POSETIV – Potential and promotion of speed pedelecs for commuters

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ABSTRACT

In Austria, the popularity of speed pedelecs is on the rise – both for commuting and leisure purposes. However, the fact that they are legally equivalent to mopeds has significant drawbacks, like the ban of their use on cycling infrastructure as well as the requirement for insurance, registration and type approval. These drawbacks could restrict the potential of speed pedelecs as an alternative mode of transport for commuting, mainly as a replacement for cars. This paper therefore investigates the extent to which the current legal framework in Austria restricts the potential of speed pedelecs as an alternative mode of transport for commuting, evaluates this framework from a safety perspective and proposes alternative regulations for speed pedelecs in Austria. To achieve this, a field study with 98 participants in different regions of Austria and Switzerland was carried out to track their commute trips and gather corresponding data based on a) their usual behaviour (mostly the use of cars), b) their use of pedelecs and c) their use of speed pedelecs. In addition to this driving data, the participants were surveyed about their experiences and opinions regarding safety at four different points in

time (before, during and after the field trial). The field study was augmented with an online survey of a broader sample of the Austrian population, which focused on people's expectations of riding a speed pedelec and possible reasons for changing from their current mode of transport to such vehicles. The results were used to produce suggestions for the legislation on speed pedelecs, guidelines for their implementation as well as potential measures to enhance both the attractiveness and the safety of speed pedelecs for commuters.

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Keywords: speed pedelecs, alternative mode of transport for commuting, legal framework, guidelines for stakeholders.

1 INTRODUCTION

The popularity of speed pedelecs is clearly on the rise. In countries like the Netherlands and Switzerland, but also in Austria, an increase in sales of speed pedelecs can be observed, and more and more people are using this environmentally friendly and healthy mode of transport for commuting and leisure purposes (Stichting BOVAG-RAI Mobiliteit 2019, velosuisse 2019).

Speed pedelecs typically have a maximum assistance speed of 45 km/h and a maximum continuous rated power of 500 to 1,000W, with 4,000W as the regulatory maximum. This is in contrast to classic pedelecs, which are limited to a maximum assistance speed of 25 km/h and a maximum continuous rated power of 600W (Rotthier et al. 2017; van den Steen et al. 2019). Based on these characteristics, speed pedelecs could extend the active commuting range (one

hour commute to/from work) and allow cyclists to maintain their speed when riding uphill or facing headwinds (Rotthier et al. 2016). Thus, they have a high potential as an alternative mode of transport for commuting, mainly as a replacement for cars, especially in areas where the availability of public transport is limited.

However, in Austria speed pedelecs are legally equivalent to mopeds. This results in substantial legal differences compared to pedelecs (Eder, 2016): To use a speed pedelec, a cyclist must hold a valid moped driving licence and wear a motorcycle helmet. The speed pedelec itself has to be type-approved and registered for traffic and therefore requires a registration plate and third party insurance. Like mopeds, speed pedelecs are subject to recurrent vehicle inspections. Last but not least, speed pedelecs can only be ridden on the roadway, not on the bicycle infrastructure.

These drawbacks and restrictions in comparison to pedelecs or bicycles could deter potential users of speed pedelecs. The obligation to use the roadway, for example, leads to speed pedelecs being overtaken at high speeds in dangerous manoeuvres by other motor vehicles. Accordingly, the actual use of speed pedelecs as an alternative mode of commuter transport by no means matches their potential as a replacement for cars.

This seems all the more unfavourable given that previous studies show that the average speed of speed pedelecs – with speed being one of the important aspects for the assessment of their safety and their legal regulations – is only slightly higher than the average speed of pedelecs and remains well below the technically possible maximum speed of 45 km/h. In a recent study, Schleinitz et al. (2017), for example, recorded an average speed of 24.5 km/h for speed pedelecs and an average speed of 17.4 km/h for pedelecs using speed loggers and the GPS data of 9 speed pedelec riders and 48 pedelec riders in Germany. A study by Blass et al. (2019) in which 101 participants rode on a 1.5 km test track in Austria with a pedelec and a speed pedelec shows an

65 average speed of 21.4 km/h for pedelecs and 23.4 km/h for speed pedelecs. However, studies
66 to date have mainly been carried out with a low number of participants or on test tracks and
67 have not taken account of customary commuting routes and conditions.

