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UNIVERSIDADE D COIMBRA

Assessing the Shared Automated Vehicles' fleet size using flow optimization in an interurban demand context

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Driving2Driverless

Cofinanciado por:

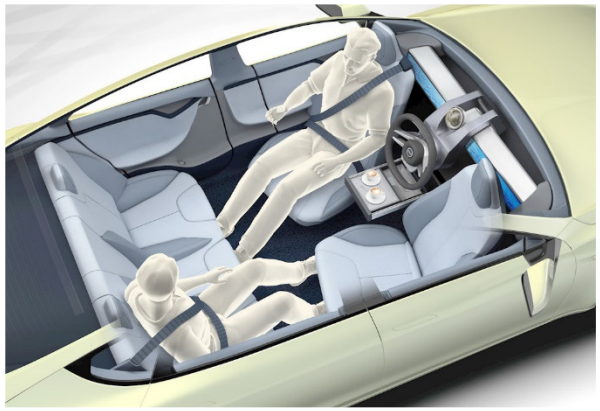
COMPETE 2020 PORTUGAL 2020 UNIÃO EUROPEIA Fundo Europeu de Desenvolvimento Regional

10.02.2020

17th GET Meeting

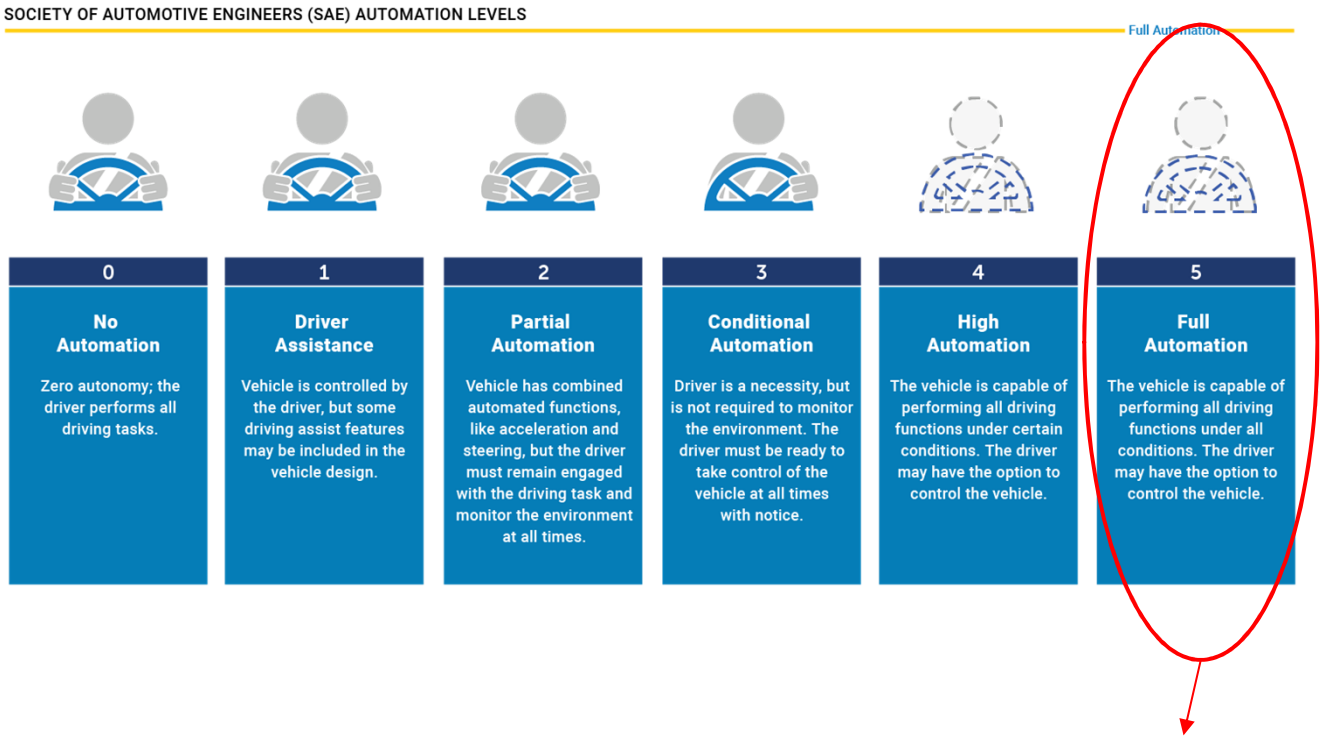
Outline

- Introduction
- Flow optimization model
- Case study
- Results
- Closing remarks



