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Can speed pedelecs really fulfil the mobility needs of daily commuters?

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Summary

Considering the problems Belgium faces regarding air quality and road congestion, a switch to light electric vehicles (LEVs) part of the solution. For the Flemish commuter, the speed pedelec is promising. This paper discusses the preliminary results of the first three companies participating in the 365SNEL-project, commissioned by the Flemish department of Environment, with the purpose of investigating the speed pedelec potential, mapping user's needs, defining appropriate accessories and designing a quality framework to determine whether speed pedelecs can fulfil the mobility needs of daily commuters.

Keywords: speed pedelec, focus groups, surveys, gps data

1 Introduction

Belgium has considerable problems regarding air quality and road congestion. The Flemish Environmental Agency [1] states that in 2017, there is a downtrend regarding emissions, reaching the European limit values, but still exceeding the values set by the World Health Organisation. Maintaining or improving that air quality is seen as one of the main challenges Belgium faces, as stated by the European Commission, best done by introducing disincentives for car use and by reducing car use[2]. A difficult feat as the number of cars [3] and the total hours of congestions keep growing year after year[4]. From the policy side, a strong focus goes out to a switch from conventional cars to an electric variant, with roll-outs of basic infrastructure of 5000 charging stations, purchase premiums (max. €5000) and the cutting of taxes[5].

Since Well-To-Wheels (WTW) studies, based on the current EU-mix for electricity[6], show that battery electric cars have the potential to half the impact on climate change[7], this transition is a step forward, but also only part of the solution. The switch to electric driving should come along with a transition to lighter electric vehicles (LEVs), that are easily 5 times more energy efficient [8]. Next to this high reduction of the environmental impact, they are also a solution for the congestion problems. Looking at the registration numbers[9], the speed pedelec showed to be one of the more promising LEVs for the Flemish commuter.

Figure 1: Current speed pedelec fleet

We report on the 365SNEL-project, commissioned by the Flemish department of Environment, as a part of its action plan "Clean Power for Transport" (CPT). In this project at least 10 speed pedelecs (i.e. fast electric bicycles limited to 45 km/h and motor power of 4 kW) from different manufacturers will be deployed in several companies for one year (Fig. 1). Covering every province in Flanders (northern part of Belgium), the project will provide at least 120 test users the opportunity to test the speed pedelecs for 3 weeks at a time. The main objectives for this scientifically based speed pedelec testing are:

1. Investigating the potential of speed pedelecs as a complete replacement for the car.
2. Mapping user's needs concerning the vehicle, the road and parking infrastructure.
3. Defining the accessories required for comfortable and safe trips in all weather conditions.
4. Designing a quality framework for manufacturers to develop quality standards speed pedelecs.

Several studies have already undertaken, mostly qualitative research on the subject of e-bikes, however there is a limited research done on the subject of speed pedelecs[10][11][12].

2 Methodology

The methodology of this paper is two-fold; we assess the user acceptance through focus groups and surveys, but also perform objective measurements through logging data with Runkeeper[13].

Firstly we use a quota sample to select the companies: companies can state their interest through an open call via media and we make a selection based on location, size and suitability for the project. In this paper, we will cover the preliminary results of the first three companies, selected for the testing periods in October, November and December 2018. Table 1 provides an overview of the sector, the location and number of employees of the companies participating. Furthermore it gives a quick insight in the response rate and the number of people who participated in the focus group and in the testing period.

In all companies we conduct an in-depth interview with the mobility manager or HR representative for contextual information. The potential test users are invited by t to voluntarily take part in the project after an invitation is sent out throughout their company. Dependant on the company's size and preferences, a tailored approach was appropriate, varying between an internal recruitment mail, an E-newsletter or person-to-person communication. Out of the responses, a selection, if possible, of 10 to 15 persons is made, representative to the original response, considering in particular age, gender, (no) experience with speed pedelecs and a commuting distance between 15 to 35 kilometres. Note that this is not the case with the participants of company 2 due to a lack of volunteers. The selected persons are invited to take part in a focus group of one hour or more. Each focus group started with an presentation about the objective of the research. Each participant was provided with a consent form, which was gathered after each focus group. The researcher moderated each focus group guided by a pre-composed topic guide. By starting each focus group with the following statement: "*Please introduce yourself briefly by stating your name, the extent of the commuting distance and how you came to your work today."*, the researcher got a starting point to ask a variant of questions. By first putting focus on motivations to use current modes of transport and barriers leading to the non-use of other modes of transport, the researcher steered conversation towards biking. Through funnelling, the researcher narrowed the conversation down from regular bicycle to electric bicycles and finally to speed pedelecs. The audio recordings were later transcribed verbatim and analysed by the researcher using NVivo [14]. Thematic analysis was used to code the transcribed focus groups guided by the phases proposed by Braun and Clarke (2006): [15]