68 This paper investigates whether the potential of speed pedelecs as an alternative mode of
69 commuter transport is restricted by the current legal framework in Austria, evaluates the
70 current legal framework from a safety perspective and proposes alternative regulations for
71 speed pedelecs in Austria. For this purpose, a field study of pedelec and speed pedelec users
72 was carried out in three different regions in Austria and one region in Switzerland and the
73 participants' experiences were surveyed online. In addition to the field study, an online
74 questionnaire was conducted with a broader representative sample of the Austrian population,
75 which focused on people's expectations of riding a speed pedelec and their possible reasons for
76 changing their current mode of transport to such vehicles. Building on the results, suggestions
77 for the legislation on speed pedelecs as well as guidelines for municipalities and authorities to
78 enhance both the attractiveness of speed pedelecs for commuters and their safety are derived.

79

80 ## 2 METHOD

81 ### 2.1 Field study and accompanying survey

82 The field study and its accompanying survey were carried out with 98 participants in three
83 different regions in Austria and one region in Switzerland: (1) Salzburg, representing an urban
84 setting, (2) Eisenstadt and surroundings, representing smaller towns and rural areas, and (3)
85 Wolfurt, Bludenz (in Vorarlberg) and Heerbrugg (Switzerland) and their surrounding areas, also
86 representing smaller towns and rural areas. The participants were all employees of various
87 companies and government bodies in these regions, who commute daily to their place of work,
88 mostly by car.

During the field study, the participants' daily trips to work were tracked over a five-week period with the help of a GPS-ready smartphone. The first week (phase 1) was used to track their customary commuting behaviour (e.g. by car, public transport or bicycle). In weeks two and three (phase 2), the participants made these trips using pedelecs (with a continuous rated power of 250W), while in weeks four and five (phase 3) they did so using speed pedelecs (with a continuous rated power of 350W). The field trial generated a huge dataset on daily commuting routines with different modes of transport. For safety-related aspects, the speed differences between pedelecs and speed pedelecs were computed and evaluated by laying a grid with cells with a length and height of 250m over those areas in which the participants had recorded trips and then calculating and comparing the average speeds for the trip segments in the cells.

To support the driving data collected, an online survey of the participants' experiences and opinions was conducted at four different points in time before, during and after the field trial, i.e. (1) before phase 2, (2) at the end of phase 2, (3) at the end of phase 3, and (4) three months after the end of phase 3. This survey contained questions on a) the process of learning to ride the pedelec and speed pedelec, b) the perception or feeling of safety during individual riding manoeuvres in the different phases, c) potential dangerous situations in road traffic and conflicts with other road users, and d) positive and negative aspects when riding pedelecs and speed pedelecs. Most of the questions on the learning process included predefined multiple choice response options, while those on the assessment of safety used Likert scales.

2.2 Online questionnaire

To further investigate people's expectations of riding a speed pedelec and their possible reasons for changing from their current mode of transport to such vehicles, an online survey of a random sample of the Austrian population was carried out. The sample included 1,013 persons aged 17 and older, all of whom live in Austria and commute daily to work by car for a (one-way) distance

of between 7 and 25 km. In the analysis of the data, a special focus was placed on those 374 participants who noted that they could in principle envision using a speed pedelec as a mobility alternative for commuting to work.

3 RESULTS

This section describes the results of the field study and its accompanying online survey as well as the online survey of the random sample of car commuters in Austria. The theoretical basis for the design of all questions in the two questionnaires was the 'Health Belief Model' (Rosenstock 1974), which provides meaningful determinants for behaviour (e.g. perceived benefits, effectiveness). The results for the field study and accompanying survey only include data from participants living in Austria and exclude those living in Switzerland because the differences in the regulatory specifications for pedelecs and speed pedelecs (e.g. maximum power, use of bicycle infrastructure, type of helmet to be used, etc.) in the two countries influence the results on driving speeds and perceptions of safety. Moreover, the results for the online survey only reflect the answers of the group of participants who could in principle envision using a speed pedelec as a mobility alternative for commuting to work but had no direct experience of doing so.

3.1 Field study and accompanying survey

a) Field study: driving speeds of pedelecs and speed pedelecs

Figure 1 and figure 2 show the cumulative curves of the average driving speeds for the trip segments of all cells in which participants had recorded trips for pedelecs (figure 1) and speed pedelecs (figure 2) in built-up areas and outside built-up areas as well as the average driving

speed that was not exceeded in 85% of the trip segments in the cells. Whereas driving speeds for pedelecs are very strongly concentrated around 25 km/h, those for speed pedelecs are far more widely distributed, i.e. more heterogenous. The driving speed that was not exceeded in 85% of the trip segments in all cells (v_{85}) using pedelecs was 26.5 km/h in built-up areas and 27.4 km/h outside built-up areas. For speed pedelecs, the corresponding speeds were 36.1 km/h in built-up areas and 38.8 km/h outside built-up areas. The difference in the v_{85} between pedelecs and speed pedelecs was 9.6 km/h in built-up areas and 11.4 km/h outside built-up areas.

