



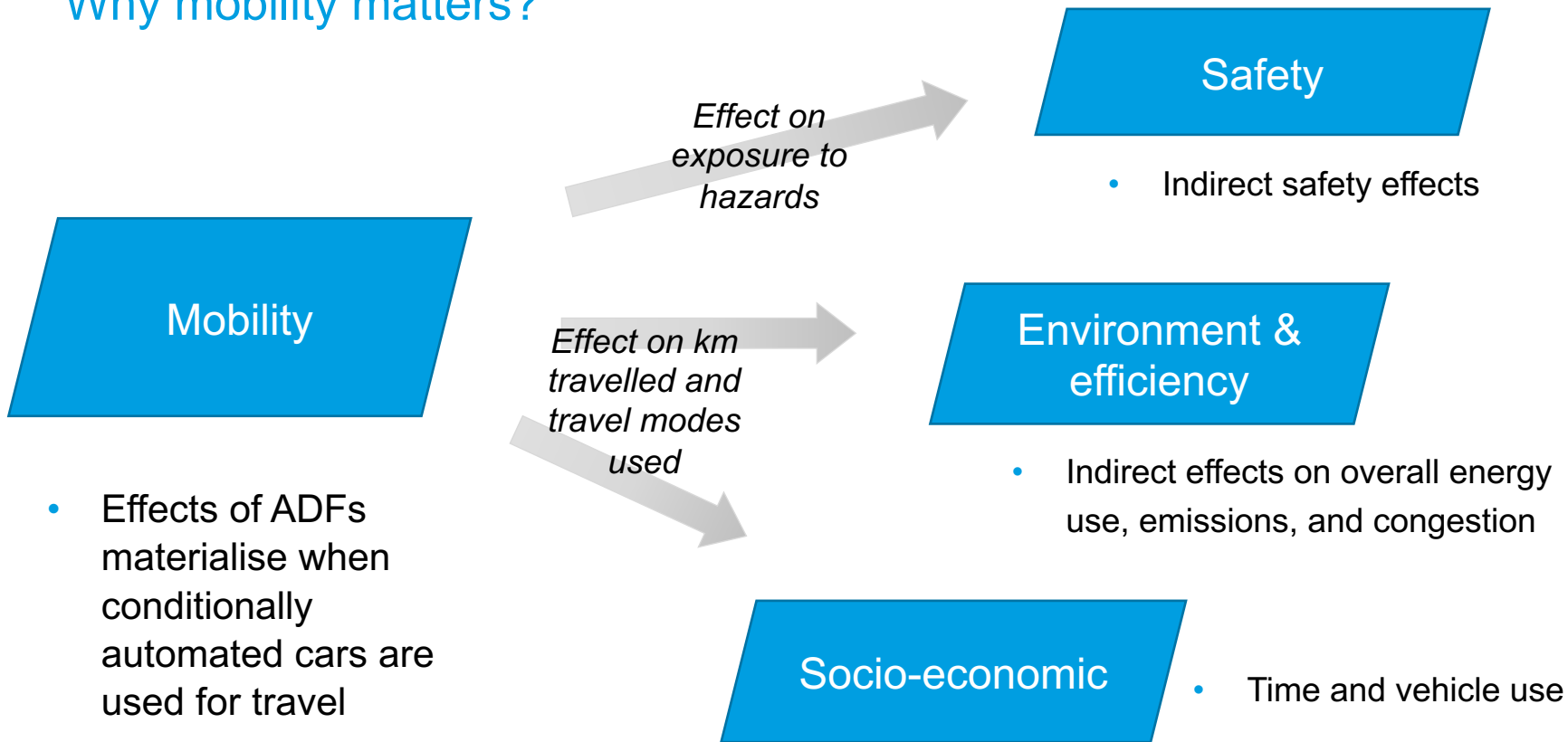
Mobility Impact Assessment

L3Pilot Final Event

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VTT



Why mobility matters?



