

# Evaluation of Bikesharing in Copenhagen

---

Client Donkey Republic Admin ApS

Author



TU Dresden

Chair of Transport Ecology

Prof. Dr. Ing. Udo J. Becker

Dipl.-Ing. Sven Lißner

Dipl.-Ing. Maike von Harten

Status Dresden, 1st of January 2021



## Directory

1. Introduction .....	4
2. Objective.....	4
3. Methodology.....	5
3.1. Analysis of trip data .....	5
3.2. Online Surveys .....	6
4. Results .....	7
4.1. Analysis of trip data .....	7
4.2. In-app questionnaire .....	13
4.3. Online Survey send via mail.....	16
5. Conclusion.....	24
Annex.....	26

## Register of figures

Figure 1: Methodological framework.....	5
Figure 2: Recorded and analysed trips from 15 <sup>th</sup> of September to the 9 <sup>th</sup> of November .....	6
Figure 3: Response of the in-app questionnaire (n=905) .....	7
Figure 4: Distribution of rental duration (n=60964) .....	8
Figure 5: Distribution of rental length (n=60964).....	8
Figure 6: Distribution of rental speed (n=60964).....	9
Figure 7: Diurnal cycle of rentals for the weekend and weekdays (n=60964).....	10
Figure 8: Diurnal cycle of rentals for the different weekdays (n=60964) .....	10
Figure 9: Distribution of rentals during the week (n=60964) .....	11
Figure 10: District of origin and destination of rentals, n=60.694.....	11
Figure 11: Frequency of rental origins (left) and rental destinations (right) .....	12
Figure 12: Most frequented public transport stations (start of rental within 150 m) .....	13
Figure 13: Main trip purpose of all rentals (left, n=905) and during peak hour from 5 to 8 am and 15 to 17 pm (right, n=180) .....	14
Figure 14: Potential substitution of all rentals (left, n=905) and during peak hour from 5 to 8 am and 15 to 17 pm (right, n=180).....	15
Figure 15: routed trips which potentially substitute journey with a private bike .....	16
Figure 16: Participant's age, n=686 (3.7 % prefer not to say their age) .....	17
Figure 17: Holdings of driving licences (n=712).....	18
Figure 18: Access to a private car (n=712).....	18
Figure 19: Reasons not to own a private car. ....	19
Figure 20: Ownership of a private bicycle (n=712).....	19
Figure 21: Reasons not to own a bicycle. ....	20
Figure 22: Frequency of using different transport modes .....	20
Figure 23: Motivation to cycle among CPH resident and non-residents.....	21
Figure 24: Motivation to use Bikesharing.....	22
Figure 25: alternative to use Bikesharing for access to public transport.....	22
Figure 26: Impact of Bikesharing on individual travel behaviour.....	23

## Register of tables

Table 1: Procedure of data cleansing .....	5
--	---

## **1. Introduction**

By now, it is beyond doubt that cycling in Copenhagen involves many positive aspects. However, even in the cycling capital there is a great competition for inner-city areas. To value the usage of this public space especially against other sharing systems, the Danish company Donkey Republic commissioned the Chair of Transport Ecology to conduct an evaluation.

Aim of the evaluation is to quantify the modal shift and determine the influence of Bikesharing on the usage of inner-city areas for transportation. Furthermore, the possible impact of Bikesharing on the travel behaviour of the people in Copenhagen is studied.

In order to answer the research questions a mixed-methods approach is conducted. One component forms the comprehensive data analysis of GPS tracks, which represent the trips of cyclists in Copenhagen during a specific interval. Whereas the modal shift and the effects of Bikesharing on the individual travel behaviour will be assessed by two online surveys.

In the first instance, the project and data acquisition should start in April. Due to the restrictions of public life in consequence of the COVID 19 pandemic and therefore decrease of trips, the data acquisition was postponed until September 2020.

## **2. Objective**

Five research questions - formulated in collaboration with Donkey Republic - help to structure the evaluation. Furthermore, these questions were decisive to choose an appropriate method for the evaluation.

1. How much travel with cars (private cars, car shares, taxis/ride-hailing) can be replaced by donkey rides?
2. How much parking of the cars in the city can be reduced?
3. Is there a reduction of private bike parking in high-pressure areas?
4. Can bike-sharing rides reduce bike travel in DSB trains?
5. Is there an Impact of bike sharing in terms of cycling modality for individuals who live in the city and already have a bike

### 3. Methodology

To answer the five research questions different methods have been applied and partly linked to each other (Figure 1). Apart from the GPS-analysis of trip data, two online surveys have been conducted. In the following, the methods are presented in detail.