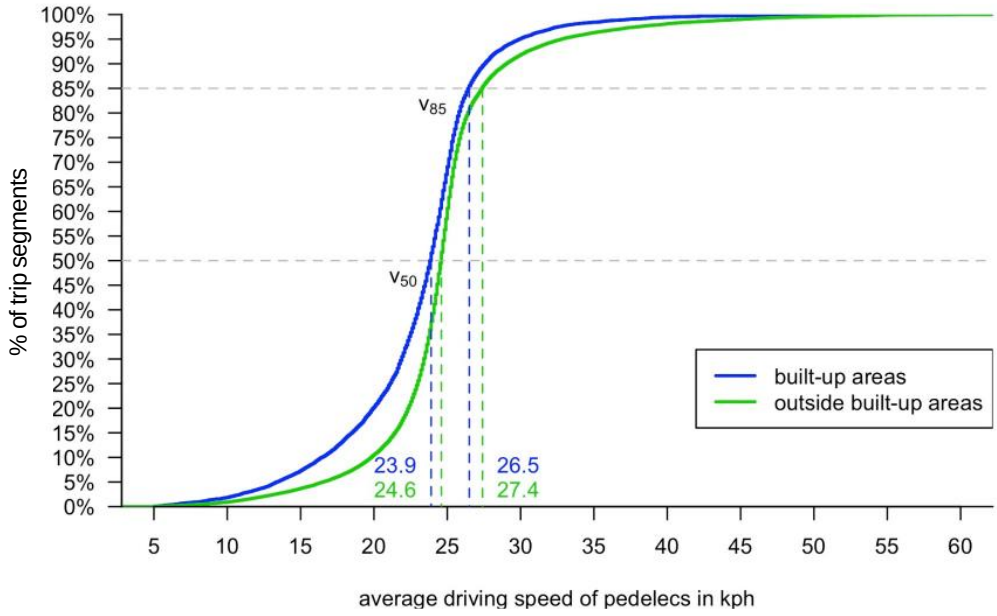
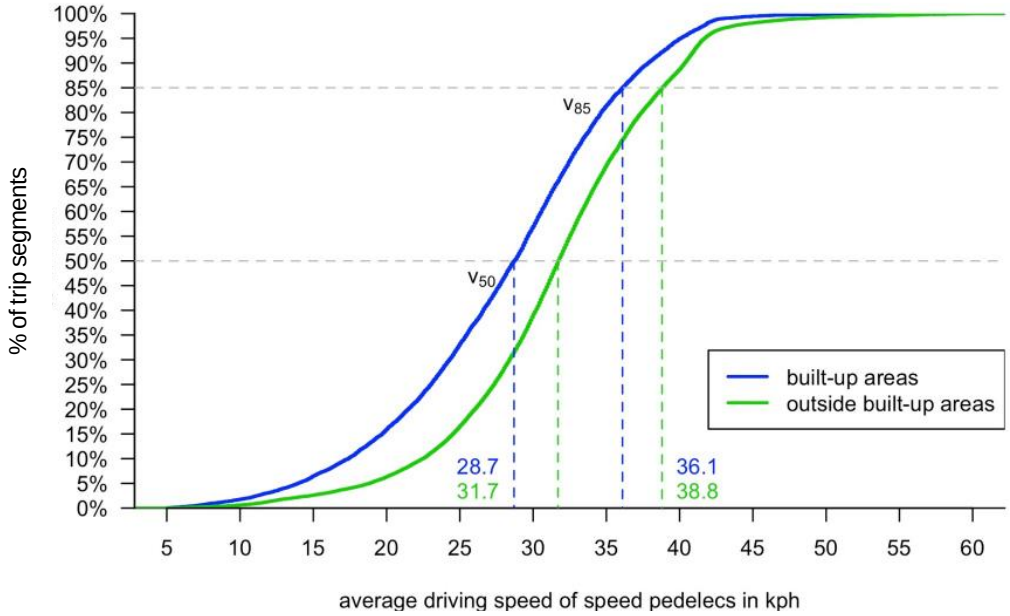