Mobility impact assessment in L3Pilot

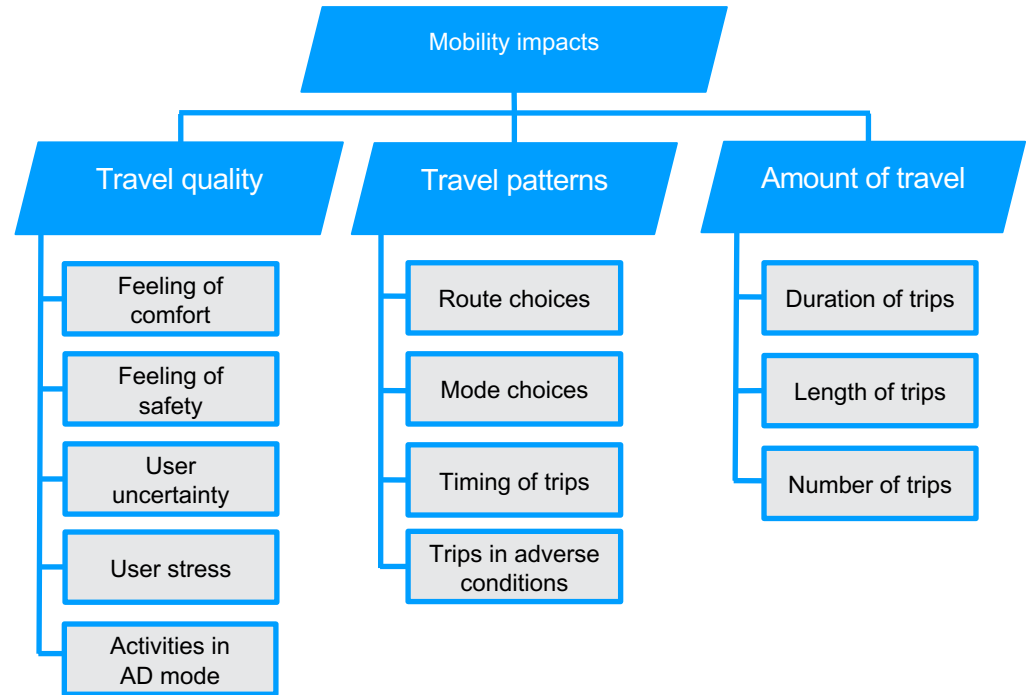
- Goal was to identify **mechanisms** and **possible outcomes** for mobility change
- L3Pilot is unique: It has data from the **general public** and **pilot site participants**, who had first-hand experience with automated driving

General public

Pilot sites

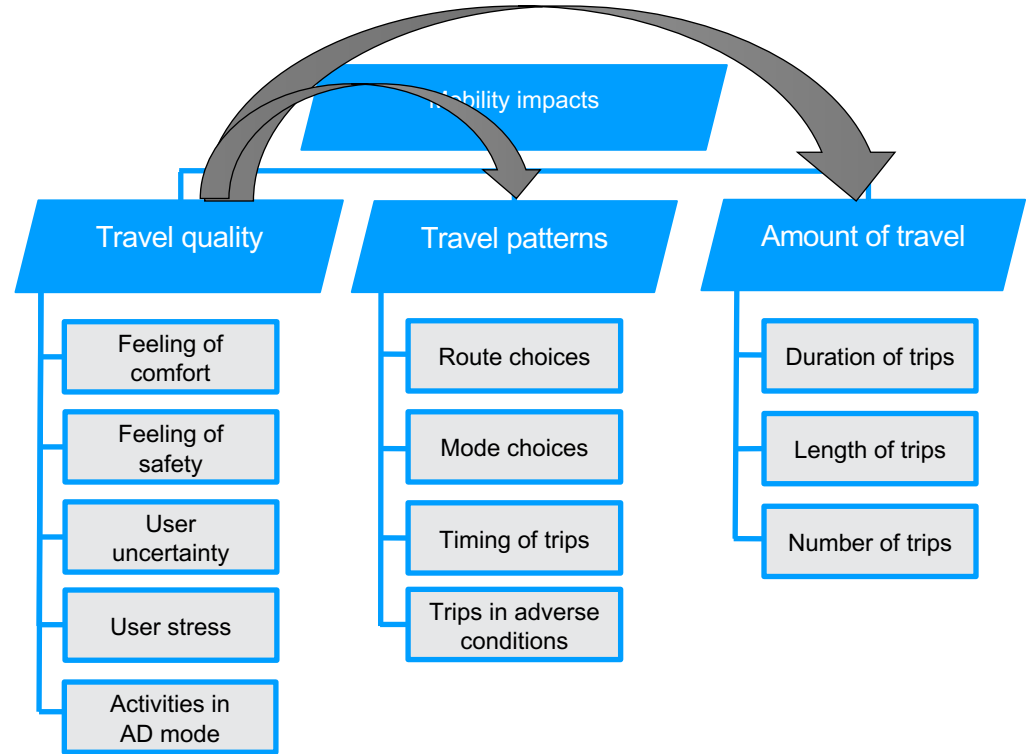
Research questions and framework

- What is the impact of ADFs on quality of travel?
- What is the impact of ADFs on travel patterns?
- What is the impact of ADFs on amount of travel?



Research hypotheses

- Use of conditional automate cars will change travel quality
- Changes in travel quality influence travel patterns and amount of travel



Main data sources

- **Pilot site data – views of pilot participants**
 - User questionnaires from the pilot sites and from the WIVW simulator study
 - Focus groups providing further insights
- **Survey data – views of the general public**
 - Impact assessment survey (n = 8,432 within Europe during 2021)
 - User and acceptance survey (= Annual survey) (n = 9,118 within Europe during 2019–2021)

