European Commission

Estimation of environmental and societal impact of new mobility services deployment

EIDEIC 2022

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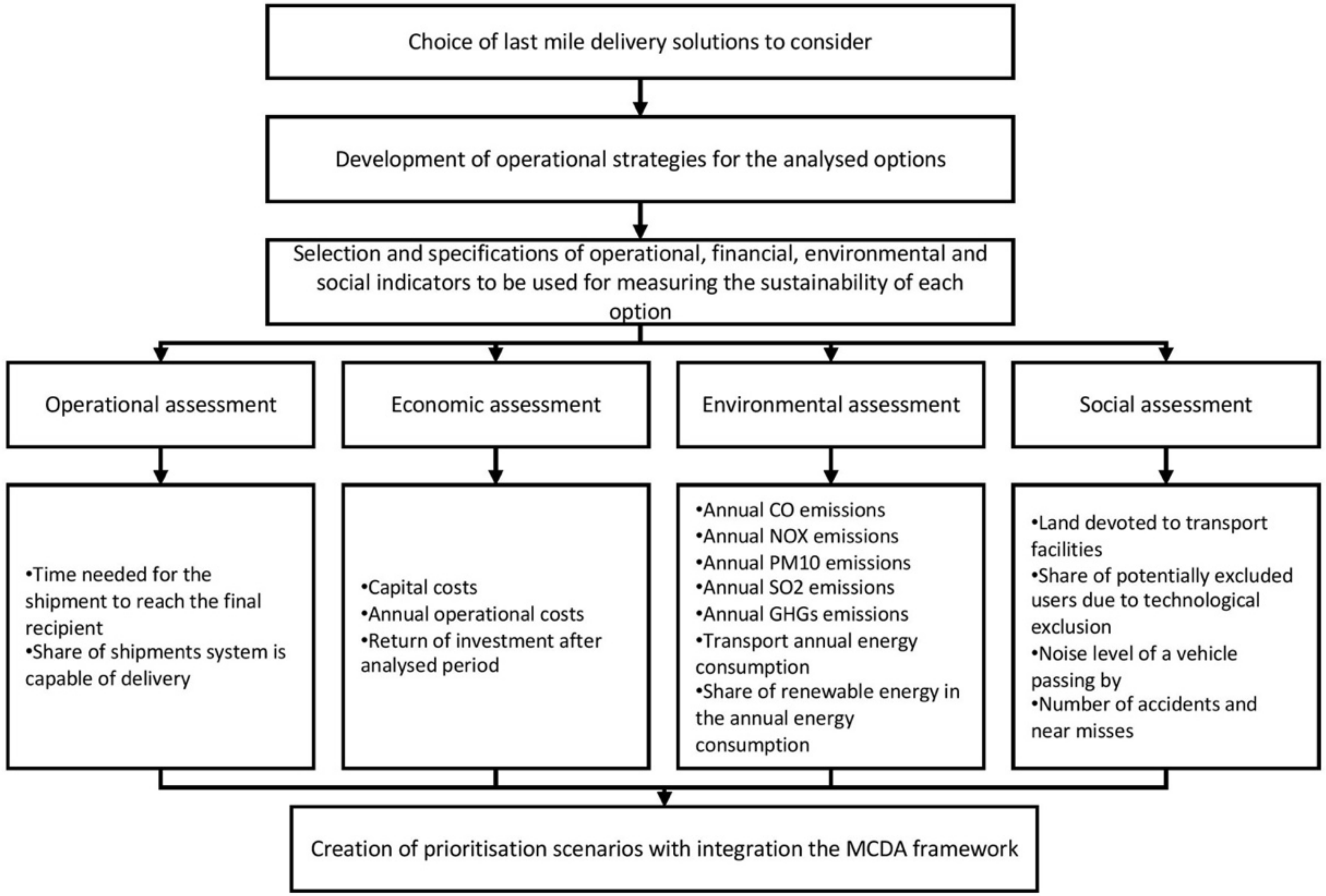
#LIVINGLABS4POLICY