Figure 1. Distribution of the average driving speed for 50% and for 85% of trip segments for pedelecs in built-up areas and outside built-up areas



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148 **Figure 2.** Distribution of the average driving speed for 50% and for 85% of trip segments

149 for speed pedelecs in built-up areas and outside built-up areas

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151 **b) Accompanied survey: experiences and opinions on riding pedelecs and speed pedelecs**

152 The results of the accompanying survey for the phase after riding the speed pedelec show that
153 the participants learned to do so relatively quickly: 25% of the participants stated that they had
154 mastered riding the speed pedelec on the first day, 66% took until the second day to do so, while
155 9% took slightly longer. This means that even though they had already ridden a pedelec, they
156 still had to get used to driving a speed pedelec. It also indicates that pedelecs and speed pedelecs
157 differ in their riding characteristics, since participants often reported that they had to get used
158 to the latter, i.e. that a familiarization process was needed when switching to the speed pedelec
159 after the two-week period with the pedelec.

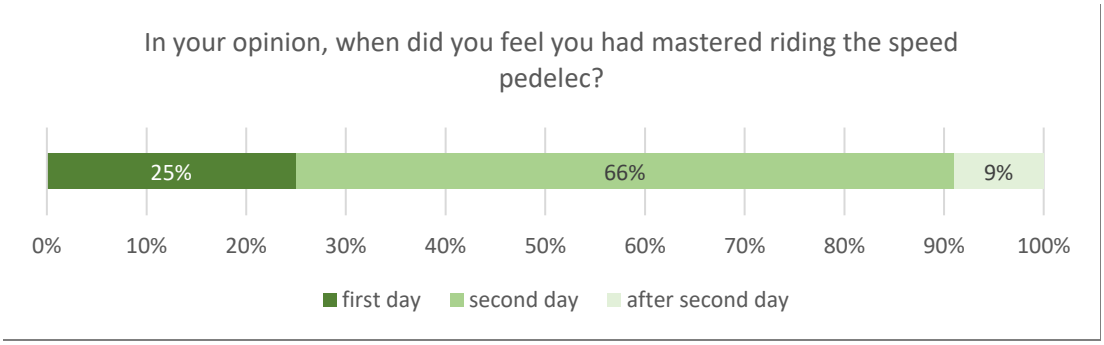


Figure 3. Point in time at which participants had mastered riding the speed pedelec (n= 52[1])

The feeling of safety (i.e. of being in control of the vehicle) during the various riding manoeuvres (starting, accelerating, braking, riding round bends, turning manoeuvres) was described overall as good by most people, with higher percentages for feeling very safe when starting and accelerating (81%) or braking (79%) than when riding round bends or turning (62%), manoeuvres which some of the participants still did not feel completely safe doing even after two weeks on the speed pedelec. As far as corresponding differences between the speed pedelec and the pedelec are concerned, a higher percentage of participants (75%) felt they were in control in all situations when riding a pedelec than when riding a speed pedelec (64%).

[1] In the following figures, n varies in accordance with the number of participants who completed the survey in time.