1. Familiarising yourself with your data: Collecting and transcribing the audio files, first readings of transcriptions.
2. Generating initial codes: Organising the data in to meaningful groups in a inductive way.
3. Searching for and reviewing themes: grouping codes into themes.
4. Defining and naming themes: shortlisting themes and subthemes

Table 1 Overview participating companies

	Company 1	Company 2	Company 3
Sector	Health	Commercial	Public
Location	North-West edge of Brussels	Sub-municipality of city of Kortrijk	Brussels centre, close to train station
# Employees	+3000	± 20	+100
# Test users	113	7	32
# Participants entry focus group			
Invited	15	7	12
Participated	13	5	11
# Participants testing period	12	7	11

Taking into account the availability of the speed pedelecs, a final selection was made after the entry focus group. The actual testers took part in a pre-test survey about attitudes, motivations and barriers towards speed pedelecs as a commuting vehicle. After one week and a half of bike use, the test users fill out an online mid-term survey based on a research done by the Stichting Wetenschappelijk Onderzoek Verkeersveiligheid (SWOV)[16][17]. Finally the post-test survey measures the potentially changed attitude, motivation and barriers to allow comparison with the pre-test survey set-up around a framework Fig. 2 based on literature review [18], [19], [20]. An exit focus group serves to gather important qualitative data on user experiences.

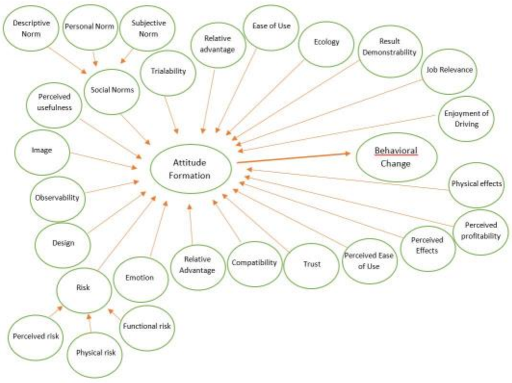


Figure 2: Visualisation of quantitative research

Secondly, through the logging of data, we gain insight into cycling behaviour, time gain and cruising speed, but it also enables us to validate the user feedback on roads, infrastructure and distance travelled collected during the focus groups. This objective data also suits its purpose in further designing the quality framework.

3 Results

First, we discuss the general response received from the recruitment survey. Then, we give an overview of the themes discussed during both the entry and exit focus groups. Next, we link the themes to the responses from the survey, with particular attention to changes in opinion/motivation in the pre- & end-term survey. Finally, we present an overview of the tracking data and compare descriptive characteristics (speed, cruising speed,…).

3.1 Recruitment survey

For the three companies, a total of 152 respondents out of +3000 staff members showed their interest by filling out the recruitment survey, with 54.6% male and 45.4% female respondents. Table 2 shows statistics of specific characteristics of this group. This includes age, commuting distance and average hours of exercise/week Besides sex, working full-time (71.7%) and preferably no former experience with speed pedelecs (92.1%), the characteristics presented in Table 2 were used as selection criteria for the focus groups.

Table2: General statistics recruitment survey response

	Age	Commuting distance (km)	Average hours of exercise/week (h)
Mean	40.77	19.9	5.3
Median	40	19.75	4
Standard deviation	8.9	8.3	3.4
Maximum	62	60	28
Minimum	22	2	0

A large part of respondents (81%) are sharing their life with a partner and 50.7% of that group have a car (petrol or diesel) available for their commute. When looking at preferred mode of transport to get to work, the car (petrol or diesel) is the most popular with 78.3% of respondents having a car (petrol or diesel) at their disposal. Following in second, third and fourth are the regular bicycle (66.5% availability), public transport (48.7% availability) and electric bicycle (22.3% availability). Other modes are carpooling, hybrid/electric cars, motorcycles (petrol or diesel) and travelling by foot. 40% of respondents never took a bike to work in contrast with 15.13%, who bike to work every day. A number matching the 14.59% of in a Flemish research on travel behaviour of 2016-2017 [21] . 68.4%, of the respondents had some experience with electric vehicles in general, only 36.8% had never rode an electric bicycle. 8.9 % of respondents had experience with a speed pedelec. Of the respondents, 96.7% found the first contact with electric bicycles pleasant, 95.9% found it comfortable, 91.8% felt confident on the bike and 91.8% felt safe during the first contact with an electric bicycle. Out of these 152 respondents eventually 34 were selected to participate in 3 focus groups following the selection criteria mentioned above Table 2.

