Dette resumé er publiceret i det elektroniske tidsskrift
**Artikler fra Trafikdage på Aalborg Universitet**
(Proceedings from the Annual Transport Conference at Aalborg University)
ISSN 1603-9696
www.trafikdage.dk/artikelarkiv

# Shared mobility and public transport – foe or friend?

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## Abstract
Shared mobility services have appeared in the city picture, offering a promising solution to sustainable mobility challenges. However, literature shows that they often do not replace car travels, but instead public transit and walking. Through a stated preference survey, information is gathered about how commuters would respond to shared mobility integrated with public transport in their daily travel to work. The objective is to identify if and how it is possible to use shared mobility in connection with public transport to replace personal vehicle use by improving the last mile of the commute, from the bus stop to the office. Results show that every fifth car commuter would leave the car at home and travel by bus if they were guaranteed a free ride with an e-scooter or shuttle from the bus stop to the office. Price was found to be an important attribute while availability of the vehicle was less important. For half of the respondents, infrastructural improvements would not change their stated preferences. E-scooter was the preferred shared vehicle followed by shuttle and then e-bike.

## Background
In 2016, the European Commission reported that the transport sector alone contributed to 27 % of GHG in Europe, and that 72 % of the transport emissions came from road transport (EEA, 2018). In Norway, like in many other countries, the government is pushing forward sustainable mobility in the National Transport Plan. Cities, such as Trondheim and Oslo, have entered into urban environment schemes with the State where the overall goal is to achieve zero growth in the use of private vehicles as a mean of transport. As a consequence, the mode share of other transport options needs to increase. Micromobility, shared transport, and alternative transit services (hereafter termed as shared mobility) have the potential to improve the environmental sustainability of transport, although this is not a given. For example, use of shared e-scooters in Oslo was found to not replace car use, but instead walking and public transport (Berge, 2019). Other studies regarding electric bicycles and ridesharing also point to the fact that shared mobility does not lead to fewer car trips

(Fyhri and Fearnley, 2015, Shirazi, 2018). At the same time, shared mobility does though have the potential to increase comfort and reduce out-of-vehicle travel time for public transport travels, which are two commonly cited barriers for public transit use.

Existing research has identified different drivers and barriers for use of shared mobility, both by looking at cycling in general and within recent studies on shared vehicles. In Oslo, a study concerning electric bikes found that insufficient cycling paths, safety and bad weather were important barriers for cycling (Fyhri and Fearnley, 2015). In addition, the study identified travel time and comfort as dominant factors in the mode choice. E-scooterists were found to value low risk for accidents, travel time savings and flexibility as important for daily travel, where the e-scooters satisfies the last two factors (Berge, 2019). In this same study, over half of the reported accidents happened without other road users present, which stresses the importance of good infrastructure. Looking beyond Oslo, a study from Chicago found that if there were parking constraints and other non-auto options competitive to driving, e-scooters were a strong alternative to cars for short trips up to 3 kilometers, (Smith and Schwieterman, 2018).

When it comes to who might use shared mobility, one study concluded that higher educated young travelers are the most likely to adopt shared mobility (Alonso-González et al., 2019). Other research concluded that the willingness to use a shared bike depended on the experience of the user; if a person had used a shared bike before, the preference for using both the private bike and the shared bike, largely increased (Arendsen, 2019). Another multinational project looked at willingness to replace short trips with walking and cycling, where the Norwegian data indicated that the potential to change the mode choice depended on the climate, but also previous habits for walking and cycling (Stangeby, 1997). Together with other studies, it seems that familiarity, experience, education and age are the most important factors to determine willingness to utilize new transport modes.

The objective of this study is to examine if shared mobility can be utilized as a complement to public transport by identifying if and how it is possible to use shared mobility in connection with public transport to replace personal vehicle use. State-of-art literature tells of the potential to utilize shared mobility as an efficient first- and last-mile connection to improve public transport, but shared mobility also has the possibility to replace public transport. In regard to public bikesharing, studies have found impacts of increased and decreased public transport usage, depending on the characteristics of the city (Shaheen and Chan, 2016). Few other studies have looked at shared mobility in connection with public transport.