Joint Research Centre

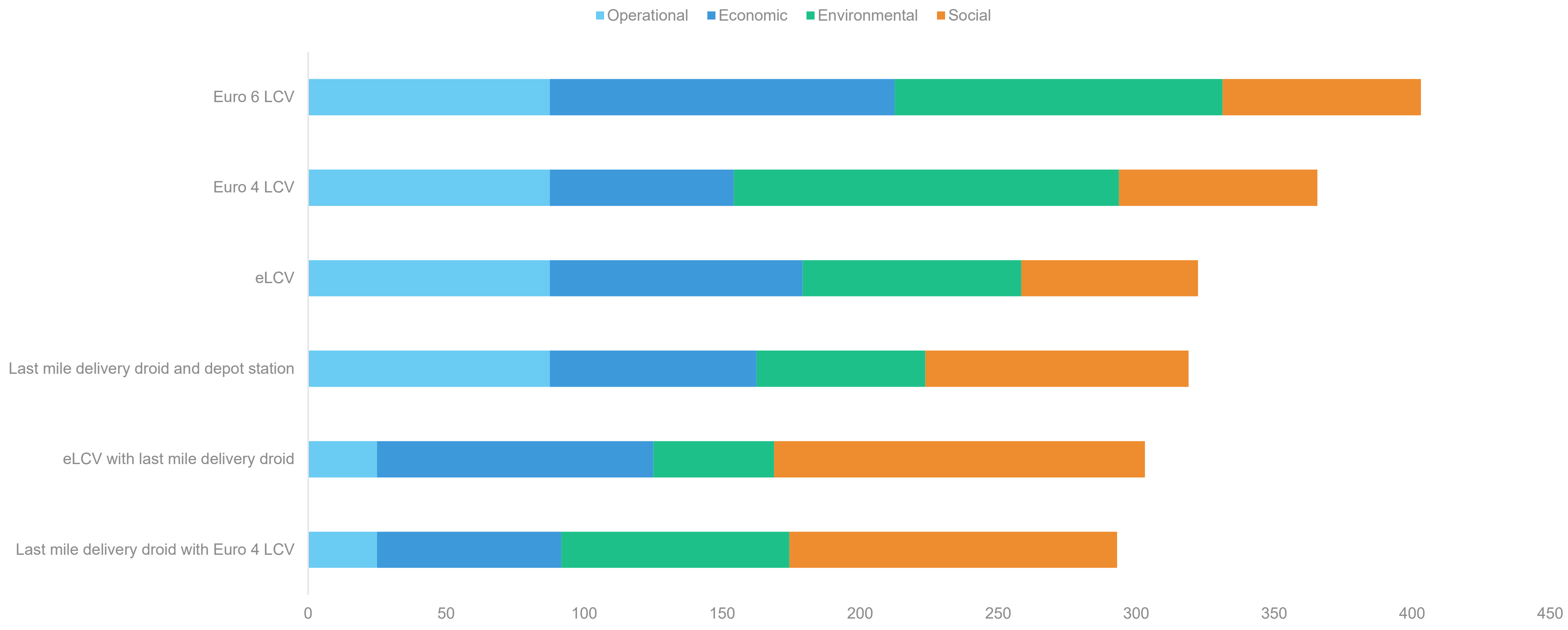
Introduction

- Collaborative Doctoral Partnership between the Joint Research Centre of European Commission and University of Cantabria
- Working with innovation in mobility at the Future Mobility Solutions Living Lab (FMS-LL)
- Focus on environmental and social impact of new mobility services tested at the FMS-LL
- Beginning of the PhD in Q1 2020
- Projected defence date Q4 2022

