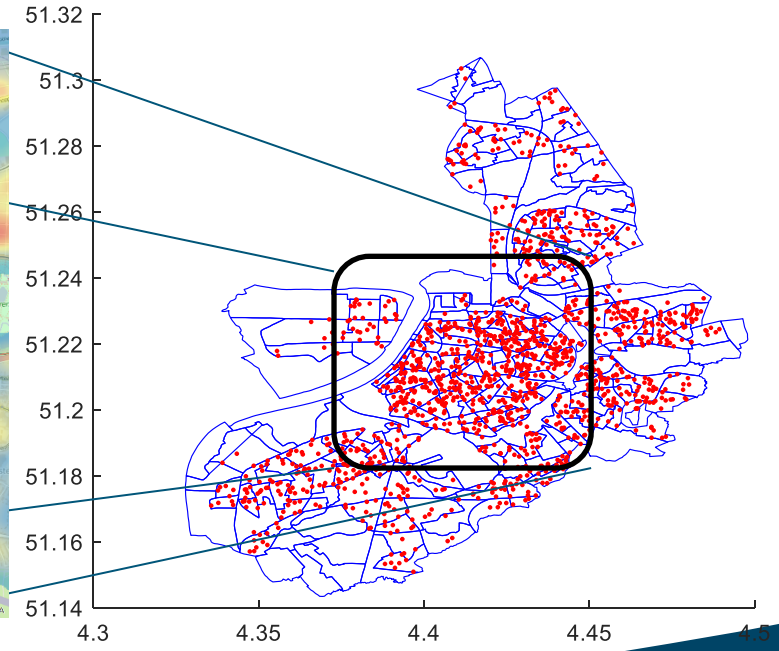


Architecture of the model

Demand Generation

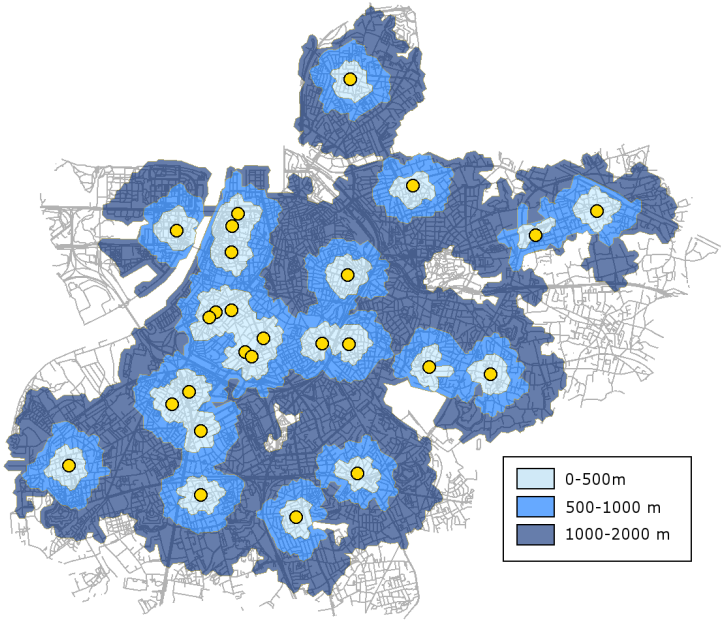
- Data from 2 companies delivering e-commerce for a 100 days period
- Aggregated in cells
  - Since probably local variations are caused by socio economics characteristics, cells with socio-economic data
- Synthetic data disaggregated and distributed randomly on cells





Architecture of the model

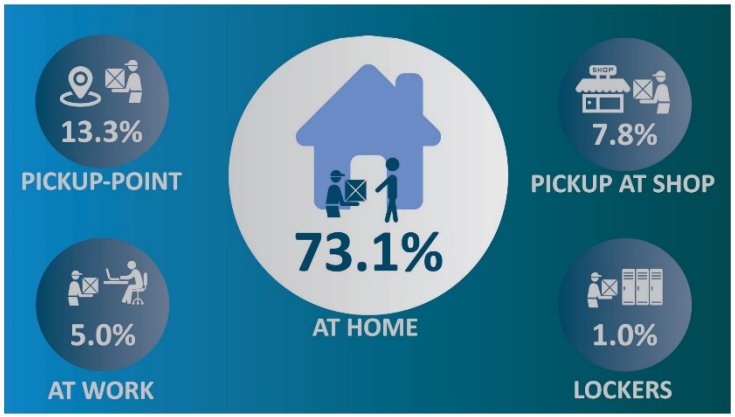
Location-allocation of pick-up points



- Data from pick-up locations of all companies (BIPT)
- Pick-up points are randomly selected to be on use depending of the scenario
- All customers from a given cell must use the closest pick-up point to the centroid of that cell.