Introduction

- Automation is becoming part of driving



Driverless vehicles (autonomous - AV)

SAV- Shared Automated Vehicles

- SAV has been studied in urban contexts;

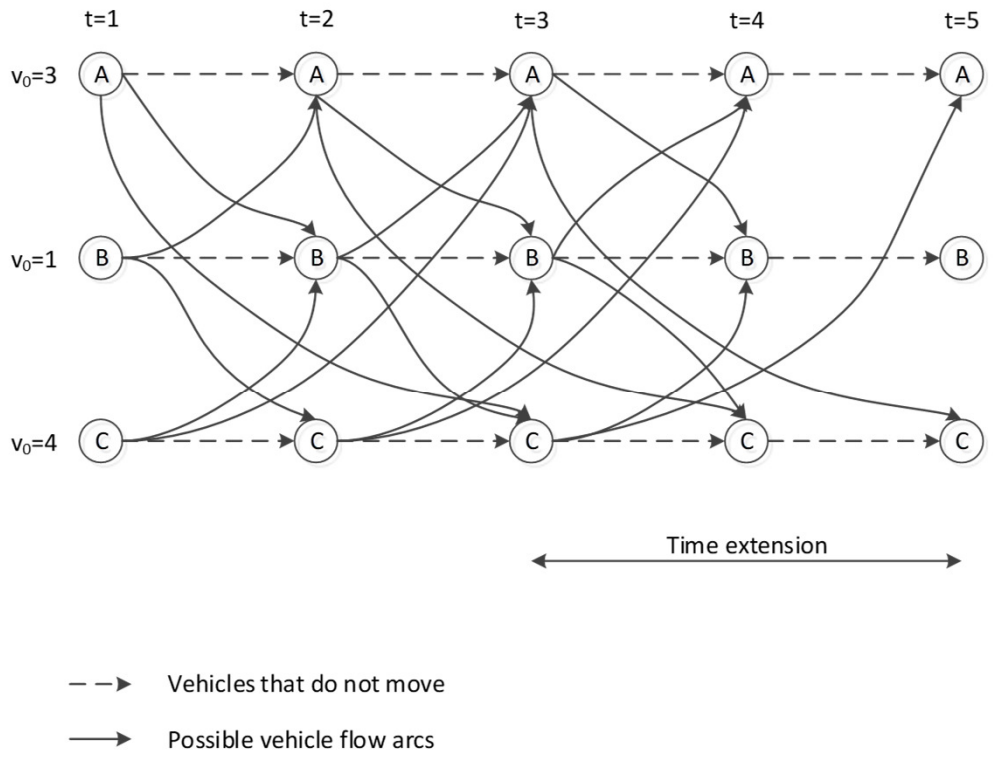
What about
Heterogeneous regions
or low density areas?

- SAV service can Improve access to mobibilty for those living in less dense areas;

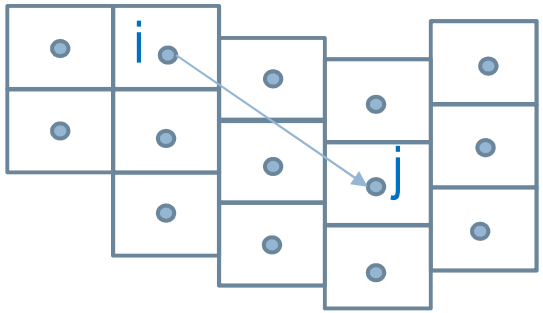
- Modeling can be simplified from routing to flow optimization

Flow optimization model

- A time-space network;
- Nodes = zones, Edges = flows;
- Vehicles can relocate;