Impact of on-demand autonomous droids



Impact of on-demand autonomous droids



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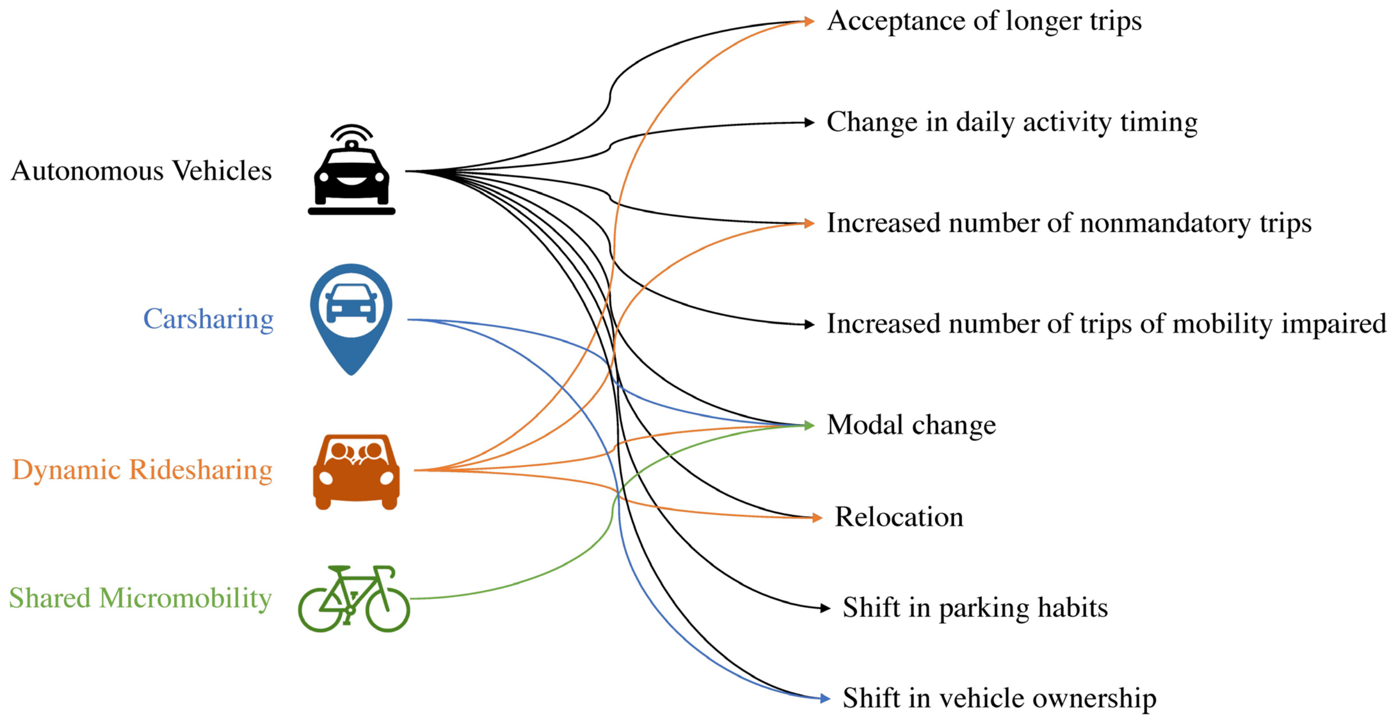
Impact of on-demand autonomous droids

- Even with **a marginal consideration of social and environmental factors**, the carbon-intensive combustion engine **LCVs did not outperform the electric innovations**
- Delivery droid-based systems could **reduce the electricity consumption and following emissions**, while **lowering the investment cost** as compared to an eLCV.
- The system that is based on delivery droids also has its **shortcomings**, namely the **limited cargo** space and **low maximum weight** of the parcel, **unproven safety** record and the plausible **marginalisation of digitally excluded**.
- There is a need to **establish the safety** of the droid through implementation on a testing ground, preferably **within living lab**, in which participants are already using innovation. Guaranteed safety of the droid would significantly improve the scores.