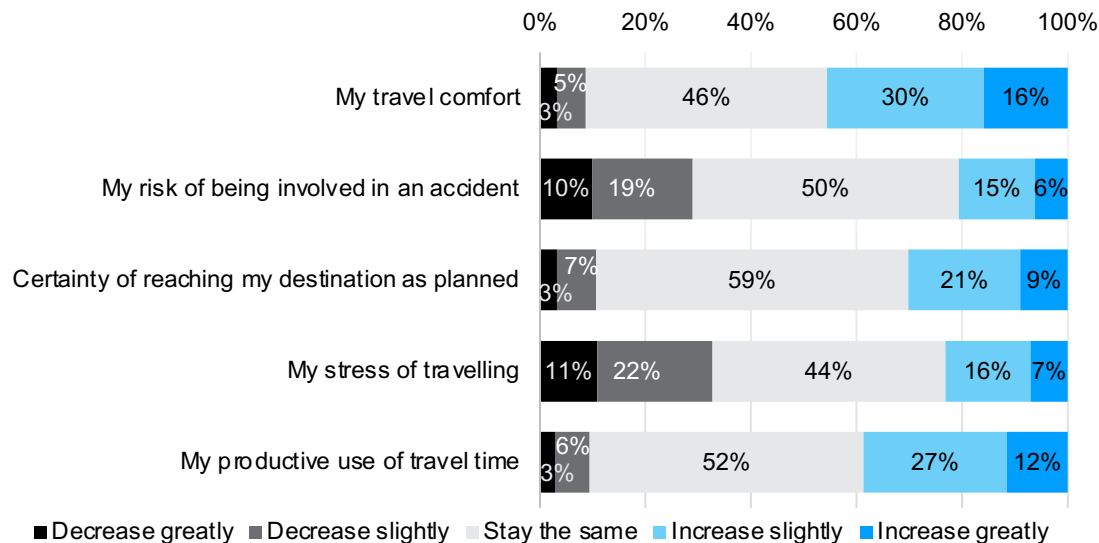


Quality of travel

Impact assessment survey – expectations

- Respondents expected that conditionally automated cars will have neutral to positive impact on the quality of travel

Q: Considering your travel behaviour described in the previous questions, how do you think conditionally automated cars would affect it?



Impact assessment survey – activities

- Respondents are willing to engage in non-driving related activities, especially leisure activities
- Similar results in the L3Pilot use and acceptance survey: 42% of the respondents would like to use the time for secondary activities

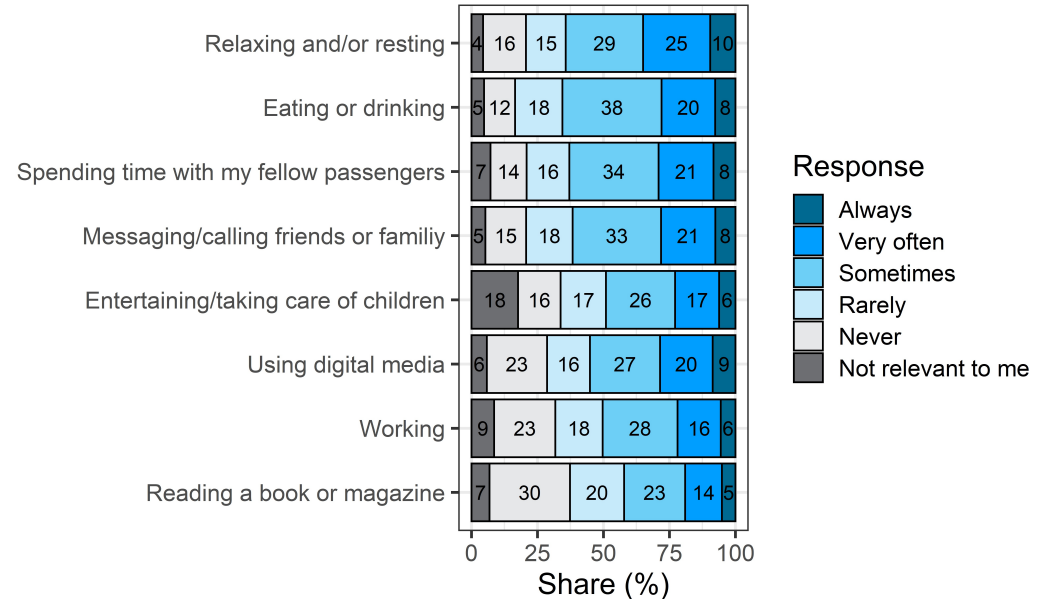


Figure. Activities the respondent would like to perform when driving in an automated mode with ADFs (n=8432).

Pilot sites – participants’ views

- ADF experience was mostly positive
 - *Predictability of ADF*
 - *Trust in ADF*
 - *Low workload of ADF*
 - van der Laan’s *Satisfying* and *Usefulness* scales
- Also pilot site participants were willing to engage in activities when driving in AD mode