Flow optimization model



- Travel time includes pick up and delivery – movement of clients

Flow optimization model

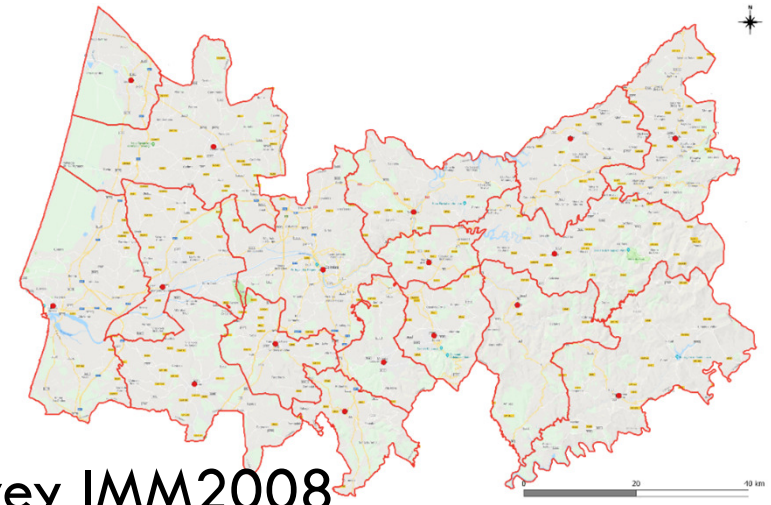
- Objective Function:

Maximize profit = revenues (price) – costs (moving, depreciation)

- Constraints:

1) Conservation of flows;
2) # of passengers do not overpass vehicle capacity;
3) # and position of vehicles at t=0;
4) Turn on-off zones worth to explore.

Case study



- Coimbra district
  (17 municipalities)

- Demand gathered from survey IMM2008
  total intermunicipal trips: 100522
  average distance: 32.5 km;
  average speed ≈ 60km/h;

Service price: 0.10€/km

- Diferent demand values
- Two types of vehicles

	Car	Minibus
Seat capacity	4	16
Vehicle daily cost (€)	20	50
Battery capacity (kWh)	52	91
Energy consumption (kWh/100km)	20	36
Running cost (€/100km)	4	7

Scenarios

1) A fleet of cars (4 seats capacity)

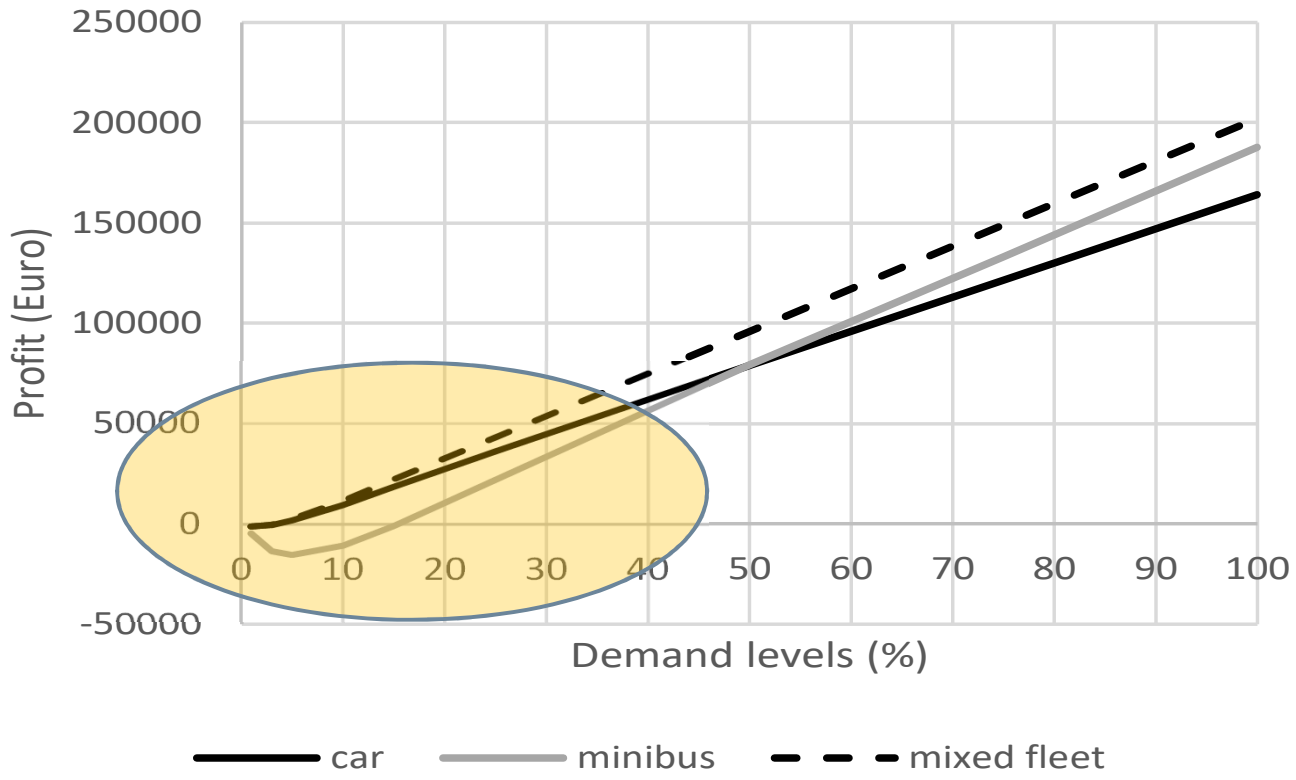
2) A fleet of minibus (16 seats capacity)