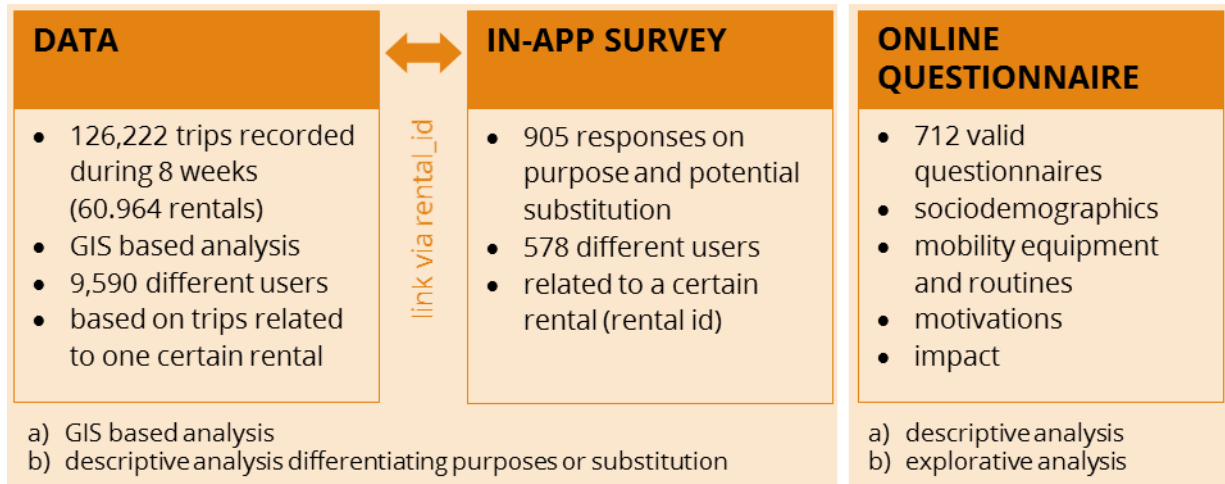


Figure 1: Methodological framework

#### 3.1. Analysis of trip data

Donkey Republic provided data of trips with shared bikes during a period of 8 weeks from the 15 of September to the 19 of November 2020. This dataset contains information about the beginning and end of each trip / rental together with the coordinates of the start and end of each trip. Two identifier enable to link trips within one rental (rental\_id) or by one account (anon\_id).

Before starting the analysis trips were routed and a procedure of data cleansing was executed to clean up duplicates, inconsistent or irrelevant data. In addition, round trips (trips with the same end and start point) are excluded, as there is no sufficient information in the dataset to route this trips.

Table 1: Procedure of data cleansing

STEP	FILTER	DATA	SHARE
0	raw	139.285	100%
1	trip speed < 25km/h	132.520	95%
2	rental duration > 2 min	131.863	95%
3	trip duration > 0	131.863	95%
4	trip length > 0	130.720	94%
5	rental length > 300m	126.222	91%

Altogether 126.222 trips or 60.964 rentals were analysed. As journeys with shared bikes can be paused and later continued with the same bike, one rental can consist of several trips. All

trips were routed using an iterated dijkstra-algorithm with a local OSRM backend realized with a batch run in a python-script. The result are encoded polylines with information on routing. Additionally start- and endtimes of trips and rentals as well as the linear distance and a factor describing the detour are attached.

For the descriptive analysis, the data of trips was aggregated with the rental\_id to look at the whole journey. The data was recorded during the second wave of the Covid-19 pandemic. It should be taken into account that the data therefore is influenced by the local and international restrictions of public life.