3.2 Focus groups

Throughout the three entry focus groups, different topics emerged. Topics returning across focus groups regarding the test subjects projected insights after three weeks where mainly speed, time management, safety, ease of use and effect on health. After the testing period, three exit focus groups were held to capture the experiences of the participants. During the latter new themes occurred, with as major topics; bike technicalities, pricing, infrastructure & regulation.

3.2.1 Before the testing period

Speed

With speed as an essential and differentiating part of the speed pedelec compared to the well-known bicycle, this topic appeared as well as a motivator and as a concern to the test subject throughout the focus groups. Motivating, because it has the potential for, according to the test persons, time savings and concerning, due to a lack of experience with those levels of velocity and the possible effects. Furthermore, it is noticeable that most participants are focused on the 45 km/h as an achievable average speed. Where in reality, not all speed pedelecs are able to reach a speed of 45 km/h. Their maximum speed is dependent on level of assistance, motor power and pedal power input delivered by the user. The possibility of travelling at lower speeds, lower than the maximum speed limit, was frequently overlooked during the three focus groups.

"… I'm not a hero on a regular bike, so I think 45km/h or 40km/h, I'm never going to dare to do that. …"

Test person 8, female, aged 43, 30 km

" … For commuting, speed does matter for me. But it is not that if I go cycling with my child in the evening when the weather is nice, that I should drive 40 to 45 km/h. I think that's not responsible. …"

Test person 16, female, aged 30, 28 km

Time management

A regularly reoccurring theme across focus groups, mentioned by participants as motivator to adopt the use of a speed pedelec was the help it could offer with time management. Two categories can be distinguished, being time gain and arrival time predictability.

Time gain

The ability to shorten the travel time between point A and B, was a definite motivator for a large group to participate in the three weeks testing period. Regular (electric) cyclists largely want to go faster than they are with their regular or racing bikes.

" ... Can I get to Brussels faster than with a racing bike? ..."

Test person 20, female, aged 42, 26 km

"... I already come to work by bike. That takes me 50 minutes. If that can go to 35 minutes, that is a wonderful improvement for me. ..."

Test person 2, male, aged 43, 20 km

Participants, who have already took their (electric) bike to work, expect a time saving because of the redundancy of time spent before and after each bike ride (showering, putting on gear,…).

"... Also saving time again. I may be going home at a later time, but I won't have to take a shower like I used to, with the regular bike I will have to take a shower as soon as I get home and immediately when I get to work. ..."

Test person 1, male aged 30, 25 km

Where regular (electric) cyclists or public transport commuters had a fairly fixed length of their commuting journey and still wanted to shorten it further, car users differ. A portion car users indicate that where they used to travel a short distance (<30 km) for less than 30 minutes, they now spent more and more time for the same distance, due to congested roads. By leaving for work earlier in the morning, the congestions are avoided, but it is considered as a loss of time. According to certain participants, the speed pedelec can offer time gain in those cases.

"... The distance I have to do from home to work, in the morning it's traffic jam. In all possible directions, no matter how I ride, I am stuck and that strikes me endlessly. The track has silted up in less than 3 years. It has completely turned 180°. It's became like that bit by bit, but now I'm really tired of it. ..."

Test person 15, female, aged 57, 10 km

"... Now, what am I doing right now? I just start earlier, at a quarter to 6 I leave by car, then I am here at 5 after 6, then I am here in 20 minutes, then a car is easy of course. But of course I would rather start again at 7 o'clock, but that means that it takes an hour and a half by car and therefore that the bike becomes interesting when it has a higher speed. ..."

Test person 5, male, aged 41, 18 km

Arrival time predictability

A second aspect of time management is the aspect of arrival time predictability. A decrease in travel time was as indicated above a mayor motivator to change travel modus, but the focus groups show that for some being able to predict the duration of their commute and the consistency of that duration is key.

"... I hope to have more predictability of your time because it's just, now I don't know if I'm going to be able to cook at home, ... "

Test person 3, female, aged 35, 22 km

"... That you can really estimate the duration of your distance. That that will be the main advantage. ..."

Test person 6, male, aged 46, 18 km

Safety

A large part of participants in all three companies had questions towards road safety. Based on earlier experiences with regular/racing bikes in combination with other road users, concerns were outed with regard to perception of speed, regulations and the braking distances.