3) Mixed fleet (cars+minibuses)

Results - profit

- Maximum profit for mixed fleet serving all municipalities

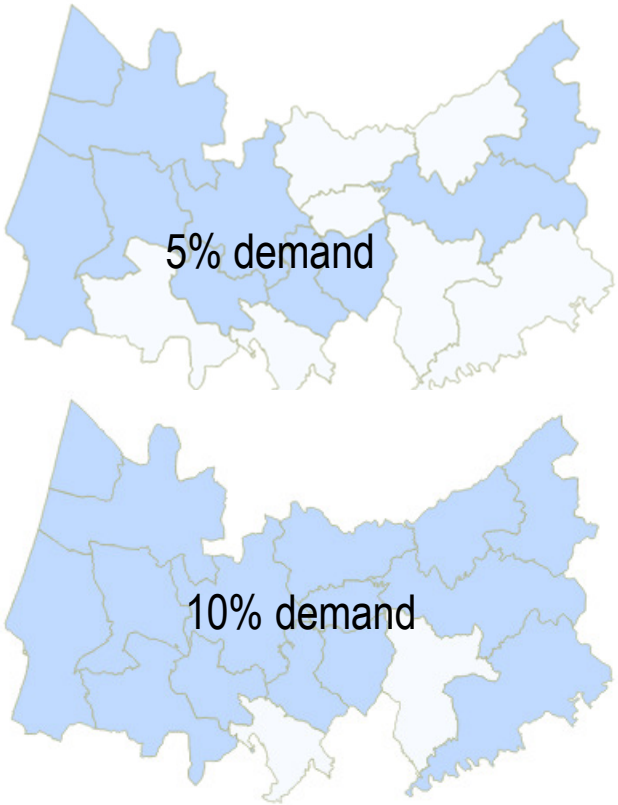
202 k€ (23% ↗ car fleet, 14% ↗ minibus fleet)