Architecture of the model

Trip Generation

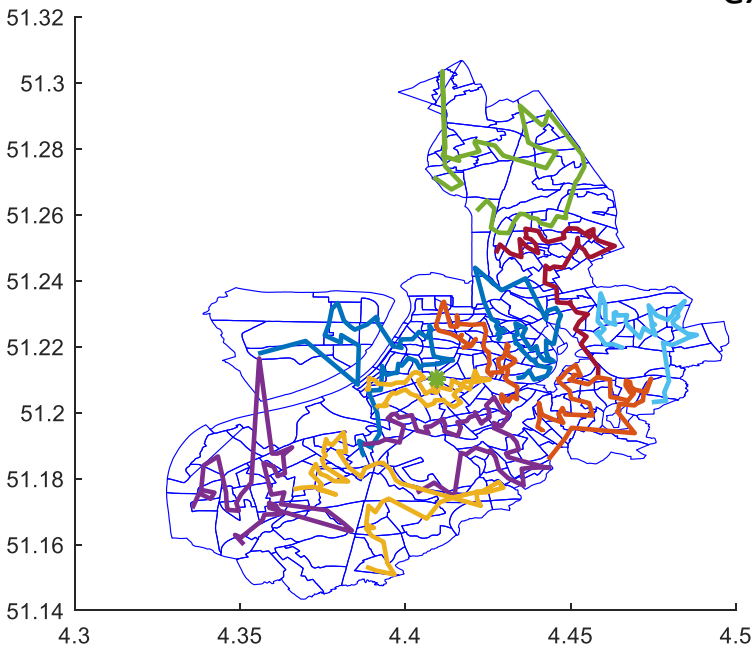


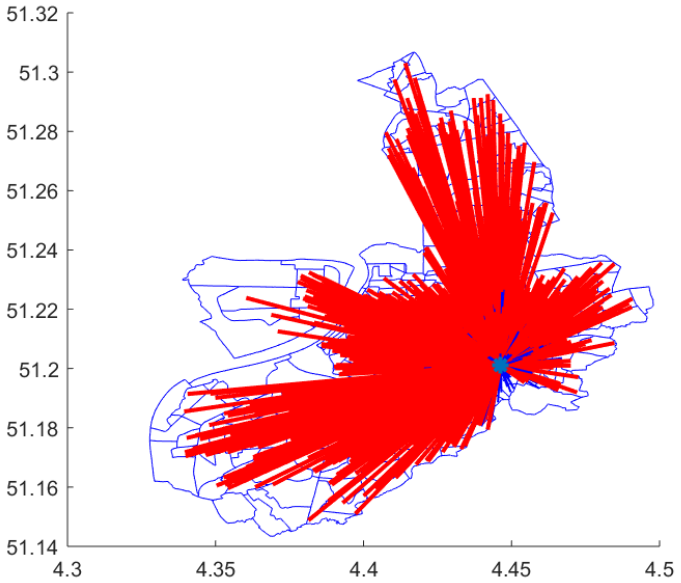
- Following the preferences of customers and the rate of failed deliveries, three types of trips are generated:
  - **Home deliveries**
  - **Pick-up point deliveries**
    - Failed deliveries
    - Pick-up points chosen as preferred location
  - **Personal collecting trips**
    - From failed deliveries
    - From pick-up points chosen as preferred location

Architecture of the model

Routing & Collection Trips

- Clarke and Wright algorithm, inserts pick-up points as part of the route.
- For collecting trips, network distance was calculated from the cell's centroid to the pick-up point. Then, modal choice data for "shopping trips", were converted in an exponential function of the distance.