Hence, there are many yet unanswered questions concerning this topic, and this study attempts to fill one of the knowledge gaps by exploring the user preferences for shared mobility and understand if availability to shared mobility would lead to increased public transport use when integrated with the existing public transport network. This is done using a stated preference survey within a considered case study. Several shared transport modes were specifically considered: Electric scooters (e-scooters), electric bicycles (e-bikes) and shuttles. Within the study, attributes of availability, cost, and infrastructure were considered.

## Methodology

As described, a case study involving a stated preference survey was chosen as the methodical approach. The area, a business park in Trondheim, Norway can be seen in Figure 1. There are two high capacity bus lines that operate about one kilometer from the majority of the offices, see Figure 2. Sluppen is localized close to the national road network, and together with good access to parking facilities, accessibility by car is high. A travel survey conducted at Sluppen from 2017 revealed that only 10% use public transport during the commute, and 60% drive a private car to work

(Zhupanova and Tørset, 2017). The survey showed that even if there was added a parking fee of NOK750/month, 35% of the car travelers would still drive to work. While an accessibility study indicates good accessibility by bike and public transport (Skjeldsvik, 2019), the proximity to a large road network and lack of bicycle and pedestrian infrastructure around the offices leads to poor walkability.

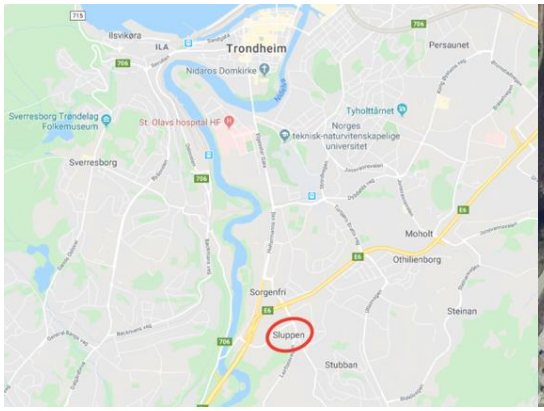


Figure 1 – Map of Trondheim extracted from Google Maps. Red circle shows Sluppen.

Figure 2 – Map of Sluppen extracted from Finn Kart. Red pins mark buildings owned by Kjeldsberg. Blue squares are bus stops.

Through the stated preference survey commuters at Sluppen were asked about potential changes in behavior after an introduction of shared mobility in the area. The respondents were divided into three groups based on their current mode; travelers by car, travelers by bus, and other travelers (bike, walk, other). Each respondent was asked a series of questions where they could choose whether to take the bus with shared mobility serving as the last mile, or travel as they do today. The groups were presented with the same 12 preference questions, randomized to reduce order bias. Attributes of travel time and cost for the bus were fixed, whilst additional cost for the shared vehicle and availability for the shared vehicle varied. The given levels for each attribute can be seen Table 1.

Table 1 - Attributes and levels

| Attribute | Levels |
|---|---|
| Travel time | Fixed for each respondent group |
| Price for bus | Fixed for each respondent group |
| Type of shared vehicle | [E-scooter, e-bike, shuttle bus] |
| Price for shared vehicle | [NOK0, NOK20] |
| Availability of shared vehicle<br>*Shuttle bus* | [always, sometimes]<br>*[no waiting time, <5 minutes waiting time]* |

Additionally, to research how the infrastructure and current road design at Sluppen affected the stated choice, respondents were asked to rate how five different infrastructure measures would have influenced their previous stated choices. The five measures with the different levels are seen in Table 2.

Table 2 - Infrastructural measures and levels

| Measure | Levels |
|---|---|
| Continuous path for bicycle and scooter (without barriers or obstacles) | [does not affect me at all, affects me to some extent, affects me greatly] |
| Traffic lights at pedestrian zone with priority for pedestrians/cyclists | |
| Wider sidewalk | |
| New asphalt | |
| Street lighting | |

To determine if an attribute or variable impacted the stated choice, chi square tests were used. A null hypothesis assumed no association between the two variables and the given p-value from the test represented the probability of the null hypothesis being true. If the chi-square test showed a p-value lower than 0.05, the hypothesis was rejected and the two variables were dependent of each other.

## Results

The study had 204 participants where 39% drove to work, 19% commuted by bus, 26% biked and 11% walked to work. Based on state-of-art literature, it was expected that age and previous use of the shared vehicle would impact the stated choice. This was statistically confirmed with 45% of respondents under the age of 35 answering that they would change mode to bus plus shared mobility, compared to 10% of the older respondents. Looking at familiarity with a shared vehicle, those who had tried e-scooters before were more willing to change mode to bus plus shared e-scooters, than those who did not (38% compared to 10%). Over half of the respondents had never tried an e-scooter before.