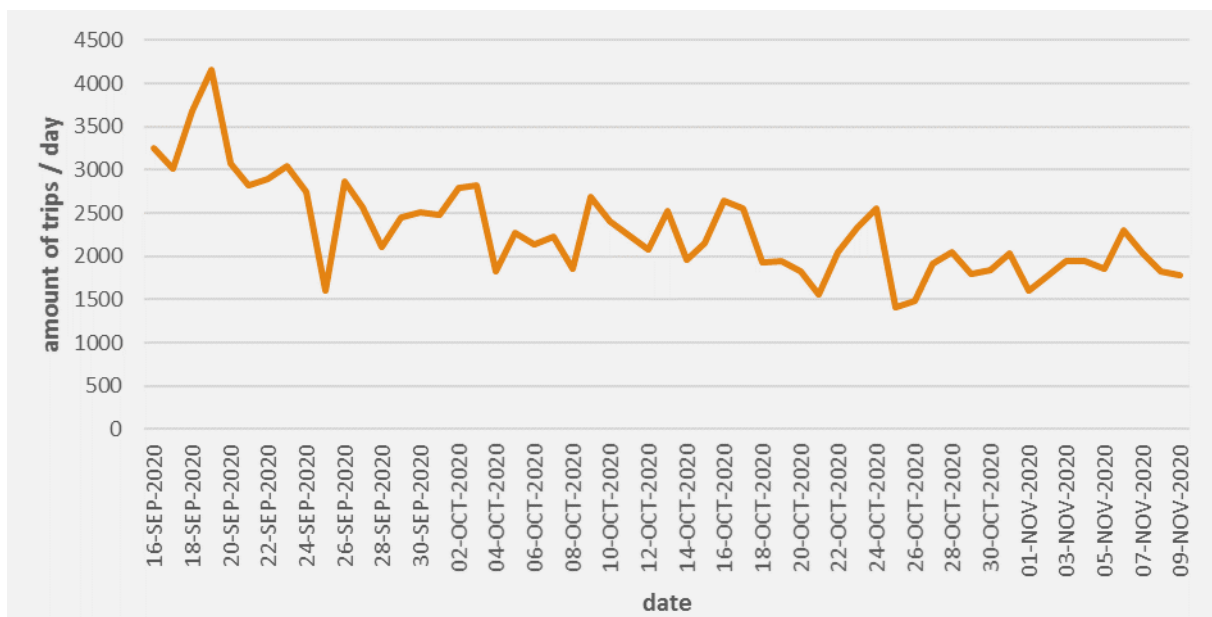


Figure 2: Recorded and analysed trips from 15<sup>th</sup> of September to the 9<sup>th</sup> of November

### 3.2. Online Surveys

Two online surveys in English language have been conducted. A translation of the surveys from English to Danish was considered not to be necessary as the App for booking is in English as well and it is expected that participants understand English though.

The first questionnaire consists of two questions and focuses on travel purpose and the potential substitution of trips with other transport modes by shared bikes of Donkey Republic (see Annex A). These questions were asked in-app just after a trip with a shared bicycle and can be linked to a certain rental in the dataset of trips by the rental\_id (part of the participant ID). Between the 17<sup>th</sup> of September and the 16<sup>th</sup> of November 548 different users responded to 905 questionnaires.

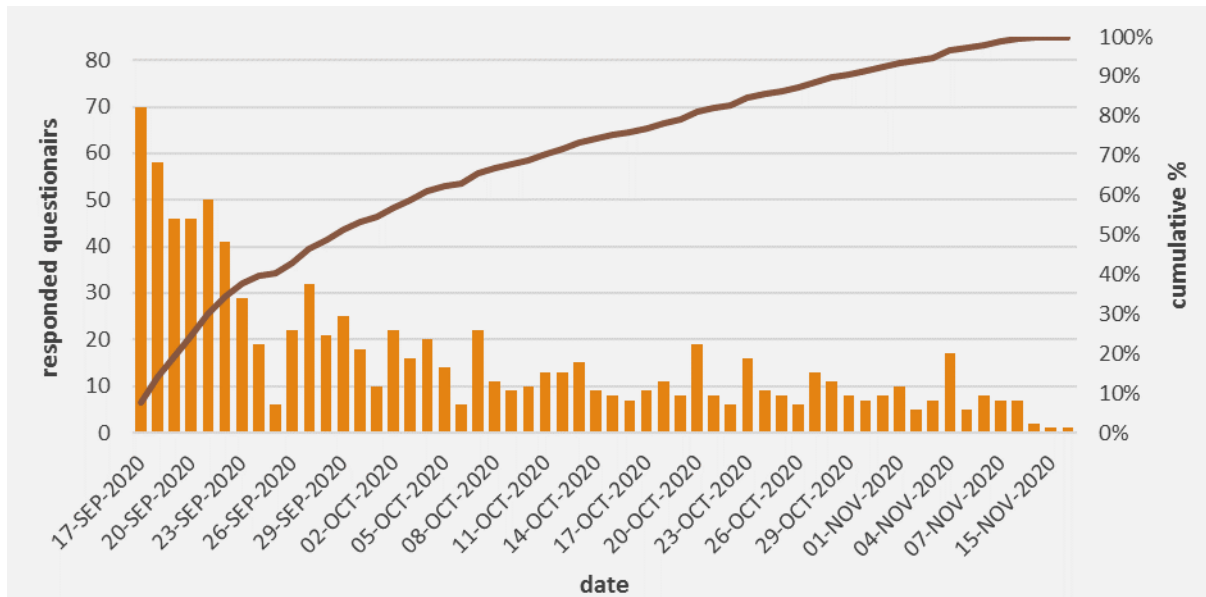


Figure 3: Response of the in-app questionnaire (n=905)

The second online survey consists of 12 questions (plus 3 conditional questions) and was created with the online tool soci survey and submitted via mail by Donkey Republic (see Annex B). During the survey period from the 29<sup>th</sup> of September and the 28<sup>th</sup> of October 791 questionnaires were answered, whereof 712 finished and valid datasets (90 %) were used for the further analysis. To motivate users of Donkey Republic to participate in the survey, they received a code for a 60-minutes free ride at the end of the questionnaire.