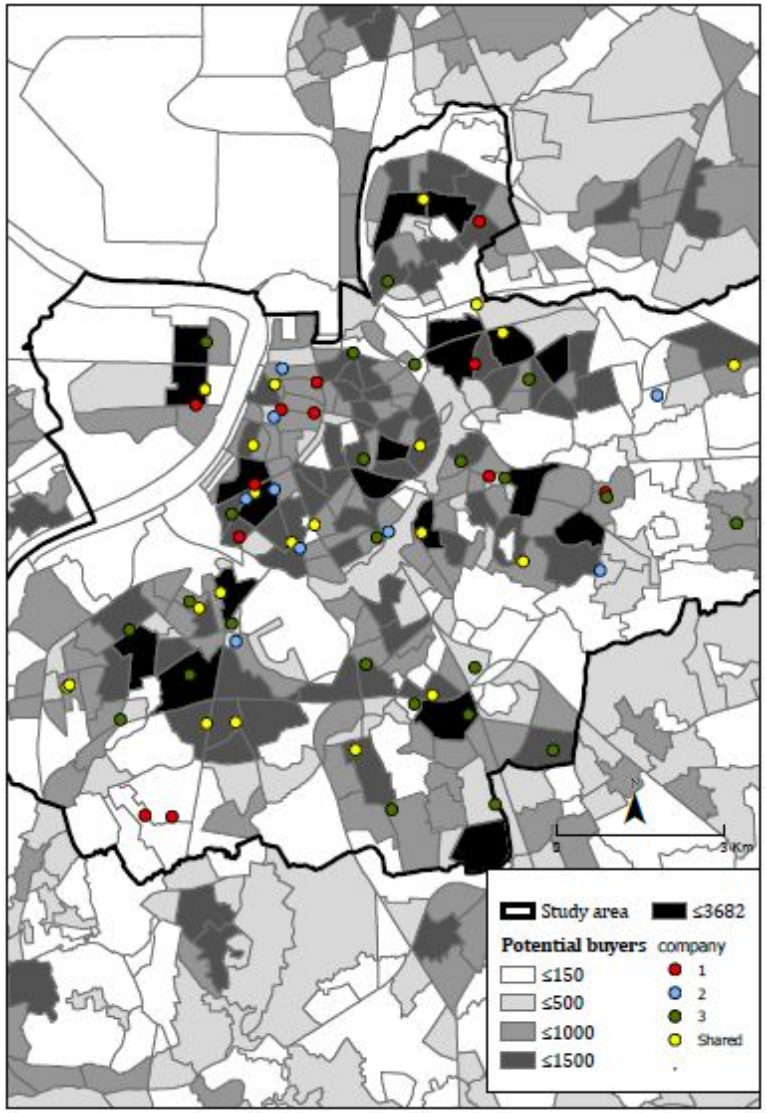
Architecture of the model

- VKT as main indicator.