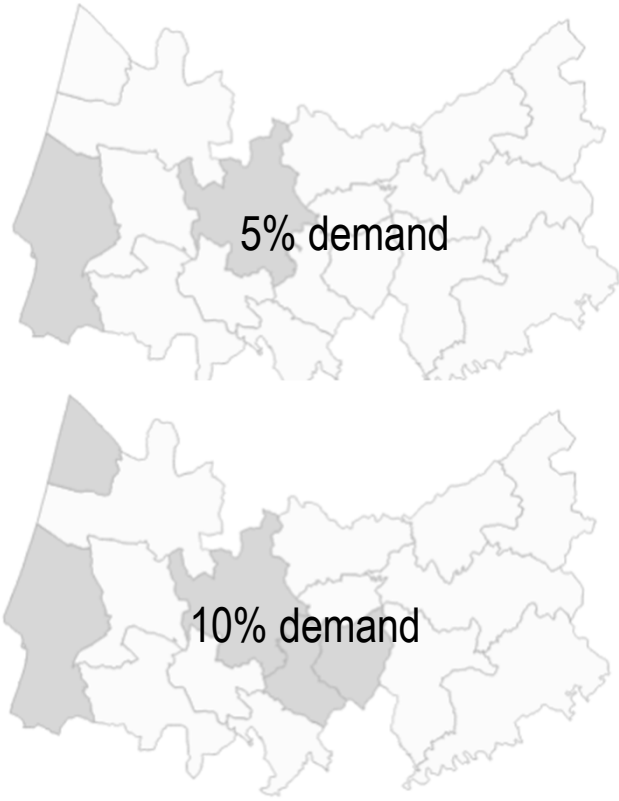
Results - Turn on-off municipalities

- Improve profit for low demand levels

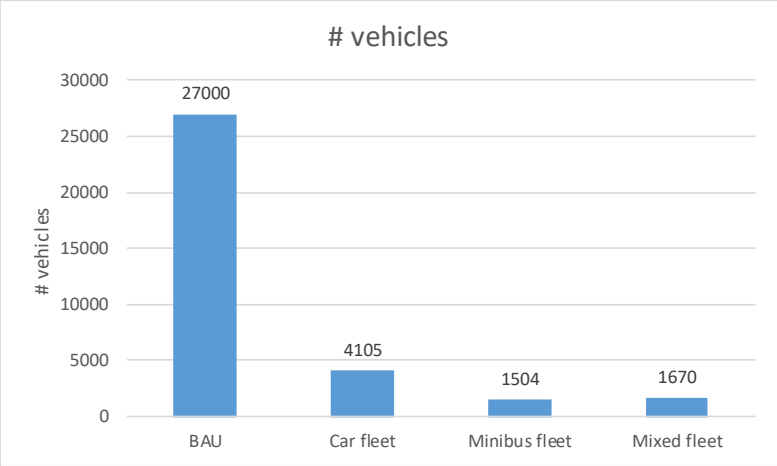
Car fleet

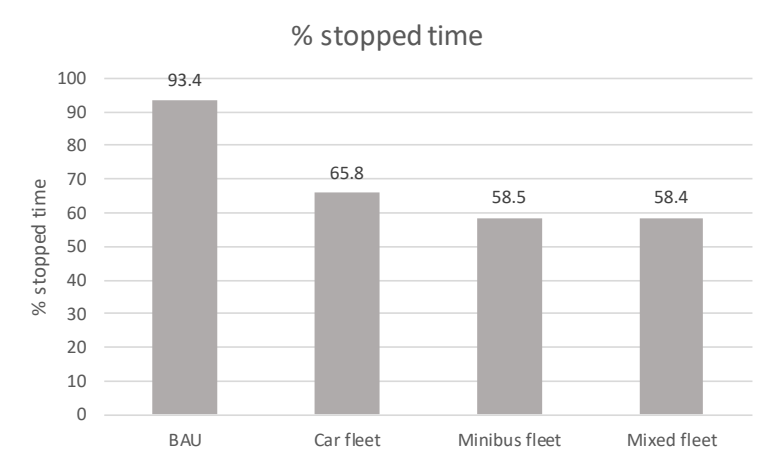


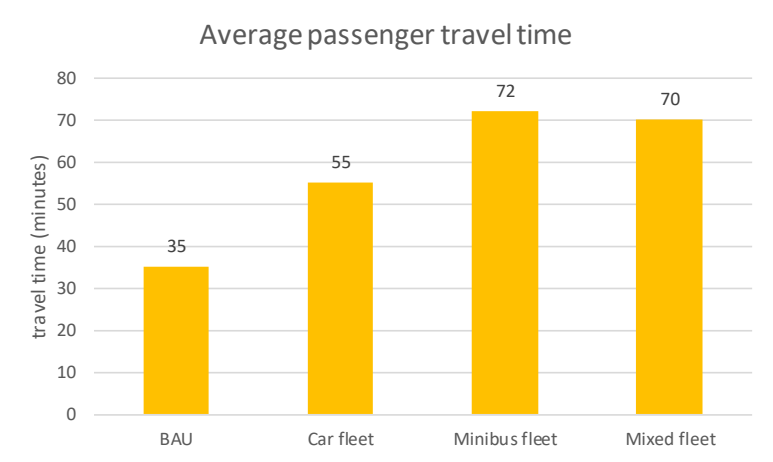
Minibus fleet



Results – comparison with BAU

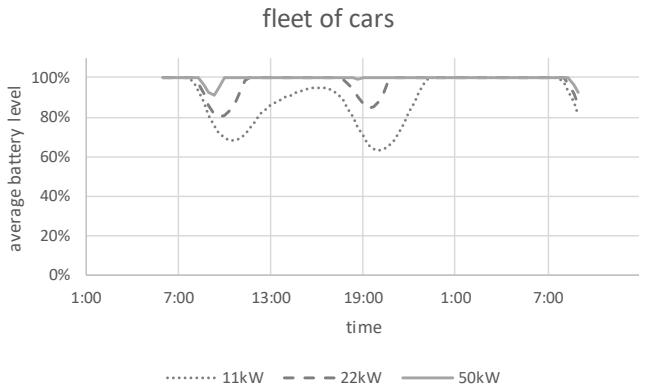


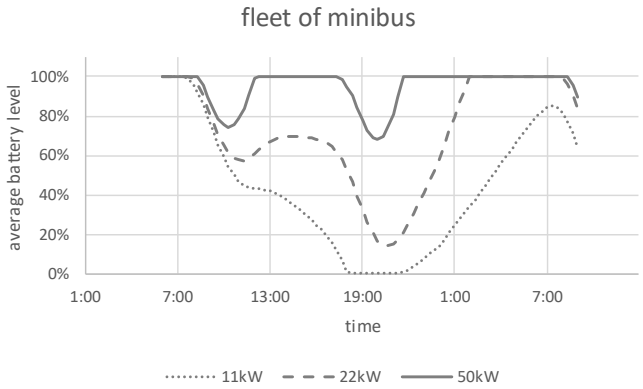


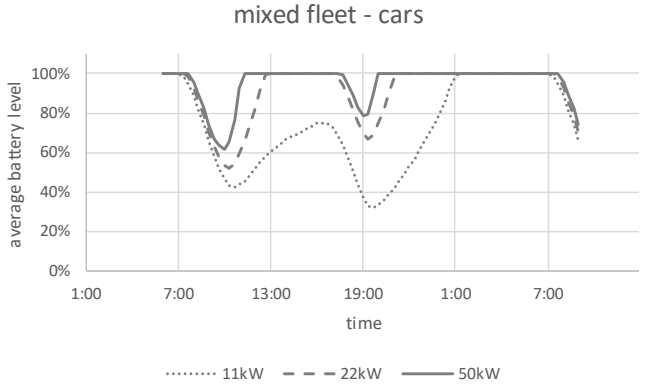


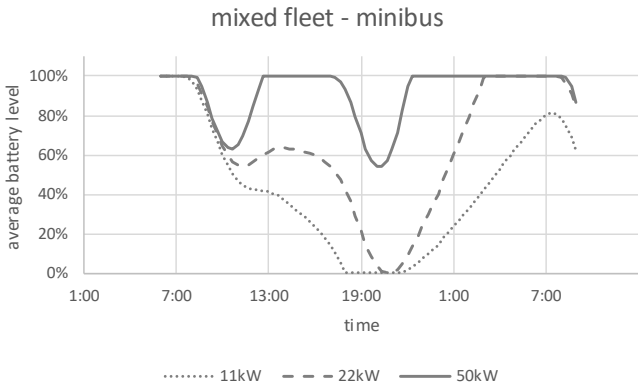
Results – electric charger type

- Important for validation









Closing remarks

- MIP model to estimate the fleet size and potential profit;
- Fast converging to optimal solution;
- Aplicable to large scale systems.

Next steps:

- Expand the analysis to the region of Aveiro;
- Develop a model to define location of chargers;
- Build an agent-based simulator.

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