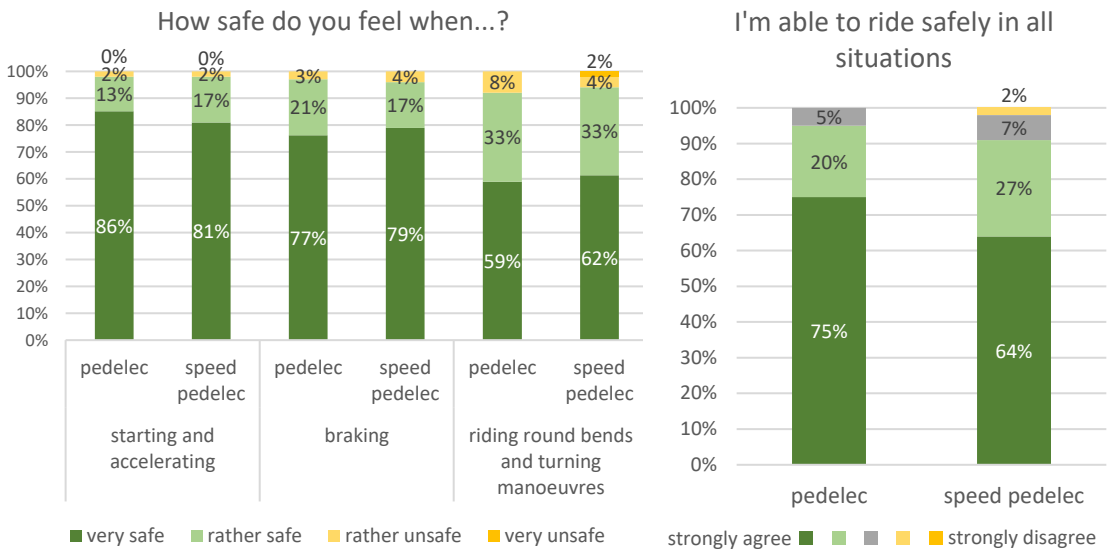


Figure 4. Participants' feeling of safety for different riding situations (left) and agreement with the statement "I'm able to ride safely in all situations" (right) for pedelecs (n=63) and speed pedelecs (n= 52)

Regarding potentially dangerous situations in traffic and conflicts with other road users when riding the speed pedelec, the participants noted that they felt at risk in road traffic because of having to use the roadway (although this allowed them to reach their destination faster) and being overtaken by cars with higher speeds and sometimes only small safety distances. Furthermore, the participants repeatedly reported that they were misjudged by other road users (which led to conflicts) because speed pedelecs are quiet vehicles and very similar in appearance to classic bicycles, thus making the difference not immediately apparent.

The participants were also asked to name the positive and negative aspects of riding a speed pedelec. The majority assessed the higher driving speed (89%) and the speed pedelec itself (81%) positively, while the fact that they were prohibited from using the bicycle infrastructure and

thus had to ride on the roadway were the two aspects that bothered them most (85% and 81% respectively).

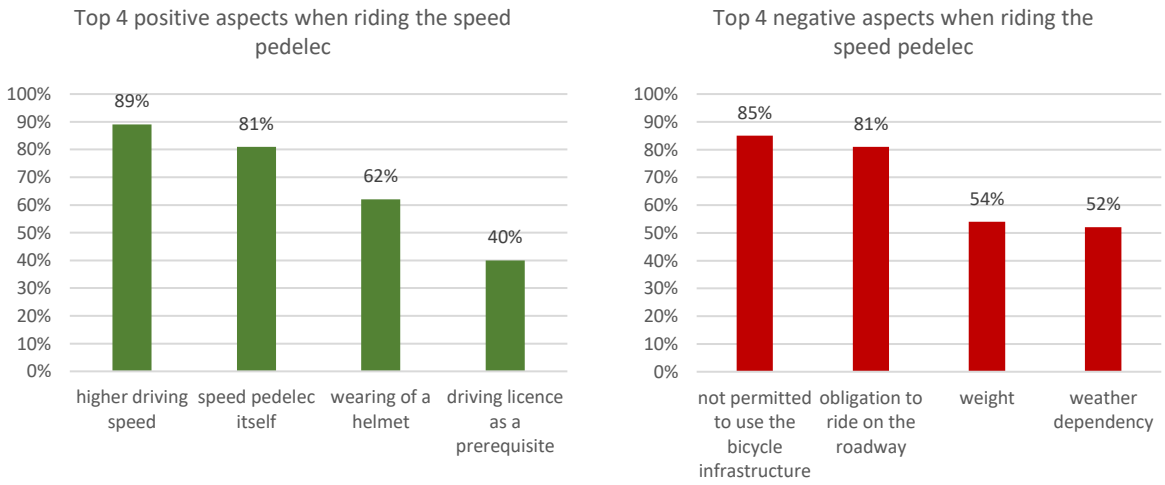
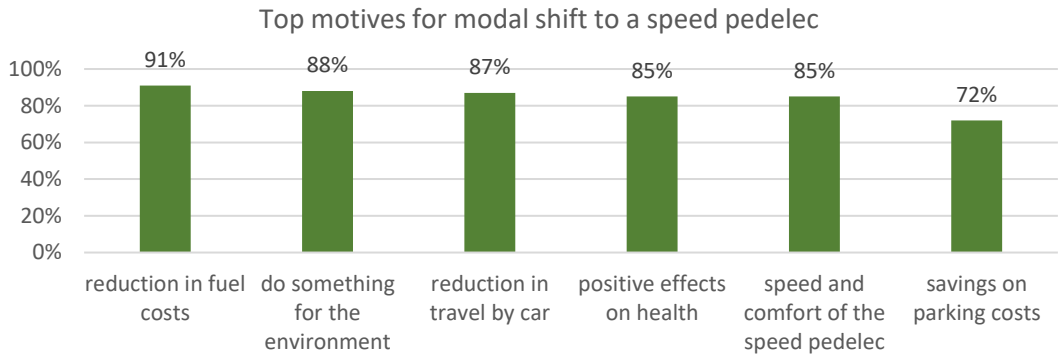