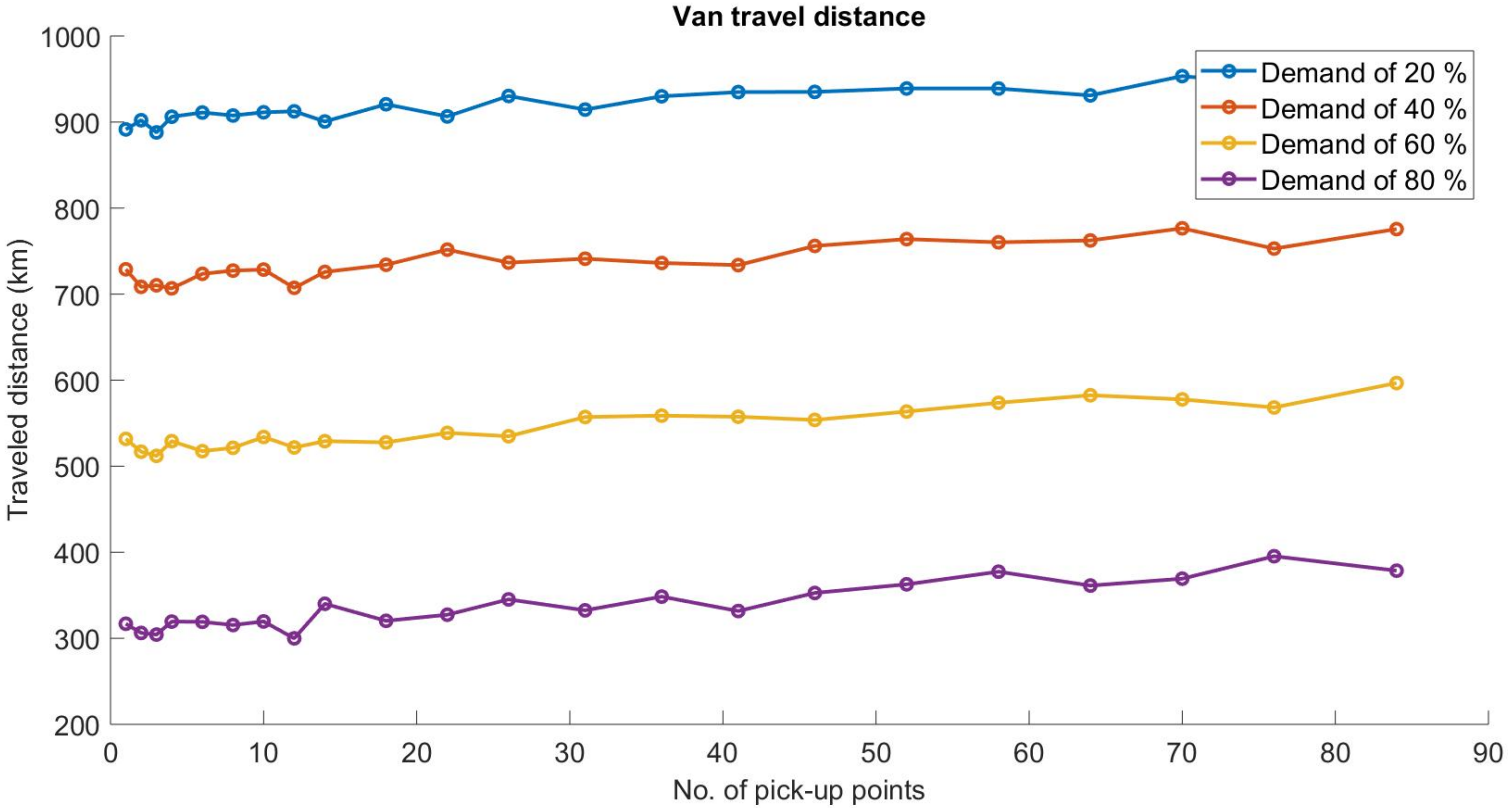
Factors that will influence the total VKT

- Location of pick-up points
- % of usage of the pick-up points
- Density of pick-up points