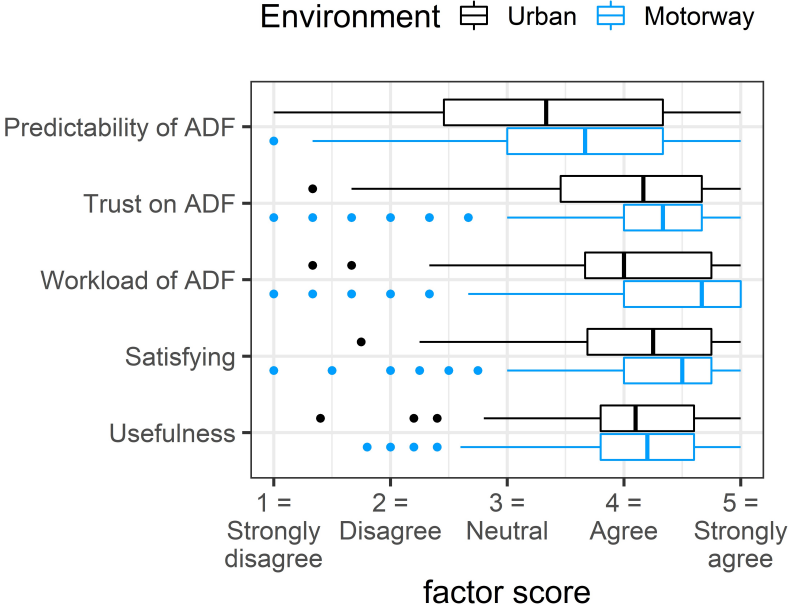


Figure. Boxplots for the travel quality factors in the pilot site questionnaire (n=262 motorway, n=137 urban).



Travel patterns

Impact assessment survey – expectations

- Personal car use may increase, and public transport use decrease

Q: Considering your travel behaviour described in the previous questions, how do you think conditionally automated cars would affect it?

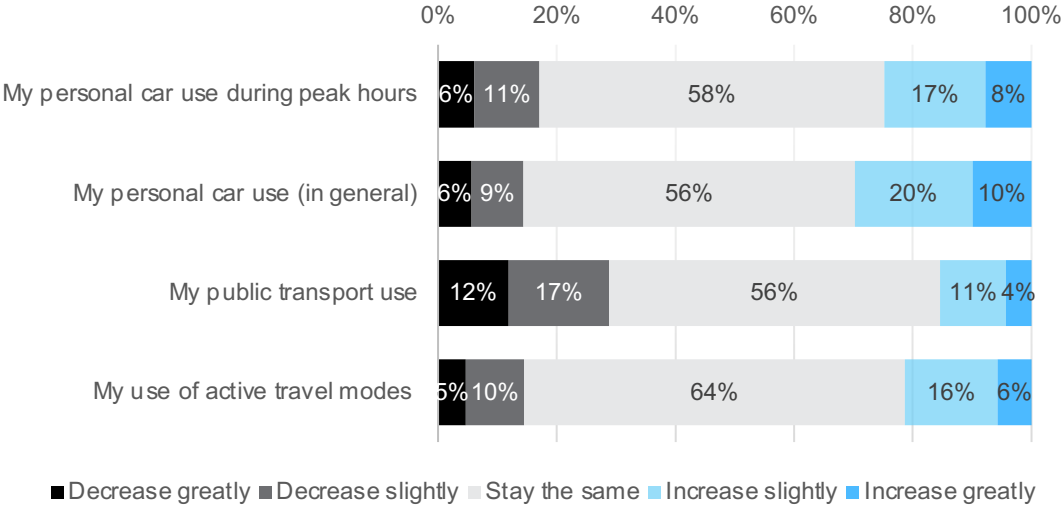
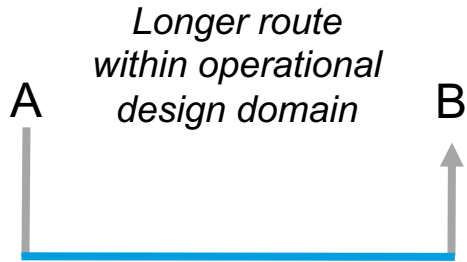


Figure: Expected impacts on travel patterns based on L3Pilot's impact assessment survey (n=8432).

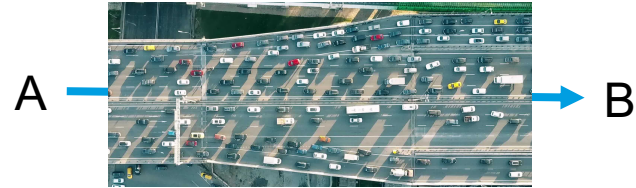
Additional time accepted

- Survey respondents and pilot site participants were asked if they would accept additional travel time in two scenarios: longer route and congestion

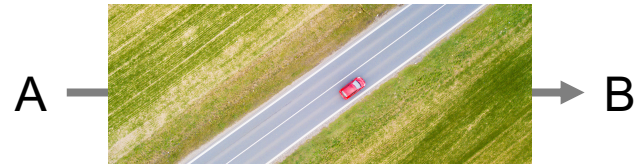
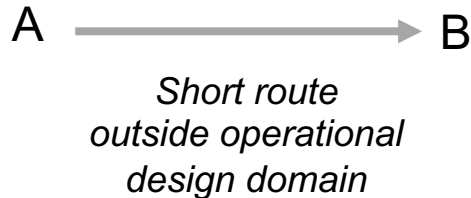
Alternative



Automated driving during the rush hour



Baseline



Driving outside the rush hour

Photos: shutterstock.com

Alternative scenarios

- **Over 90% of the respondents were willing to accept longer travel times** if they would not need to drive themselves
- 13–33% longer travel times in median → Estimated value of travel time savings between 12% to 25%
- Some travellers will switch to routes within ODD even if they were longer
- Rush hour travel by car becomes more acceptable

	Scenario	Baseline trip (min)	Accept longer travel times (%)	Median (min)	Median (% of baseline)
Pilot site questionnaire – Motorway	Longer route	30	93	10	33%
	Congestion	30	91	10	33%
Pilot site questionnaire – Urban	Congestion	30	93	10	33%
Impact assessment survey	Longer route	30	90	10	33%
	Longer route	120	91	20	17%
	Congestion	30	95	4	13%
	Congestion	120	91	20	17%



Amount of travel

Impact assessment survey – expectations

- One-fourth of the respondents expected that they would travel more with conditional automated cars

Q: Considering your travel behaviour described in the previous questions, how do you think conditionally automated cars would affect it?