Figure 5. Top 4 positive (left) and negative (right) aspects when riding the speed pedelec (n= 52)

3.2 Online survey of a random sample of Austrian car commuters

a) Motives for a modal shift to speed pedelec

The motives for a possible modal shift, i.e. a change in the current mode of transport, to a speed pedelec were manifold. Those named most frequently by the survey participants related to financial considerations, environmental issues and health: 88% considered it important to have a positive impact on the environment, 87% wanted to reduce the number of trips they make by car, 85% thought about the positive effects on their health, 91% considered it important to save fuel, while 72% sought to reduce their parking costs. For 85% of the participants, the speed and comfort of a speed pedelec would be the decisive factors.



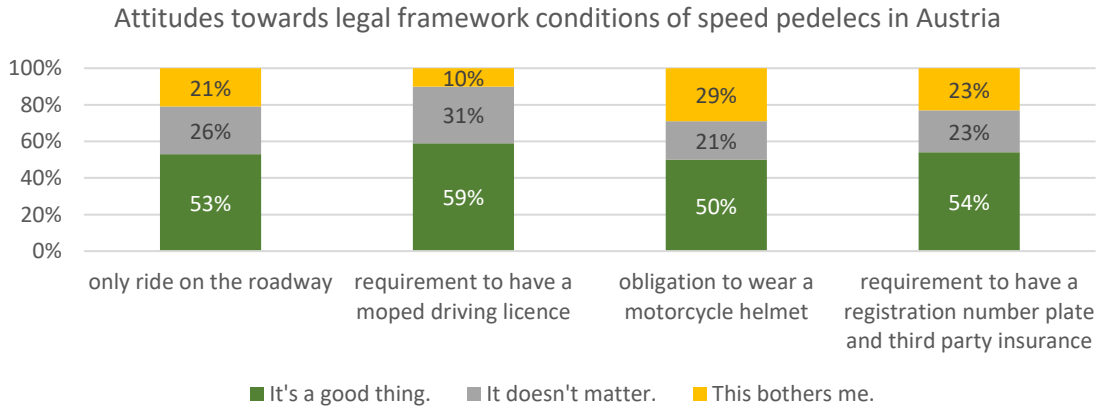
202

203 **Figure 6.** Top motives for a modal shift to speed pedelecs (n= 374)

204

205 **b) Legal framework for speed pedelecs**

206 The legal framework for speed pedelecs in Austria is generally not perceived by the
207 participants to be a particular hurdle. Only 21% explicitly stated that they were bothered by
208 the fact that they were only allowed to use the roadway when riding a speed pedelec. The
209 requirement to have a moped driving licence, a registration plate and third party insurance
210 as well as the obligation to wear a motorcycle helmet were not predominantly perceived as
211 negative aspects.



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213 **Figure 7.** Attitudes towards the legal framework for speed pedelecs in Austria (n= 374)

c) Barriers to and facilitators of a modal shift to speed pedelecs

The most frequently mentioned barriers to shifting from their current commuting mode to a speed pedelec were the costs incurred, both in terms of time and money: only 31% of the participants would consider an additional 15 minutes of commute time to be acceptable, while 73% stated that the maximum cost of buying a speed pedelec should not exceed 2,500 €.