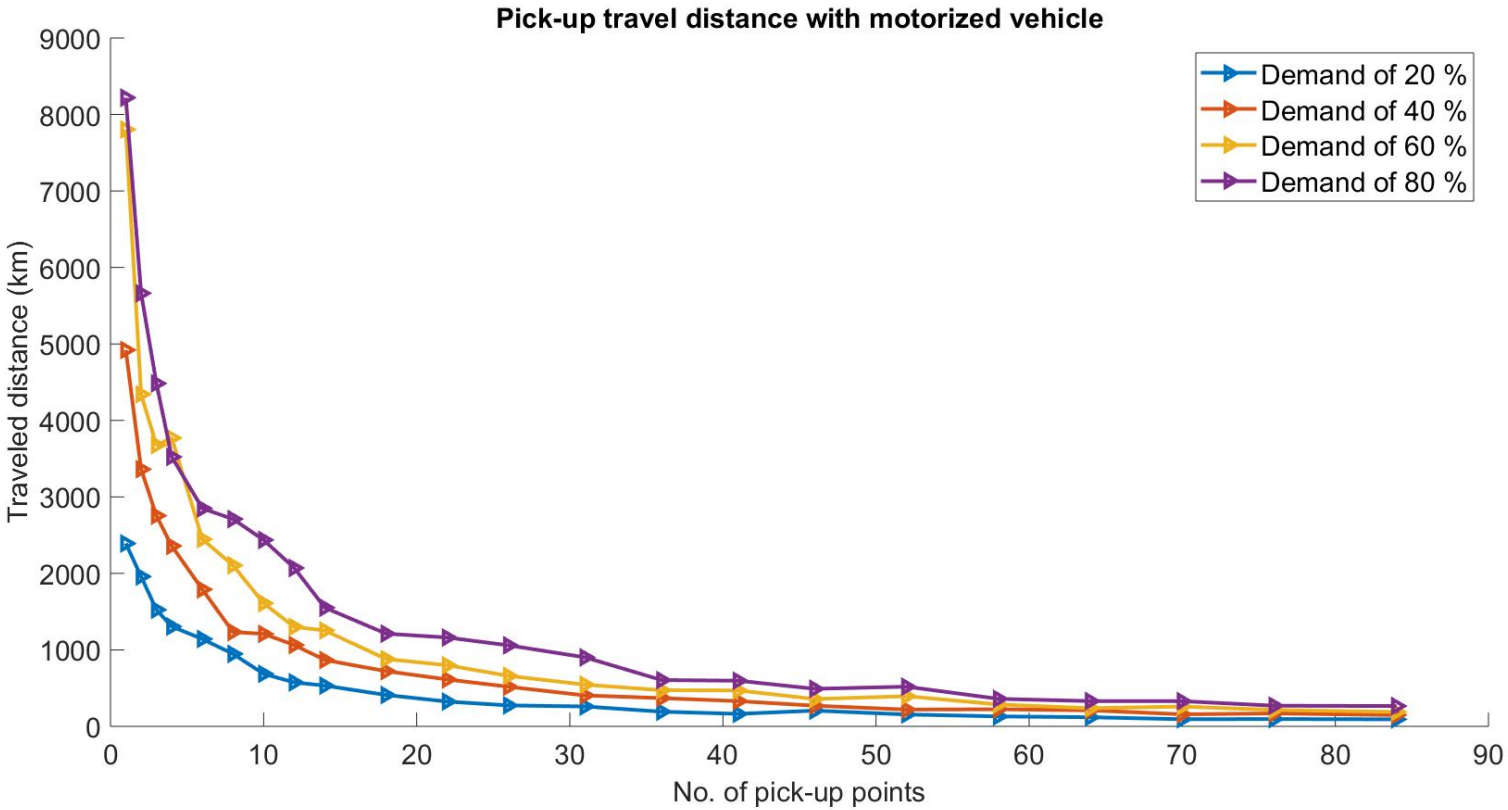
Results


Study area
≤3682
Potential buyers
company
≤150
≤500
≤1000
≤1500
1
2
3
Shared
3 Km