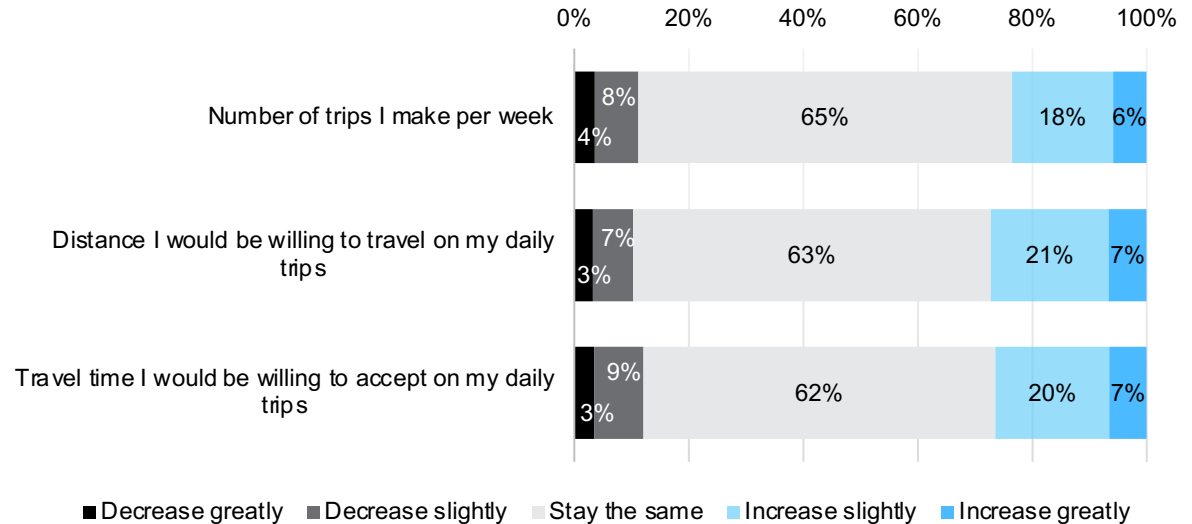


Figure. Expected impacts on amount of travel based on L3Pilot's impact assessment survey (n=8432).

Pilot site participants' expectations

- 78% would use ADFs on their **current trips**
- 25% would make **more car trips** with ADFs
- 37% would make **longer car trips** with ADFs