"... My biggest curiosity is feeling versus safety. You can already hear about people crashing. When I said that at home, that was also the first reaction. I am curious about how I will experience that. ..."

Test person 28, male, aged 58, 20 km

"… I don't really feel safe on my racing bike in the dark periods of the year, but I don't know if it will be better or worse on a speed pedelec. …"

Test person 29, male, aged 51, 19 km

Ease of use

A returning reasoning during the focus groups for car use was the convenience of that mode of transport. Participants believed that if the speed pedelec were to take the place of the car, it should be easy to use.

"… I am curious about the ease of use. How heavy is it, how safe is it, how fast can I move around with it. …"

Test person 22, female, aged 40, 20 km

"… To me, no matter how fast the bike goes, it's probably just about convenience. To see how easy it is to take the bike. Because I do live around the city centre and I only have to be around the city centre and the like, but there you also have detours and you can't get through that once and they are working there. And by car you soon get stuck and start cursing because you can't go any further and you have to do a big tour, but I think you will have that convenience. That you are easier through everything. …"

Test person 14, female, aged 24, 6.2 km

Effect on health

The topic of health can be divided into two categories being mental health and physical health. Participants are divided on whether a speed pedelec can be beneficial for the general fitness. Views on the mental aspect of biking to work every day are stooled on observations from colleagues and friends.

"… For me, I think, mainly an improvement in my condition. The most important thing for me is the ease of use and the time savings and less stress …"

Test person 2, male, aged 43, 20 km

"… But also in such a way that I would feel fitter. With the car I can be so tired and no longer fit for anything else as often as I get here or at home, so I'm in a traffic jam. And I have two colleagues and they come every day with the bike and they have so, they say we have so much energy and if they come by car, they are so dazed. …"

Test person 32, female, aged 25, 25 km

"… I think mainly in the direction of psychological well-being, that you come home comfortably, no stress. The condition, that will probably come along, but psychological well-being in itself is better. …"

Test person 6, male, aged 46, 18 km

3.2.2 After the testing period

After the testing period and (more) experience on a speed pedelec, a difference in recurring themes was noticeable. Despite themes as time management, speed and effect on health returning, other different themes arose in the focus groups after the testing period. Following section will add findings relating to the previous themes, but will also describe some major new themes in short.

Reoccurring themes

As mentioned above, speed and time management returned as general themes after the testing period. Where at first a speed of 45 km/h seemed too fast for a portion of the participants, it is striking there is a certain curiosity towards the speed limit of 45 km/h with each testing group.

"… the speed, on parts where it was really safe, I also tested how fast the bike goes. If that is uphill and the wind is against me, I really had to pedal hard to go over 30. Downhill and tailwind, you quickly reach that 45km/h…."

Test person 9, male, aged 56, 17 km

The focus groups showed that saving time compared to the commuting time spent with the previous mode of transport, depends on the average speed, which is concurrent with the type of speed pedelec, the former mode of transport and the route taken. Several participants were under the impression they were gaining time, not only by going faster than for example taking the same route at the same hour with their bike, but also by not having to shower or by putting other clothes on.

"… The advantage of the speed pedelec over the normal bike is that you don't really sweat, which is not so important in driving home, but in driving to work is useful. You don't have to leave home half an hour earlier to take a shower at work and then once at work, there is some time to prepare before you start your day. That is an added value. That gives some time savings. …"

Test person 5, male, aged 41, 18 km

However not all participants' focus was on gaining time, but rather the time predictability of the duration of their commute. Some not even considered extra time on the speed pedelec as a loss of time, but talked about a moment of tranquillity and introspection.

"… With me also the experience of always a fixed time from home to here, a 35 minute trip was it for me, which is not so much that I have to get up earlier or leave earlier or so, to the activities after work or so. That all fits perfectly within the timing. I liked it very much …"

Test person 4, male, aged 25, 20 km

A large fraction of the participants across the three focus groups found that commuting with the speed pedelec had an impact on both their mental and physical health. Taking in the fresh air and movement emptied several heads in the morning and the evening, others pointed out that having to pay extra attention to potential dangers in traffic created a weary mind.

"… Fun to have a fresh head, actually I'm more relaxed to arrive at work in the morning and actually more relaxed at home as well. You've had that fresh air, that's great. …"

Test person 14, female, aged 24, 6.2 km

"… That is less relaxing in the sense that you have to pay more attention to everything. …"

Test person 30, female, aged 56, 22 km

Improvement of the physical health appeared to be solely dependent on original state of the participant's physique and the intensity of which he/she pedals.

"… I was also a bit disappointed because I can't really call it sports…."