## 4. Results

### 4.1. Analysis of trip data

The rental duration is calculated as the sum of trip durations with the same rental id and the trip duration is defined by the difference of lock- and unlock-time. On average, a rental of a shared bicycle lasts 54 min, whereas most trips last between 6 and 25 min (57 %). Only 15 % of the trips last longer than one hour and 7 % longer than two hours (Figure 4). It should be taken into account that this time represents the time cycling but also includes pausing-time during one rental and the time for parking the bicycle.

The average length of a rental is 5 km but 50 % of the rentals are not longer than 3 km. About 10 % of the trips are longer than 10 km and 7 % longer than 20 km (Figure 5). Compared to other journeys with a bicycle with a share of 38 % within a distance of 4 km (DNTS and DTU (ed.), 2020), journeys with Bikessharing are shorter (59 % of the rentals are shorter than 4 km). It seems users in Copenhagen tend to use Bikessharing for shorter distances e.g. accessing and egressing public transport.

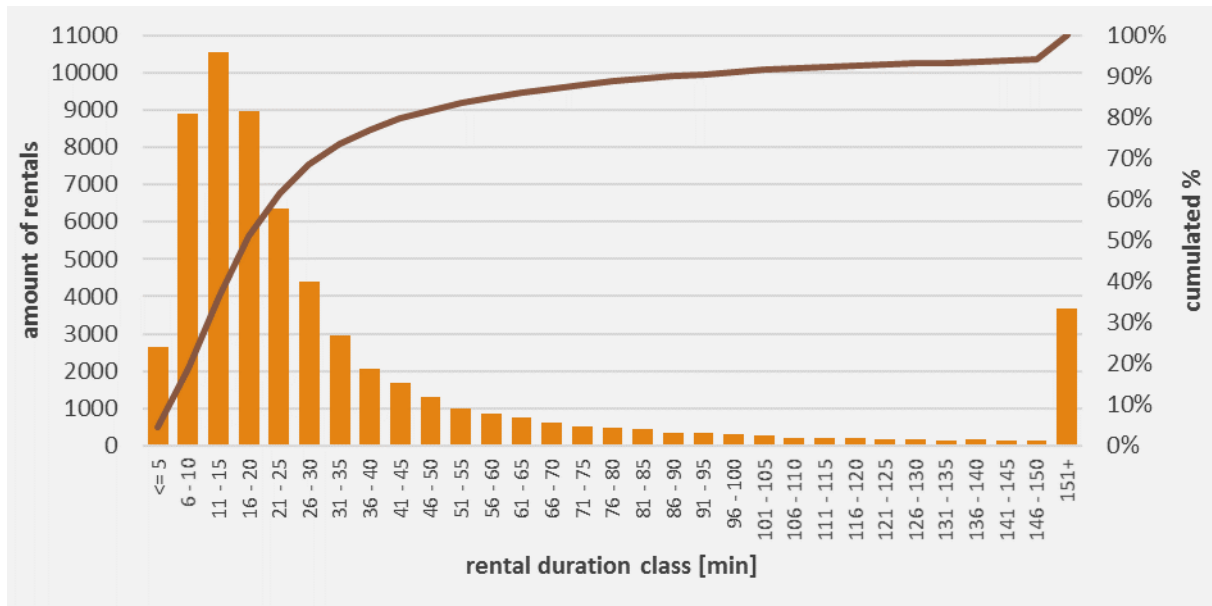


Figure 4: Distribution of rental duration (n=60964)