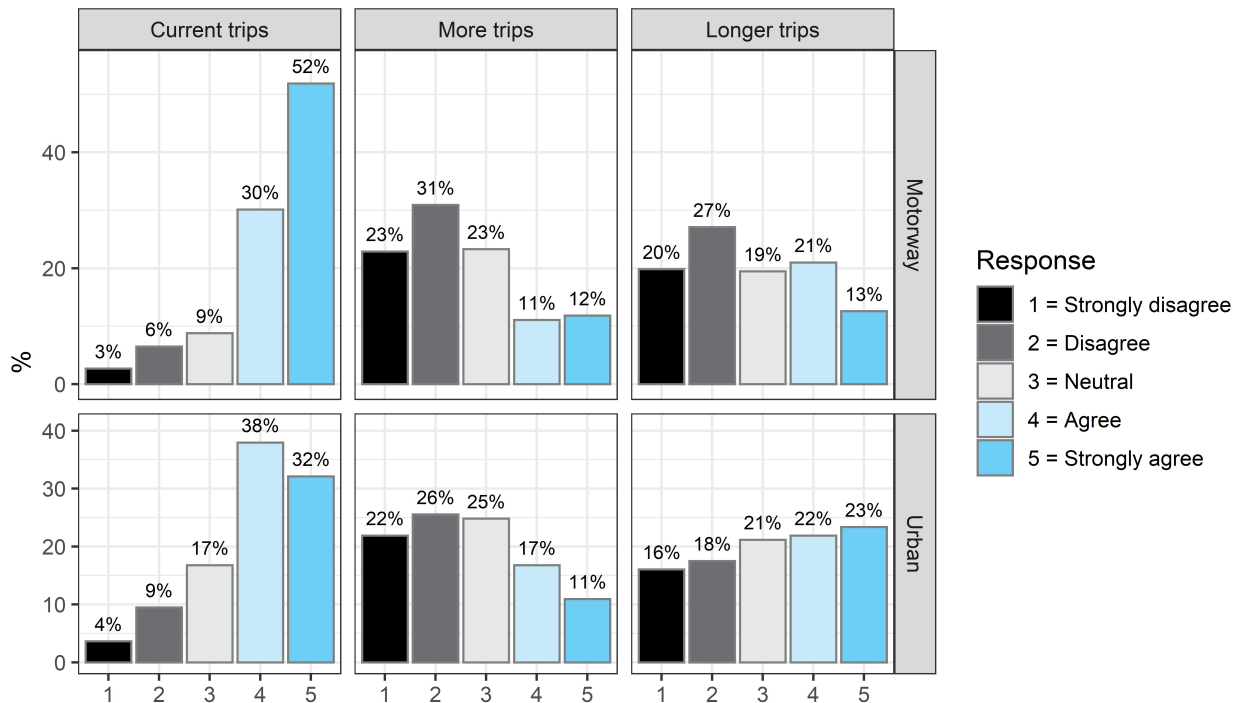


Figure. Pilot site participants' willingness to use ADF on their current trips, and expectation to travel more trips or longer trips once ADF is