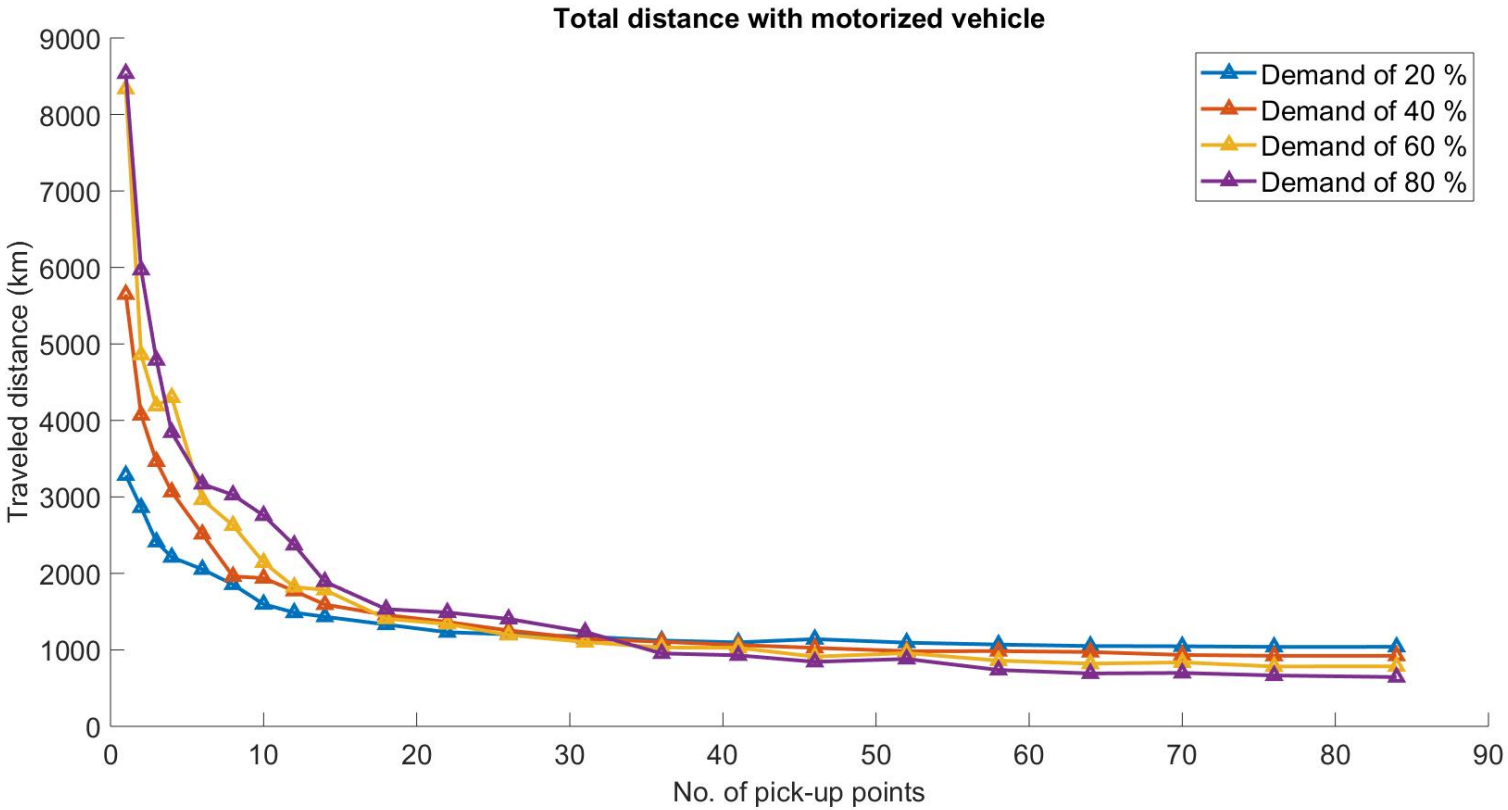
Results


Van travel distance
Traveled distance (km)
No. of pick-up points
Demand of 20 %
Demand of 40 %
Demand of 60 %
Demand of 80 %
1000
900
800
700
600
500
400
300
200
0
10
20
30
40
50
60
70
80
90

Results


Pick-up travel distance with motorized vehicle
Demand of 20 %
Demand of 40 %
Demand of 60 %
Demand of 80 %
Traveled distance (km)
No. of pick-up points
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
0
10
20
30
40
50
60
70
80
90

Results


Total distance with motorized vehicle
Demand of 20 %
Demand of 40 %
Demand of 60 %
Demand of 80 %
Traveled distance (km)
No. of pick-up points
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
0
10
20
30
40
50
60
70
80
90

Conclusions

- Proliferation of pick-up locations is not necessarily translated in a reduction of the net VKT, saturation comes fast.
- A widespread use of pick-up points will certainly have a positive influence on VKT from vans but will have a negative influence on the VKT from the collection trips
- The system is optimized with high adoption and high density but… we are optimizing VKT, the real objective function are the negative externalities, how can we discriminate the negative externalities depending on the affectation level.
- The potential of pick-up points is realized when this **facilities** follow a sustainable logistics planning: are located in strategic points, have a representative market to attend and have a defined service proposition.

Further research

- Sensitivity to mode choice, how distance affect mode choice and how to encourage behavioural change.
- How adoption of pick-up points is associated with the distance? How service level, willingness to pay and general accessibility can influence the adoption.
- Collaboration, impacts of using the same pick-up points by different companies.
- How negative externalities can be mitigated by the logistics infrastructure at the pick-up points (located in strategic places, loading/unloading bays, drop-off using clean vehicles)
- Influence of manned vs unmanned pick-up points on the mode choice.


RICHTING MORGEN
MET WETENSCHAP, TECHNOLOGIE, CREATIVITEIT & INNOVATIE
Vlaanderen In Actie Pact 2020
Vlaanderen is innovatie
Thank you for your attention!
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