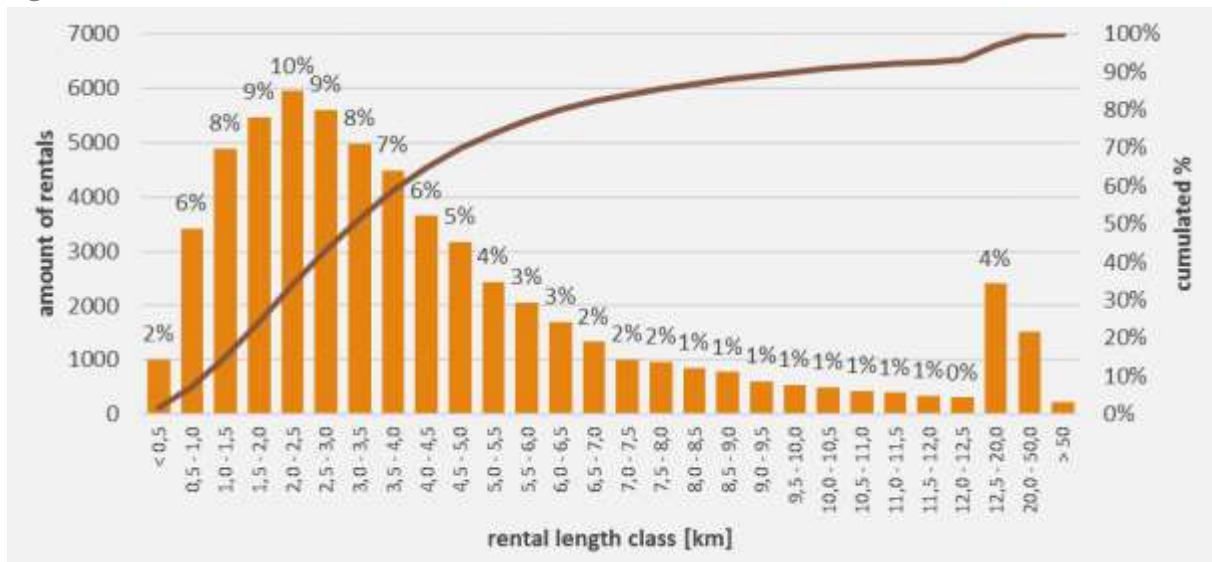


Figure 5: Distribution of rental length (n=60964)

The average speed calculated<sup>1</sup> is 11km/h whereas 11 % of the rentals have a speed higher than 15km/h (Figure 6). The share of 40 % of rentals with a speed lower 10km/h indicates that pausing-times or time for parking are included in the rental duration as well.

<sup>1</sup> The speed is calculated based on the rental duration and the rental length, which could be determined at the end of the routing procedure.



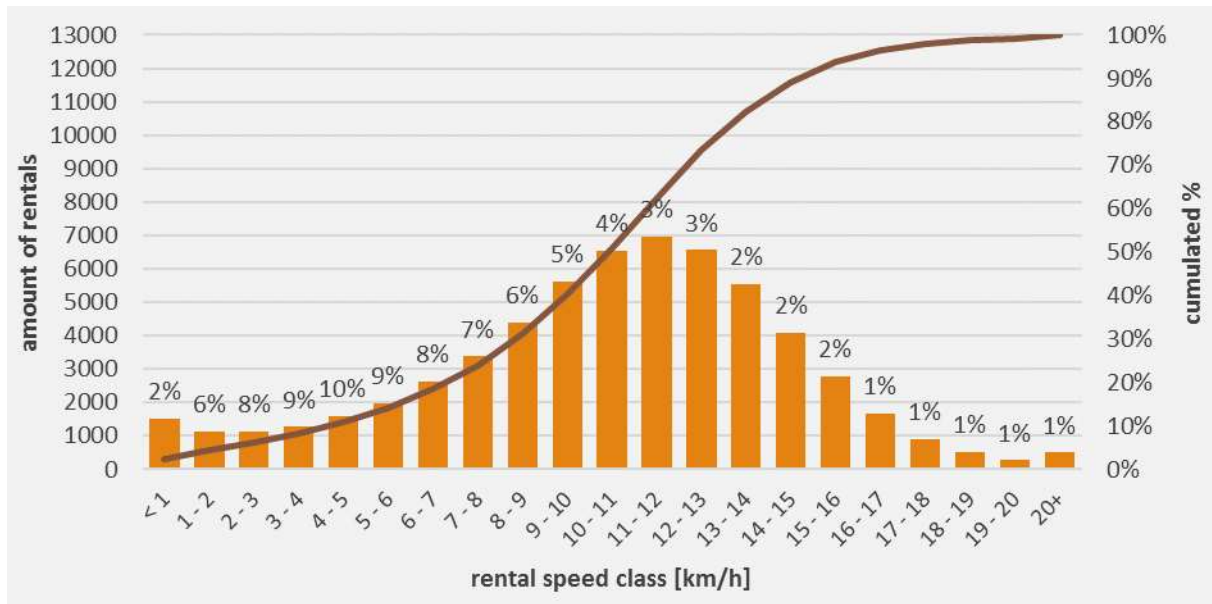


Figure 6: Distribution of rental speed (n=60964)

During the day, the amount of rentals strongly varies and the diurnal cycle on the weekend is completely distinctive compared to the cycle on weekdays (Figure 7). Two peaks can be identified on weekdays. The first one lasts from 6 am to 8 am and the second slightly stronger peak lasts from 15 to 17 pm. The stronger peak in the evening is in accordance with other studies on free-floating Bikesharing (VT (ed.), 2018, S. 27). This cycle with two peaks generally indicates that Bikesharing is used for commuting purposes (work or education). On the weekend however, no peaks but an overall higher amount of rentals from 10 am to 16 pm with a maximum at noon can be observed.

Looking also on the diurnal cycle of different weekdays (Figure 8) additional findings can be made. On Fridays and Saturdays Bikesharing is used more intensely late at night and on Saturdays and Sundays also in the early morning between 0 and 3 o'clock. Thus, Bikesharing is used when going out on the weekend days.