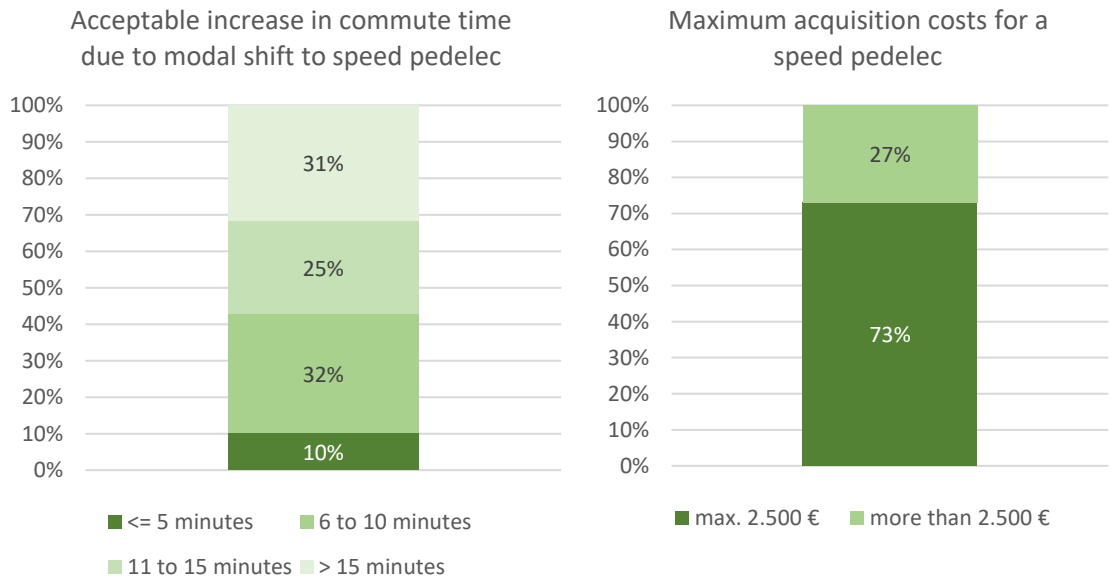

Figure 8. Acceptable increase in commute time due to a modal shift to a speed pedelec (left) and maximum acquisition cost for a speed pedelec (right) (n= 374)

The most frequently mentioned facilitators of a modal shift to a speed pedelec were funding/grants for the purchase of such a vehicle (59%) and a lower price for speed pedelecs (58%). For 36% of the participants, safe parking facilities at work were a motivating factor, while 33% considered financial support from their employers to be important. 27% mentioned permission to use cycling infrastructure and removal of the requirement to have a registration plate and third party insurance as facilitators of such a modal shift. The participants also often

mentioned the opportunity to test a speed pedelec on their commute trip prior to making a purchase decision as an important factor.

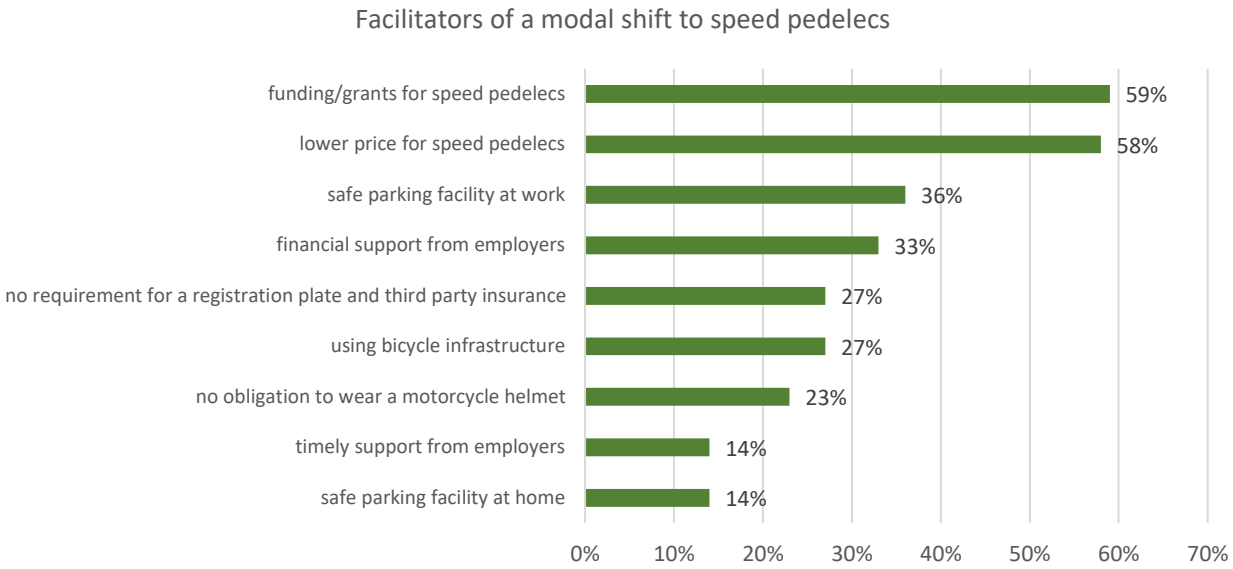

Figure 9. Facilitators of a modal shift to speed pedelecs (n=374)

4 DISCUSSION AND CONCLUSIONS

This paper investigated whether the potential of speed pedelecs to become an alternative mode of commuter transport is restricted by the current legal framework in Austria. For this purpose, a field study was carried out with commuters using speed pedelecs to get to work and accompanied by a survey of their perceptions of safety. The field study was augmented by an online survey of a random sample of the Austrian population to determine the expectations of riding a speed pedelec and possible reasons for changing to this mode of transport for commuting to work.