Test person 22, female, aged 40, 20 km

"… Yes I do sport a lot. But it went faster on my scale anyway. That first week, I noticed that. …"

Test person 14, female, aged 24, 6.2 km

New themes

At the start of each testing period, participants were informed about road regulations specific for speed pedelecs. The speed pedelec in Belgium is legally defined as a moped type P. The focus groups however showed that road regulations and road signs weren't always clear-cut.

"… I still find it something strange. For me it is neither a bike nor a moped. It rides on the bike path, but you are not a bike, you are not a bike. I don't really know. … I even find that very strange that it is so expensive. …"

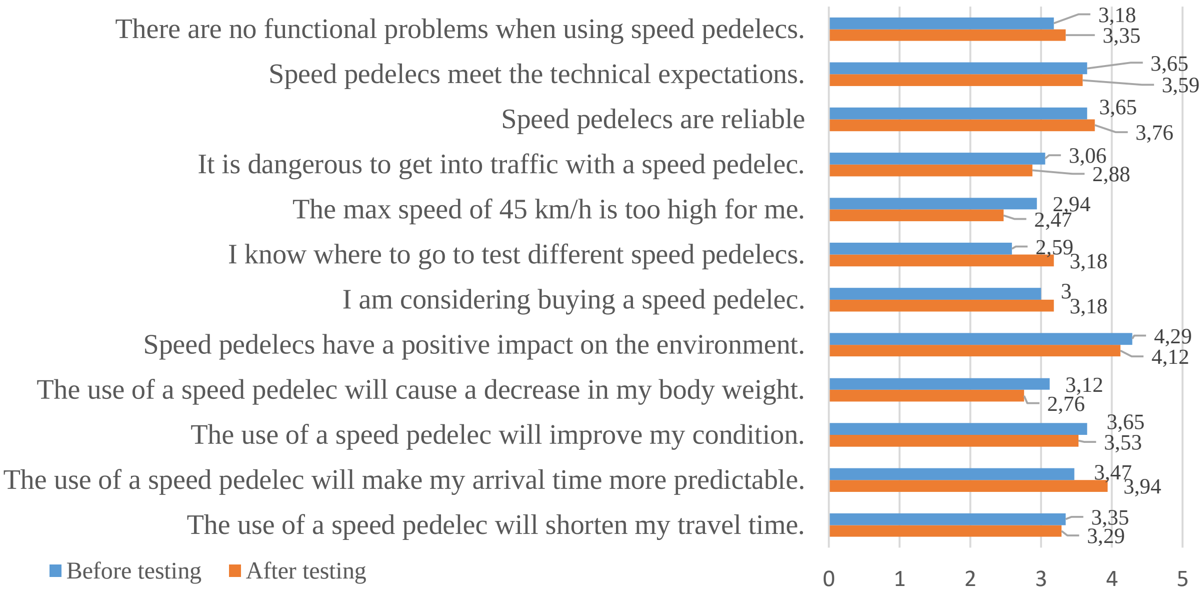
Test person 19, male, aged 29, 3 km

Related to the inability of this participant to grasp the essence of the speed pedelec, is his lack of understanding for the steepness of the price. High purchase prices can be seen as one of the biggest barriers as stated by commuters besides a lack of decent cycling infrastructure and technical difficulties of the bikes, to adopt speed pedelecs as sound commuting vehicle. Finally an overarching topic returning in each exit-focus group was the technicalities of the speed pedelec. Participants all agreed on the heavy weight of the bikes, being a burden from the moment that there was no more electrical pedal assistance, as well as a sheer desire for suspension, especially with the combination of high speed and inadequate infrastructure. Varying opinions however on the size of the tires, the volume of the ringing/horn signal and the practicality of the side-view mirror.

3.3 Surveys

With surveys before and after the testing period, the research attempts to bring out a possible change in attitude. Figure 3 gives an small excerpt of the extensive question list built upon the structure showed in Figure1. A 5-point Likert scale was used. (Totally agree = 5, Agree = 4, Neutral = 3, Not agree = 2, Totally not agree = 1)

Figure 3: Excerpt averages pre- & post survey



3.4 Spatial-temporal analysis

Participants were asked to log their daily commute using the Runkeeper application on their smartphone. In this section the early findings regarding that data are shown. In a first section, general information of the data is described, secondly a comparison between the companies is drawn.