Irrespective of current mode choice, commuters prefer e-scooters as a last mile option. There is much less willingness to take use of shared mobility if the service costs NOK20, indicating that price is an important attribute. A decrease in availability does affect the stated choice, but not nearly as much as price. Approximately 1 out of 5 car drivers would choose to travel with public transport, given that either a shuttle bus or an e-scooter was free and always available. The shuttle bus alone can attract over 10% of the car commuters to shift to public transport, even if the availability is not guaranteed. Interestingly, the results show that even if a shared vehicle was available and free, 30-40% of bus users would prefer to walk the last mile to the office, and not take advantage of the shared mobility option. These results tell that the saved travel time at Sluppen is not as crucial as the time spent on the bus and on transfers.

In addition, one assumed that the other parts of the trip chain would also play a role in the stated choice. The results show a tendency that a “better” first mile (high frequency bus with a stop near home) would make more commuters move from car to bus plus shared mobility, but the sample size is too small to conclude a statistical significance.

Car drivers are less influenced by the suggested infrastructural measures than bus users and bike commuters. In general, bus users are more influenced by the measures than the other mode groups. Whilst only 20-40% of all other commuters would be influenced by a wider sidewalk in their decision to travel with bus plus shared mobility or not, the measure would influence 74% of all bus commuters.

The results of this study indicate that shared mobility does not have to a be a competitor to public transport. Results do indicate that shared vehicles would have bigger impacts on mode choice if distances travelled in the case study area were larger, but every fifth car driver would leave the car at home if a shared mobility option was presented at work under the right circumstances. In this case study, it would seem that an enhancement of last mile travel from the bus stop to the office is not enough to satisfy most car commuters to change mode. This travel group was also poorly represented in the study and additional research should further investigate the other barriers towards car use in Trondheim. Given the importance of price, possible incentives for commuters should be examined, and more knowledge is needed to better understand how shared mobility best can be used to replace car commutes.

## References


ALONSO-GONZÁLEZ, M. J., HOOGENDOORN-LANSER, S., VAN OORT, N., CATS, O. & HOOGENDOORN, S. 2019. Drivers and barriers in adopting Mobility as a Service (MaaS)– A latent class cluster analysis of attitudes. *Transportation Research Part A: Policy and Practice,* 132**,** 378-401.

ARENDSEN, K. 2019. *Shared mobility for the first and last mile: Exploring the willingness to share.* Master thesis, Delft University of Technology.

BERGE, S. H. 2019. *Kickstart for mikromobilitet - En pilotstudie om elsparkesykler.* Oslo: Institute of Transport Economics.

EEA. 2018. Greenhouse gas emissions from transport in Europe. Available: https://www.eea.europa.eu/data-and-maps/indicators/transport-emissions-of-greenhouse-gases/transport-emissions-of-greenhouse-gases-11.

FYHRI, A. & FEARNLEY, N. 2015. Effects of e-bikes on bicycle use and mode share. *Transportation Research Part D: Transport and Environment,* 36**,** 45-52.

SHAHEEN, S. & CHAN, N. 2016. Mobility and the Sharing Economy: Potential to Facilitate the First- and Last-Mile Public Transit Connections. *Built Environment,* 42**,** 573-588.

SHIRAZI, S. A. 2018. *Assessing ridesharing´ s potential to reduce congestion during commute.* Master thesis, Norwegian University of Sciene and Technology.

SKJELDSVIK, E. M. 2019. *ABC-metoden som normativt lokaliseringsverktøy i samordnet arealog transportplanlegging.* Master, Norwegian University of Sciene and Technology

SMITH, C. S. & SCHWIETERMAN, J. P. 2018. *E-Scooter Scenarios: Evaluating the Potential Mobility Benefits of Shared Dockless Scooters in Chicago.* Chicago: DePaul University.

STANGEBY, I. 1997. *Attitudes towards walking and cycling instead of using a car.* Oslo: Institute of Transport Economics.

ZHUPANOVA, L. & TØRSET, T. 2017. *Reisevaner og reisemuligheter for arbeidstakere på Sluppen i Trondheim.* Trondheim: Norwegian University of Science and Technology.