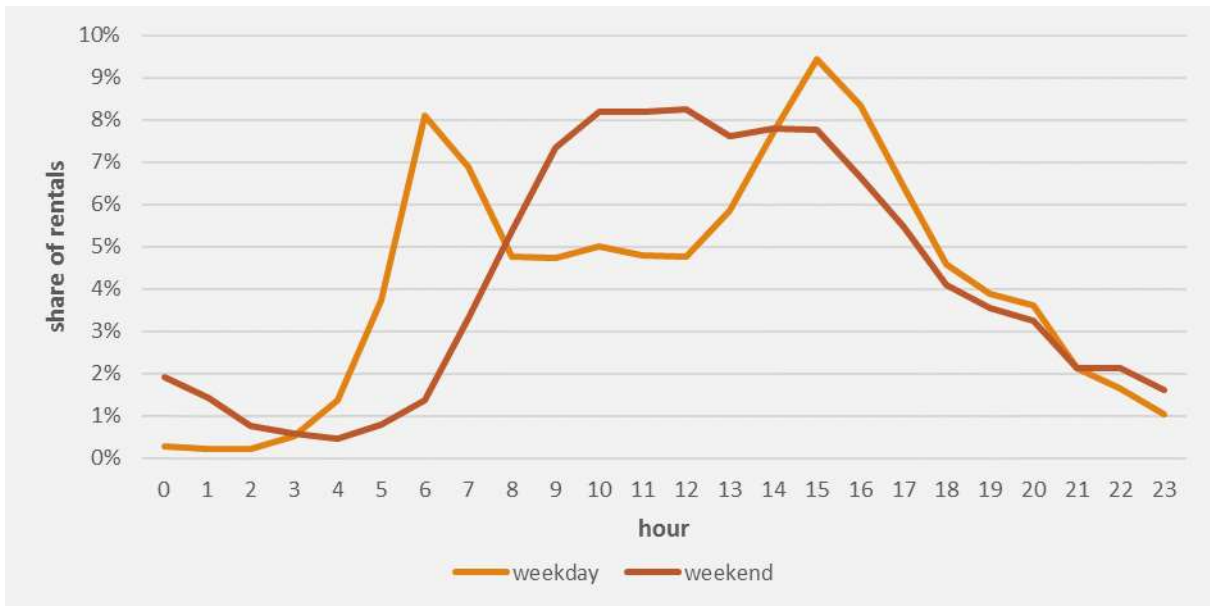


Figure 7: Diurnal cycle of rentals for the weekend and weekdays (n=60964)

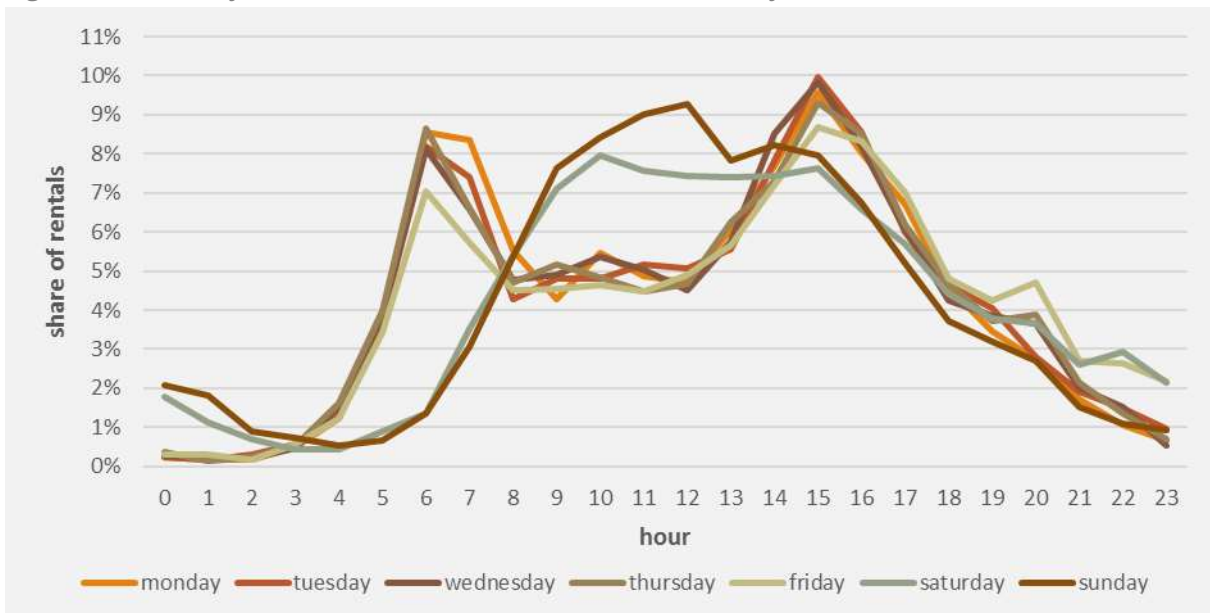


Figure 8: Diurnal cycle of rentals for the different weekdays (n=60964)

In general, the amount of rentals on different weekdays is quite even and counts between 12 % and 16 % (Figure 9). The highest share of rentals occur on Fridays and Saturdays. Although purposes are probably different on other weekdays, the utilization of Bikesharing is equally.