3.4.1 General information

Travelled distance

Regarding the total of all travelled distances of the 30 participants in Fig. 4, almost half (47%) of the trips undertaken are trips between 10 to 20 km, 14% of the total amount of trips is more than 25 to 30 km. However we also see that 19% of trips are between 0 and 10 km, which is not in line with the selection criteria of a commuting distance between 15 and 35 km. The percentage of 19% can be explained by taking in account that not all participants of the second testing companies had a commuting distance of > 15 km. Furthermore, participants also tracked extra activities, besides commuting. If the travelled distance per trip is visualized by means of a boxplot in Fig. 7, we see a median of 18.1 km and quartiles on respectively 12 km and 21.3 km. Even a number of outliers around 50 km where participants tested the maximum reach of the speed pedelecs.

Travel time

As with the travelled distance in Fig. 5, it is noticeable that almost half (46%) of the trips logged by the participants takes between 20-40 minutes and a quarter of the total logged trips is between 40 minutes and one hour. Looking at the travel time data of all trips taken in the three companies in the form of a boxplot in Fig. 8, we can see that the median lies at 38 minutes and 50% of all data can be found between 29.4 and 49.5 minutes. Outliers here are participants who forgot to close the Runkeeper after stopping because of mechanical failures or flat tires. More analysis is needed to compare the data with the estimated commuting time provided by participants through the recruitment survey, where 65% indicated to travel more than 30 minutes and less than one hour for their daily commute.

Average speed

First analysis of the logging data gathered by the participants in Fig. 6, gives us a distribution of average speeds divided in 5 categories. Interesting to see is that the average speed over half of the trips is between 20-30 km/h and 30 % is between 30-40 km/h. Further analysis is needed with respect for cruising speed (i.e. speed which is the most common during a trip).

Figure 4: Travelled distance (km)

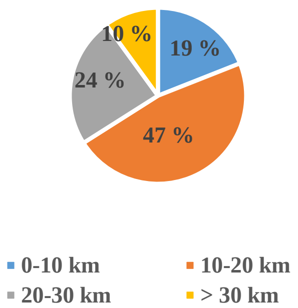


Figure 5: Travelled time (min)

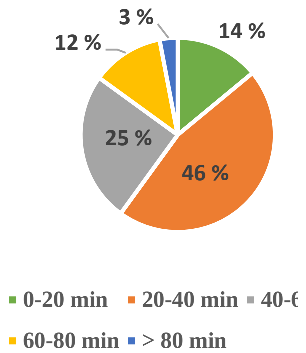


Figure 6: Average speed (km/h)

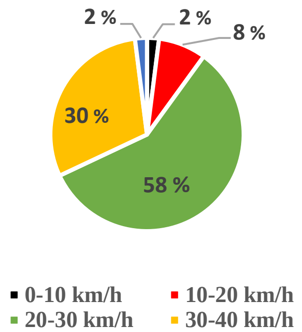


Figure 7: Travelled distance (km)

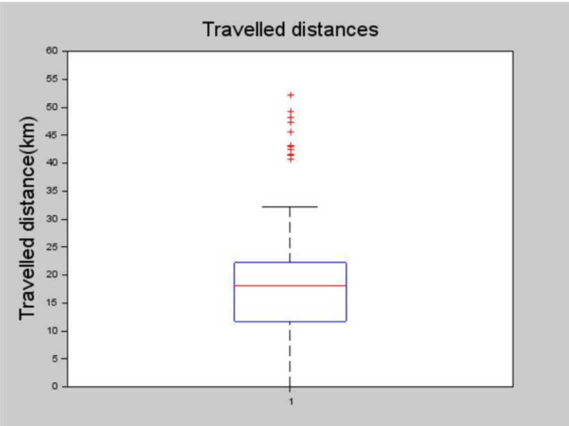
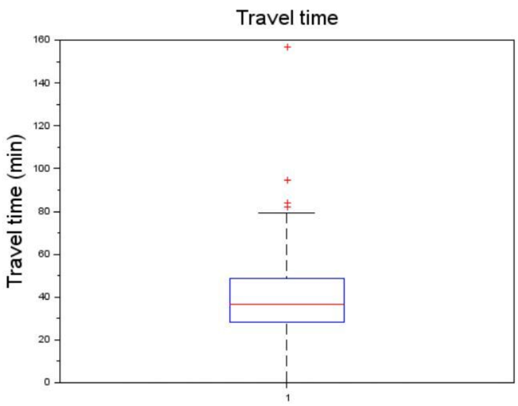


Figure 8: Travelled time (min)



Types of riders

Through preliminary analysis of the logging data of each participant, the ways in which the participants travelled between work and home throughout the testing period can be divided into three categories, being "the conservative", "the optimizer" and "the discoverer". Where a "conservative" rider always takes the same path in the morning or the evening Fig. 9, in most cases the quickest way, an "optimizer" will search for a better route for the appropriate time Fig. 10. The "discoverer" on the other hand, trying different routes, exploring a variety of possibilities Fig. 11. Not every participant can be placed under one category and is, over the period of the three weeks testing, a combination of the three.