available (n=262 motorway and n=137 urban).

Most important predictors* based on the pilot site data

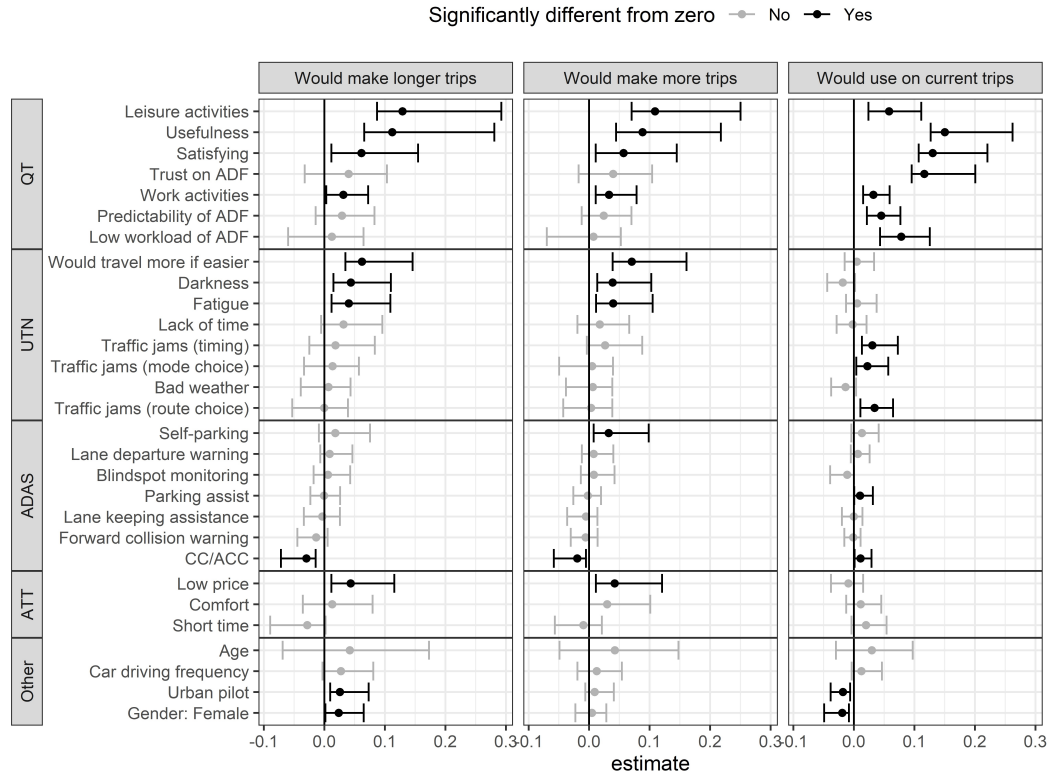
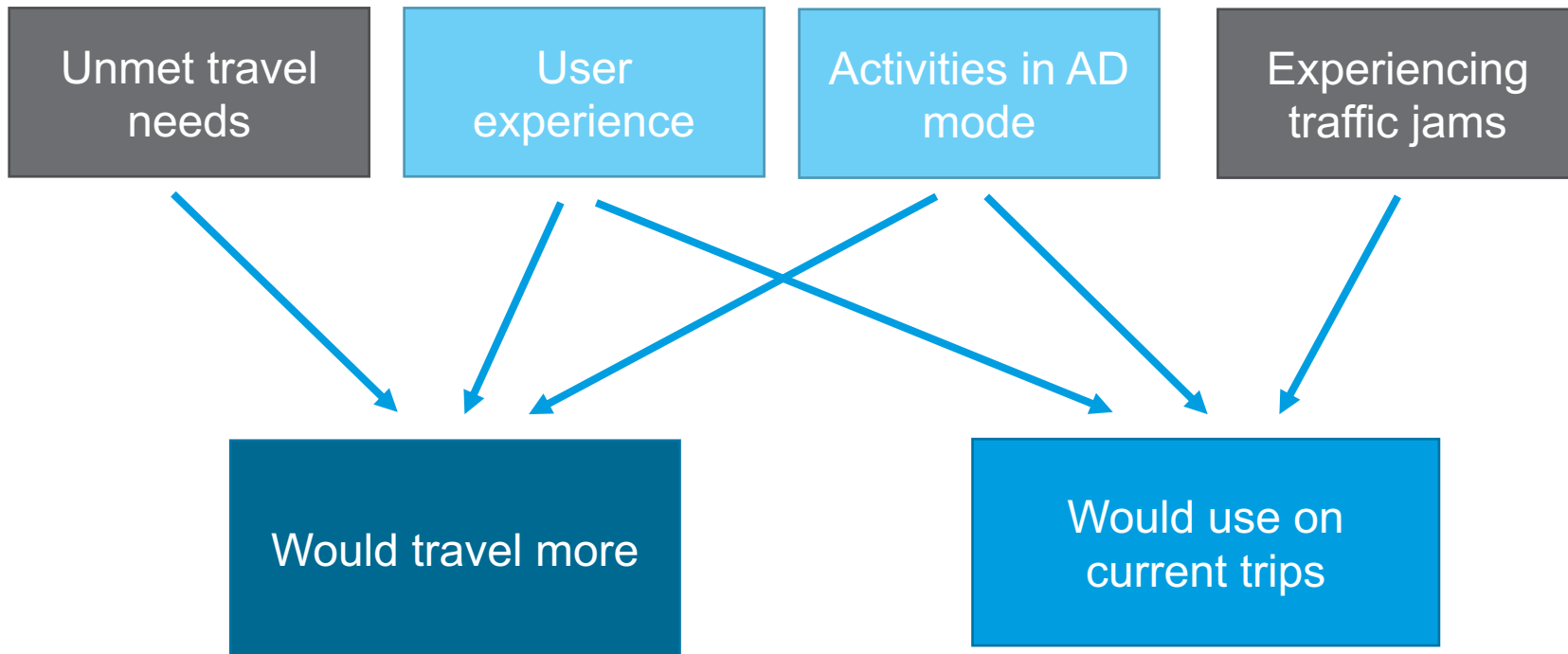