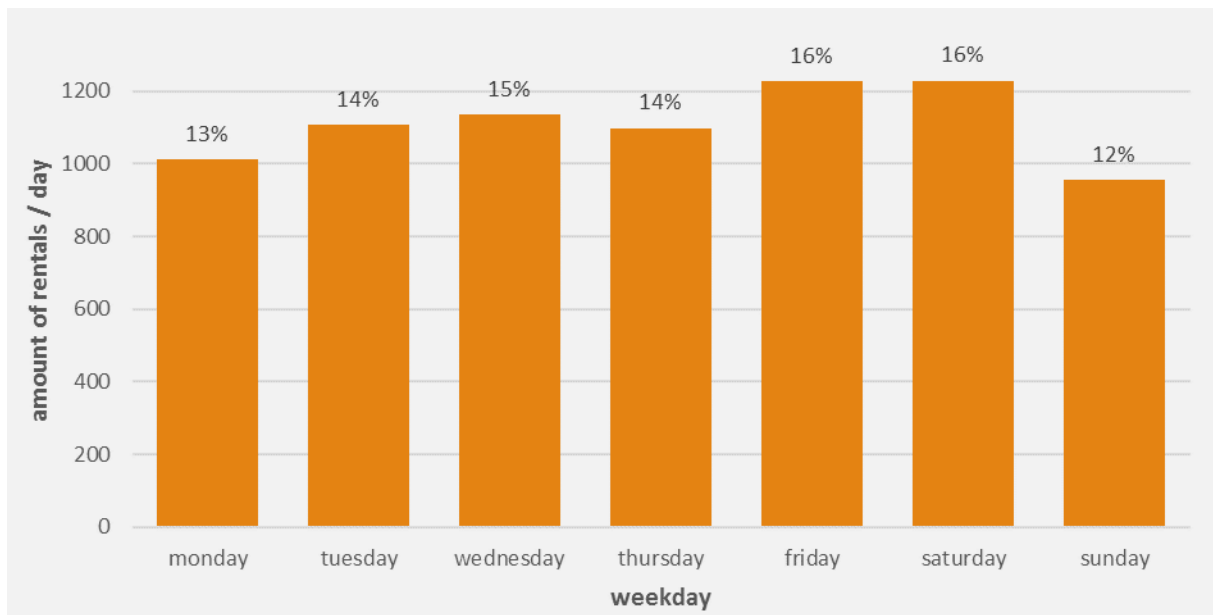


Figure 9: Distribution of rentals during the week (n=60964)

The division of the study area Copenhagen in administrative districts enables the formation of a matrix of rental-volume between different districts (Figure 10 and Figure 11). Almost one-third (27 %) of all rentals begin or end in Indre By; the city centre of Copenhagen. In the neighbouring district Vesterbro-Kongens Enghave begin or end 16 % of all rentals. As seen in the Figure 10 on the diagonal, most rentals end in the same district they begin. These rentals within one district account for 43 % of all rentals<sup>2</sup>. Only 2 % of all rentals begin or end out of the city of Copenhagen (*vicinity*).