Figure 9: "Conservative"

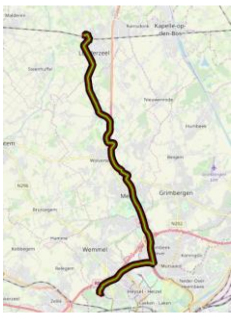
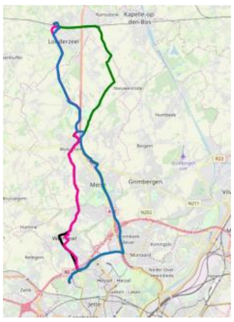


Figure 10: "Optimizer"

Figure 11: "Discoverer"



3.4.2 Specific comparison

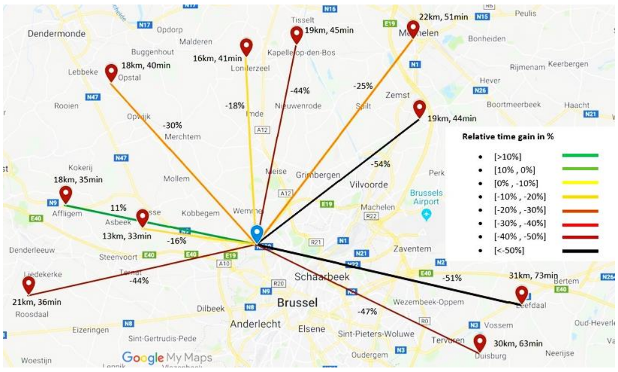
In this paragraph the specific comparison will be made between the three companies, regarding the time gained in comparison with the car. Each map shows one day in the testing period in which the users have driven a speed pedelec to work. The testing company is indicated on the map with a blue marker, the starting point of each participant is indicated with a red marker including the distance covered that day and the time it took. The latter is taken out of logging data per participant. Next, the same departure hour was used to search in the historic data of the route planner of Google Maps to discover the travel time from home to work by car on that specific day and hour. Google Maps, provides a minimum and maximum time value, where the average was taken to compare to the travel time between speed pedelec and car. The relative time gain was calculated as followed:

$$Relative\ time\ gain\ (\%) = \frac{\Delta t_{car} - \Delta t_{speed\ pedelec}}{\Delta t_{speed\ pedelec}} \tag{1}$$

The first company Fig. 12 is located at the edge of Brussels, connected with other smaller cities as Aalst and Mechelen through express ways. In this case, there is one participant that has 11% time gain on a travel time of 35 min and a distance of 18 km. Two of the participants of the first company have a time gain less than-20%, which is a time loss less than 20%.

In the general description of this section, it is described that the median of travel time by speed pedelec is 38 minutes. With a relative time gain of -20%, a participant loses in worst case scenario 6.3 minutes, which is relative to the travel time being 31.7 minutes. Furthermore there are seven participants with more than 20% time loss and two participants with more than 50% time loss, which means that those participants spent more than double the amount of time on the speed pedelec than they would in their car.

Figure 12: Relative time gain for company 1



The second company Fig. 13 is located in a more rural area in the west of Flanders. In this case, one participant has nor time gain, nor time loss. This is due to the minimal commuting distance for this participant. One other participant has a relative 11% time loss for a travel time of 18 minutes, however all other participants have time losses of + 25 %.

Figure 13: Relative time gain for company 2

The third and final company Fig. 14 is located in the centre of Belgium's capital, which again creates a different situation with a good access to public transport and unpredictable traffic situations in the centre of Brussels. In this case we see there are two participants with time gain and two participants with time losses of 2.5% and 7.7%. Furthermore, two participants with time loss of less than 20%. However also one participant with a time loss of 47.4%, which can be explained by the extremely prudent character and low speed of the participant in question. In this case we could say the speed pedelec is almost as fast a car for distances less than 30 km, provided a good infrastructure.

Figure 14: Relative time gain for company 3

4 Conclusion & Discussion

This paper reports on the first findings of the 365SNEL-project, commissioned by the Flemish department of Environment. In this project a fleet of speed pedelec is deployed in several Flemish companies for one year, covering every province in Flanders (northern part of Belgium) starting October 2018. In this paper, the methodology of data gathering and analysis within the project was discussed, together with qualitative insights as a results of the focus groups as well as a preliminary descriptive analysis of the quantitative data collected through the surveys within those three companies, linked with the gps tracking-data collected with the Runkeeper application. An overview of the three companies was given as well as the response of the recruitment survey. The main topics of the entry and exit focus groups were discussed with statements from participants, linked with a small excerpt of the results of the pre- & post-survey. Concluding with a spatial-temporal analysis of the tracking data.