Figure: Bootstrapped ridge regression parameter estimates. Larger estimates denote a stronger positive association with the predictors (on the left) to the outcome variables (on the top).

*) Not necessarily causal

Factors influencing mobility with conditionally automated cars





Scaling up

Scaling up of the mobility impacts

- Scaling up estimated the potential for change in vehicle km travelled (VKT)
- Scaling up was based on
 - Estimated changes in the **value of travel time**
 - **Travel time change** estimated in L3Pilot efficiency and environmental impact assessment simulations
 - Increase in kilometres due to **increased travel opportunities**
- Changes in the above variables were translated by considering the penetration rates and elasticity coefficients derived from the literature

Scaled-up mobility impacts

- **Car kilometres are predicted to increase**
- Value of travel savings and penetration rate are the main determinants
- Dynamic feedback loops are not considered: e.g., more traffic → more congestion → car travel becomes less attractive

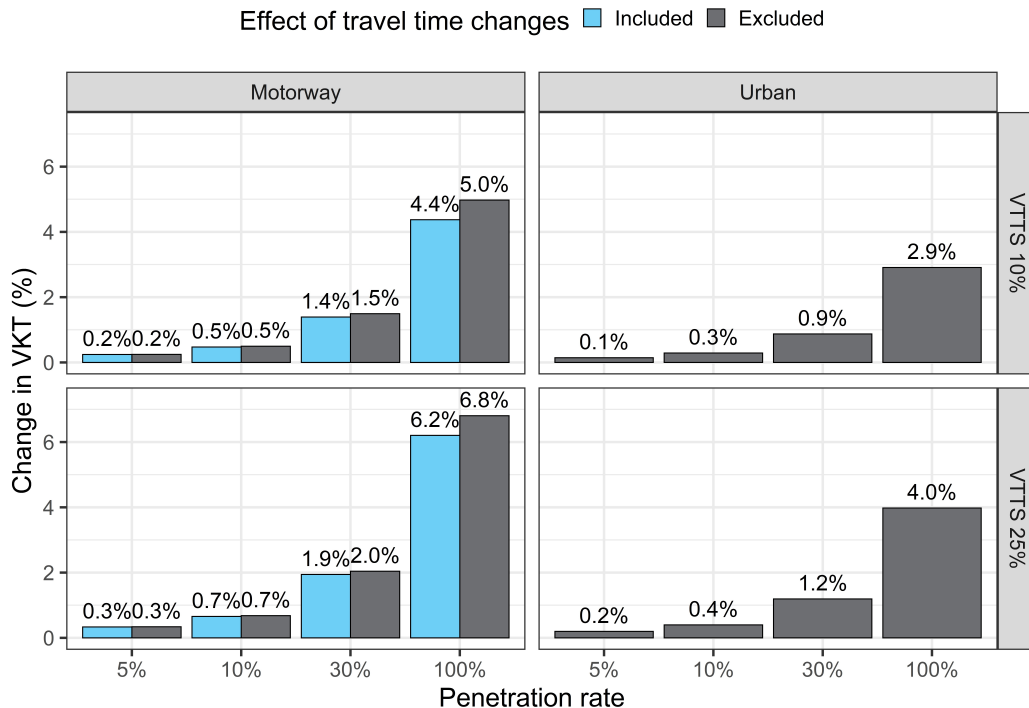
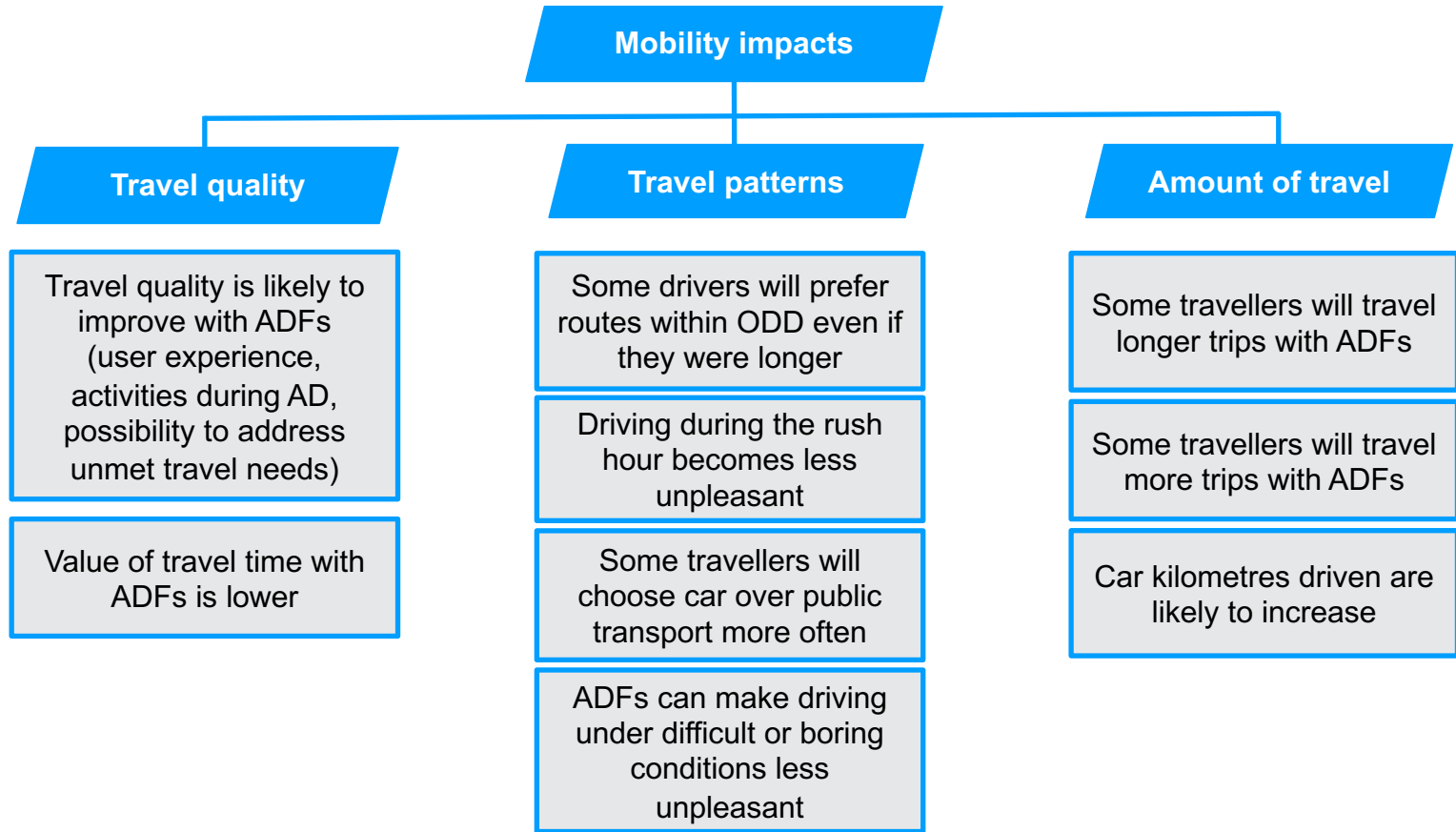


Figure. Estimated changes in car VKT due to conditional automation at different penetration rates for the motorways and urban roads.



Summary



Publications with additional information

- Lehtonen, E., Malin, F., Innamaa, S., Nordhoff, S., Louw, T., Bjorvatn, A., & Merat, N. (2021). Are multimodal travellers going to abandon sustainable travel for L3 automated vehicles? *Transportation Research Interdisciplinary Perspectives*, 10, 100380. <https://doi.org/10.1016/j.trip.2021.100380>
- Lehtonen, E., Wörle, J., Malin, F., Metz, B., & Innamaa, S. (2021). Travel experience matters: Expected personal mobility impacts after simulated L3/L4 automated driving. *Transportation*. <https://doi.org/10.1007/s11116-021-10211-6>
- Nordhoff, S., Louw, T., Innamaa, S., Lehtonen, E., Beuster, A., Torrao, G., Bjorvatn, A., Kessel, T., Malin, F., Happee, R., & Merat, N. (2020). Using the UTAUT2 model to explain public acceptance of conditionally automated (L3) cars: A questionnaire study among 9,118 car drivers from eight European countries. *Transportation Research Part F: Traffic Psychology and Behaviour*, 74, 280–297. <https://doi.org/10.1016/j.trf.2020.07.015>



Thank you for your kind attention.

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 723051.