Impact of autonomous vehicles

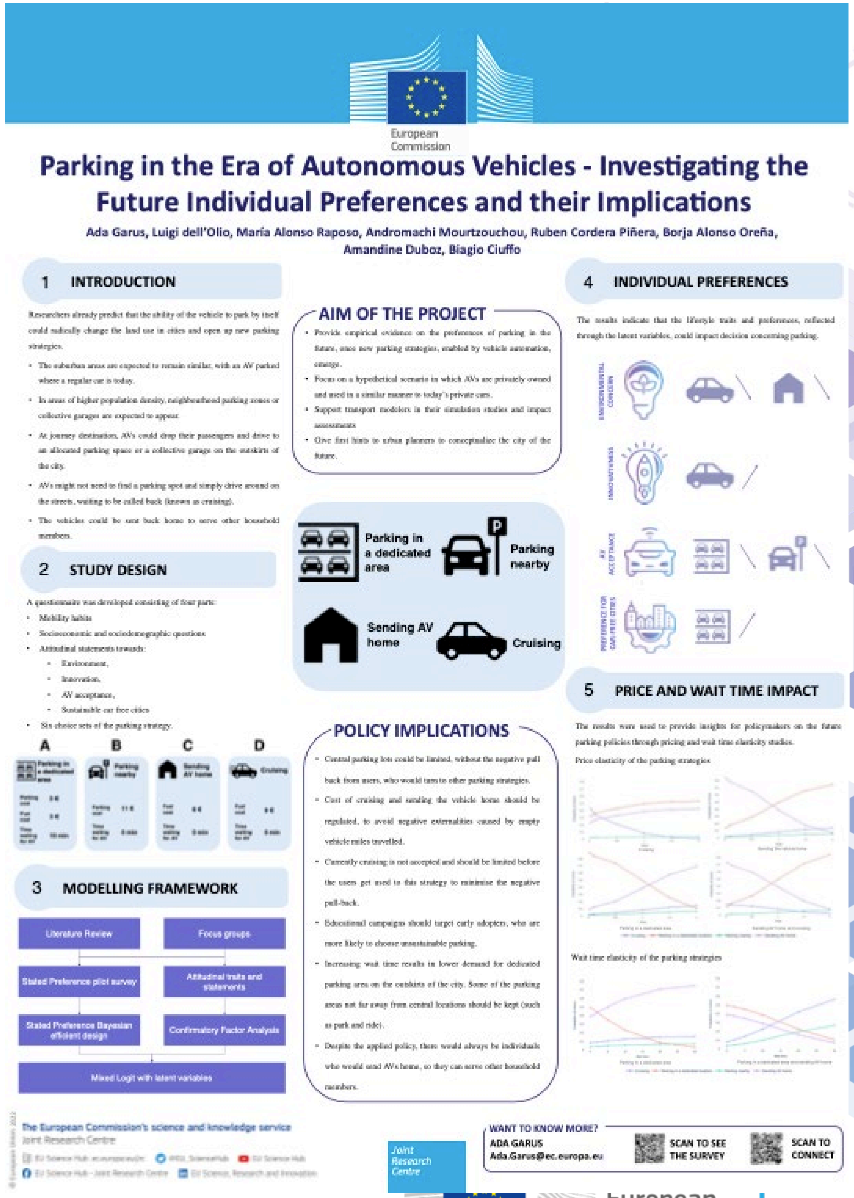
- Systematic literature reviews study with pending publication focusing on classification of behaviour changes that could occur due to vehicle automation.

- Technical overview of possible models and tools to use and complementary courses required to better comprehend the field.