As this paper only covers the results of the first three participating companies, it does not, as of this time, give a representative image of the conducted research. More in-depth analysis of current qualitative, quantitative and tracking data is needed, as well as an addition of data from the other 7 participating companies, before it could be possible to draw any conclusions.

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References

[1] *Jaarrapport Lucht,* http://www.vmm.be/bestanden/VMM-2017-LKT_TW.pdf, accessed on 2018-10-29

[2] *EU Environmental Implementation Review: Highlights Belgium* http://ec.europa.eu/environment/eir/pdf/factsheet_be_en.pdf, accessed on 2018-10-29

[3] *Statbel*, https://statbel.fgov.be/nl/themas/mobiliteit/verkeer/voertuigenpark, accessed on 2018-10-29

[4] *Touring*, https://www.touring.be/nl/pers/filebarometer-2017-verzadiging-van-het-wegennet-veroorzaakt-een-uitbreiding-van-de, accessed on 2018-10-29

[5] *Milieuvriendelijke voertuigen*, http://milieuvriendelijkevoertuigen.be/beleid, accessed on 2018-10-29

[6] *Life Cycle Analysis of the Climate Impact of Electric Vehicles,* https://www.transportenvironment.org/sites/te/files/publications/TE%20-%20draft%20report%20v04.pdf, accessed 2018-10-30

[7] M. Messagie et Al., *A Range-Based Vehicle Life Cycle Assessment Incorporating Variability in the Environmental Assessment of Different Vehicle Technologies and Fuels,* Journal of Energies, doi: 10.3390/en7031467

[8] *Het potentieel van lichte elektrische voertuigen in Vlaanderen,* https://iiw.kuleuven.be/apps/lev/eindrapport.pdf , accessed on 2018-10-31

[9] *VRT NWS,* https://www.vrt.be/vrtnws/nl/2018/12/10/meer-dan-16-000-speed-pedelecs-ingeschreven-vanaf-morgen-is-num/, accessed on 2019-02-27

[10] A. Wolf et. Al., *Technology adoption of electric bicycles: A survey among early adopters,* Transportation Research Part A: Policy and Practice, ISSN 0965-8564, 69(2014), 196-211

[11] P. Plazier et Al., *"Cycling was never so easy!" An analysis of e-bike commuters motives, travel behaviour and experiences using GPS-tracking and interviews,* Journal of Transport Geography, ISSN 0966-6923, 65(2017), 25-34

[12] S.Edge et Al., *Exploring e-bikes as a mode of sustainable transport: A temporal qualitative study of the perspectives of a sample of novice riders in a Canadian city,* Canadian Geographer, ISSN 1541-0064, 62(2018), 384-397

[13] *Runkeeper,* https://runkeeper.com, accessed on 2018-10-31

[14] *NVivo, https://www.qsrinternational.com/nvivo/what-is-nvivo,* accessed on 2018-02-26

[15] Braun, V., & Clarke, V., *Using thematic analysis in psychology,* Qualitative Research in Psychology*,* 3(2), ISSN 1478-0887, 3(2006), 77–101.

[16] *SWOV,* https://www.swov.nl/publicatie/speed-pedelecs-op-de-rijbaan-observatieonderzoek, accessed 2018-08-28

[17] *Comparing and Analysing the Behaviour of Users of Conventional Bicycles and Speed Pedelecs: Naturalistic Cycling,* https://dspace.library.uu.nl/handle/1874/341686, accessed on 2018-10-29

[18] V.Venkatesh et Al., *Technology acceptance model 3 and a research agenda on interventions,* Decision Sciences, ISSN 0011-7315, 39(2008), 273-315

[19] A.Fyhri et Al., *A push to cycling-exploring the e-bike's role in overcoming barriers to bicycle use with a survey and a intervention study,* International Journal of Sustainable Transportation, ISSN 1556-8334, 9(2017), 681-695

[20] M. Petschnig et Al., *Innovative alternatives take action – Investigating determinants of alternative fuel vehicle adoption,* Transportation Research Part A: Policy and Practice, ISSN 0965-8564, 61(2014), 68-83

[21] *Mobiel Vlaanderen,* https://www.mobielvlaanderen.be/pdf/ovg52/analyserapport.pdf, accessed 2019-03-10

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