With regard to the existing restrictions on speed pedelecs in Austria, the results show that participants in both the field study and the online survey did not perceive the requirements to

hold a moped driving license, wear a motorcycle helmet and have a registration plate and third party insurance to use speed pedelecs to be predominantly negative. However, it should also be noted that the participants in the online survey likewise mentioned the lower costs of speed pedelecs to be an important facilitator of a modal shift and that the requirements to have a moped driving licence, a registration number plate and third party insurance are all aspects that contribute to the (high) cost of (using) speed pedelecs. In addition, whereas only a smaller percentage of participants in the online survey felt bothered by the fact that speed pedelecs can only be ridden on the roadway, those in the field study considered being prohibited from using the cycling infrastructure or obliged to ride on the roadway to be the most negative aspects when riding speed pedelecs. This suggests that the disadvantages and dangers of the current legal regulations only become fully apparent when a person actually tries out and uses a speed pedelec.

Moreover, the results of the field study indicate that v_{85} for speed pedelecs was higher than for pedelecs but – and in line with previous studies (Schleinitz et al. 2017, Blass et al. 2019) – that these speeds were far lower than the maximum assistance speed of 45 km/h. However, outside of built-up areas – where there were fewer intersections and traffic signals, and the participants had fewer braking and acceleration processes and more opportunities to use the pedal assist over 25 km/h – the v_{85} reached nearly 40 km/h. In such cases, the difference between the driving speeds of speed pedelecs and pedelecs was also higher than in previous studies (e.g. Blass et al. 2019), where the participants only used the speed pedelecs on a test circuit. Furthermore, the distribution of the average driving speeds for the trip segments of the rides in our field study indicates that while the driving speeds for pedelecs were strongly concentrated at around 25 km/h, those for speed pedelecs were far more widely distributed and heterogenous. In comparison to the studies by Schleinitz et al. (2017) and Blass et al. (2019), the driving speeds measured in our field study, i.e. the v_{85}, were higher both for built-up areas and outside of built-

up areas, which might be due to the fact that participants were commuters and not a mix of user groups like in the aforementioned studies. In this regard, studies like those by Lienhop et al. (2015) have illustrated that the driving speeds of commuters are considerably higher than those of other cyclist groups.

In addition, regarding the feeling of safety (i.e. vehicle control), some of the participants still did not feel completely safe when riding the speed pedelec even after two weeks of doing so. They felt less safe when riding round bends or carrying out turning manoeuvres in particular. For the latter, although overall participants felt more safe on pedelecs than speed pedelecs, slightly more of them felt very safe on speed pedelecs, a result which can be attributed to the fact that they had used a pedelec first and become accustomed to it in such situations: the differences between pedelecs and speed pedelecs would doubtless have been higher had they not gained this experience. Moreover, the participants mentioned that they felt at risk in road traffic when using the roadway because they were overtaken by cars with higher speeds and small safety distances.

Building on these results, to foster the use of speed pedelecs as an alternative to cars for commuters and to increase their safety, we recommend opening up the cycling infrastructure to speed pedelecs, but only under certain conditions. These should ensure that the riders of classic bicycles are protected as far as possible from faster speed pedelec riders and should also increase the safety of speed pedelec riders on those occasions where they cannot ride safely on the roadway. This recommendation to open up the cycling infrastructure applies in particular for built-up areas, where speed pedelecs should be allowed to use cycle lanes, multipurpose lanes as well as separate, well-developed cycle paths. However, the width of the cycle path, volume of cycle traffic and speed of motor vehicles must also be taken into account. Nevertheless, the possibility of also opening up the cycling infrastructure to speed pedelecs

outside of built-up areas should also be considered on a case-by-case basis and with due consideration to various safety parameters. A general opening up of the cycling infrastructure to speed pedelecs – as is the case in Switzerland – is not recommended for Austria based on the results of this study as the speed differences between speed pedelecs, pedelecs and classic bicycles – especially outside of built-up areas – are too high.

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