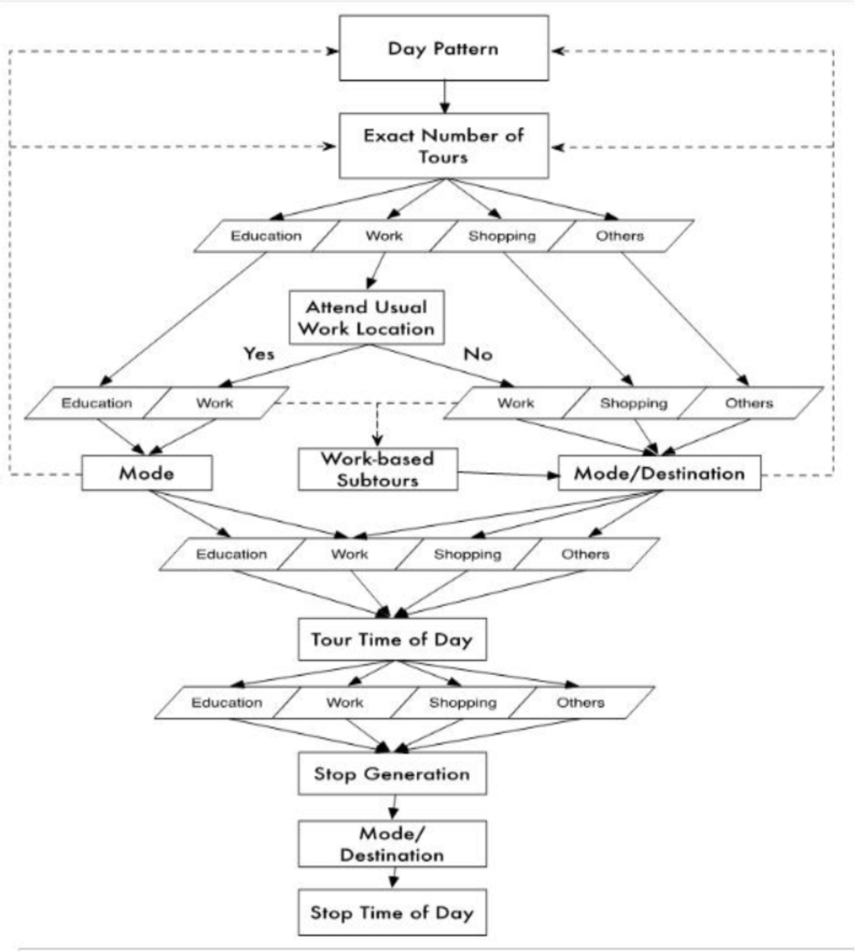
Impact of autonomous vehicles

- Design, implementation and analysis of mixed logit stated preference survey on the parking preference of private AVs considering four alternatives: on-street parking nearby, dedicated garage on the outskirt of a city, sending the vehicle back home and cruising. Considered attributes: parking cost, fuel cost (environmental proxy), waiting time.
- Aiming to:
  - Provide empirical evidence on the preferences of parking in the future, once new parking strategies, enabled by vehicle automation, emerge.
  - Focus on a hypothetical scenario in which AVs are privately owned and used in a similar manner to today’s private cars.
  - Support transport modelers in their simulation studies and impact assessments
  - Give first hints to urban planners to conceptualize the city of the future.



Impact of autonomous vehicles

- Implementation of identified behavioural changes into the Activity Based Model (state of the art framework used for transportation demand modelling) that constitutes of synthetic population and a chain of travel choice models.
- Synthetic population of Santander created using Variational Autoencoder and data provided by UNICAN.
- Travel choice models estimated using biogeme and travel diaries of Santander population.
- Travel demand simulated using an MIT state of the art SimMobility software.
- Travel supply simulated using Aimsun Next combined with Aimsun Ride plug-in.
- Data prepared and analysed using python and its numerous libraries.



Scientific impact

Publications:

- Last-mile delivery by automated droids. Sustainability assessment on a real-world case study, Sustainable cities and society (2022)
- JRC Future Mobility Solutions Living Lab (FMS-Lab): conceptual framework, state of play and way forward, European Commission Report (2021)

Work pending publication:

- Impact of New Mobility Solutions on travel behaviour and its incorporation into travel demand models, Journal of Advanced Transportation
- Parking in the Era of Autonomous Vehicles - Investigating the Future Individual Preferences and their Implications, Transportation Research: Part A

Conferences and seminars:

- Parking in the Era of Autonomous Vehicles - Investigating the Future Individual Preferences and their Implications, Transportation Research Board Annual Meeting (2022)
- Sustainability assessment of last mile delivery droids for postal services at JRC Ispra, The Joint Research Centre seminar (2022)

Thank you!

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BACK-UP

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Impact of on-demand autonomous droids

Dimension	Objective	Indicator	Euro 4 LCV	Euro 6 LCV	eLCV	eLCV + last mile delivery droid	Last mile delivery droid + Euro 4 LCV	Last mile delivery droid + depot station
Operational	Quality of service	Time needed for the shipment to reach the final recipient	2-3 days	2-3 days	2-3 days	0-1 day	0-1 day	0-1 day
		Share of door-to-door deliveries	100%	100%	100%	100%	100%	95%
Economic	Economic productivity	Capital costs [€]	-	32 000	38 000	42 535	13 605	23 605
		First year operational costs [€]	2 834	1 645	822	817	927	834
		Return of investment after analysed period	0%	18%	25%	23%	67%	41%
Environmental	Air pollution prevention	Annual CO emissions [g]	309,50	132,81	0,22	0,12	0,58	0,69
		Annual NOX emissions [g]	419,31	259,43	0,52	0,29	21,62	51
		Annual PM10 emissions [g]	132,09	8,03	0,007	0,004	13,30	42,46
		Annual SO_x emissions [g]	2,06	1,94	48,17	26,88	9,84	10,05
	Climate stability	Annual GHG emissions [g]	2 544 244	2 394 075	1 146 159	639 492	480 975	409 989
	Energy efficiency	Transport annual energy consumption [kWh]	8 604	8 093	2 373	1 324	1 331	1 216
		Share of renewable energy in the annual energy consumption	0%	0%	33%	33%	12%	13%
Social	Community development	Land devoted to transport facilities [m2]	20	20	20	30	30	10
	Equity	Share of potentially excluded users due to technological exclusion	No	No	No	Yes	Yes	Yes
	Noise minimisation	Noise level of a vehicle passing by [db]	74	74	70	66	65	66
	Safety and security	Number of accidents and near misses	0	0	0	ND	ND	ND