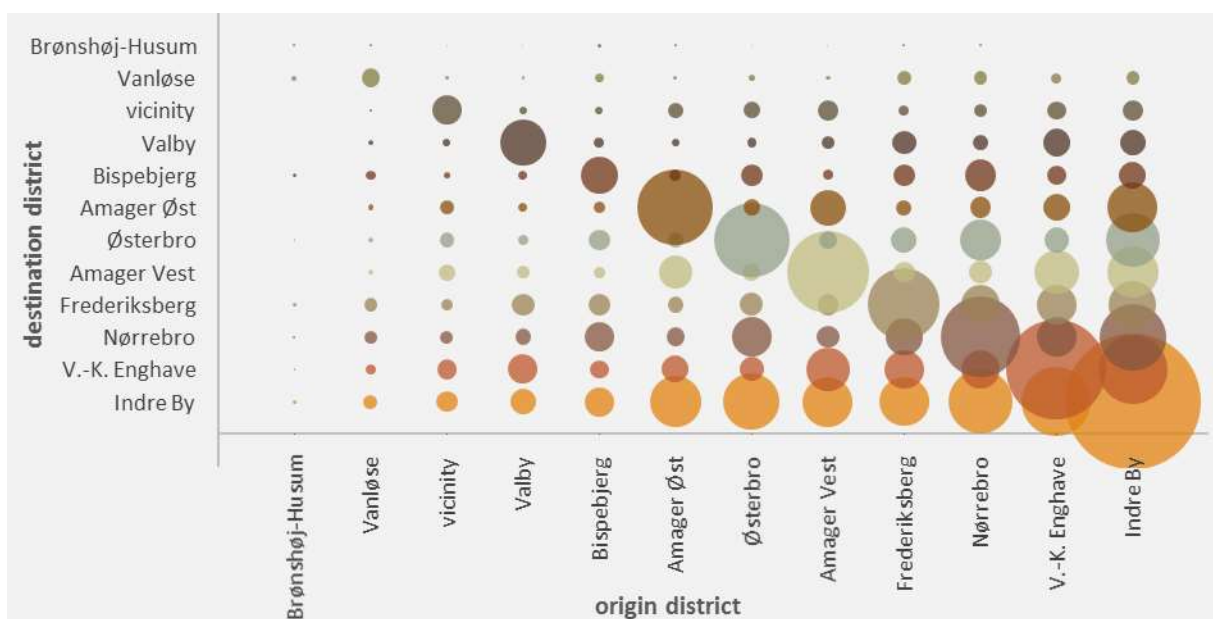


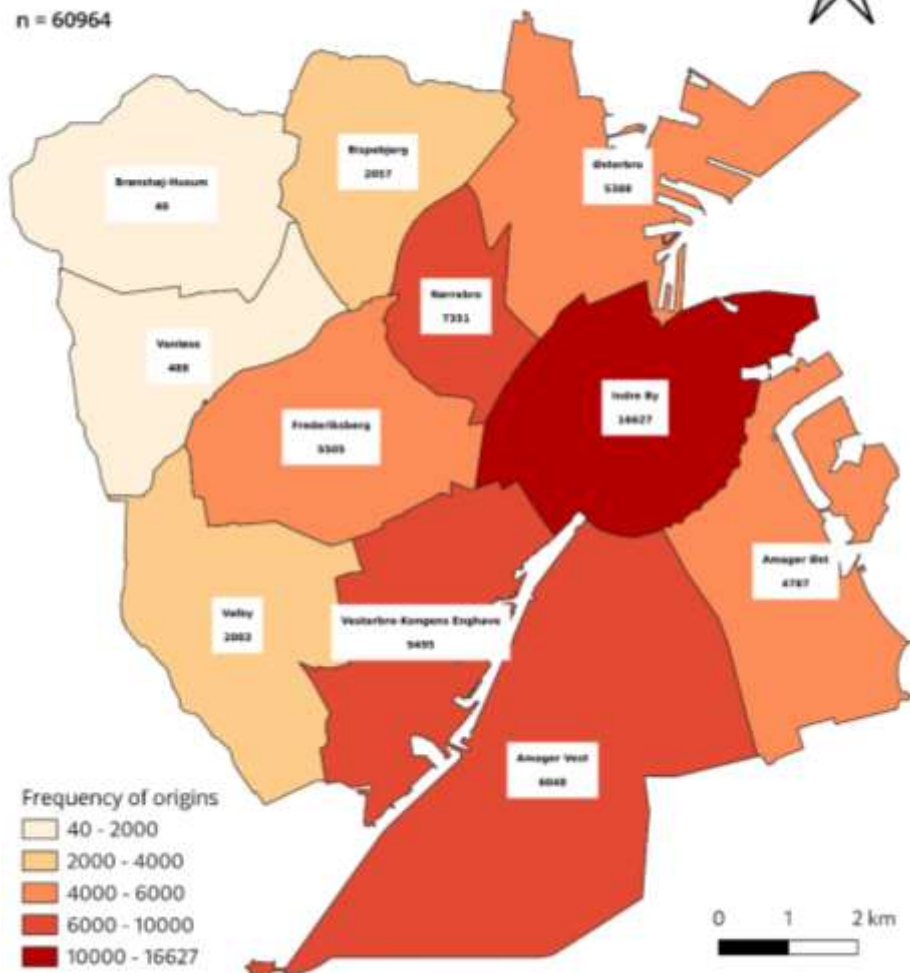
Figure 10: District of origin and destination of rentals, n=60.694

<sup>2</sup> The amount of rentals within one district is influenced neither by the weekday nor by the peak-hour.

### Frequency of rental origins, aggregated by districts

(1175 rentals starting out of Copenhagen are not displayed in this map)

n = 60964



### Frequency of rental destinations, aggregated by districts

(1209 rentals ending out of Copenhagen are not displayed in this map)

n = 60964

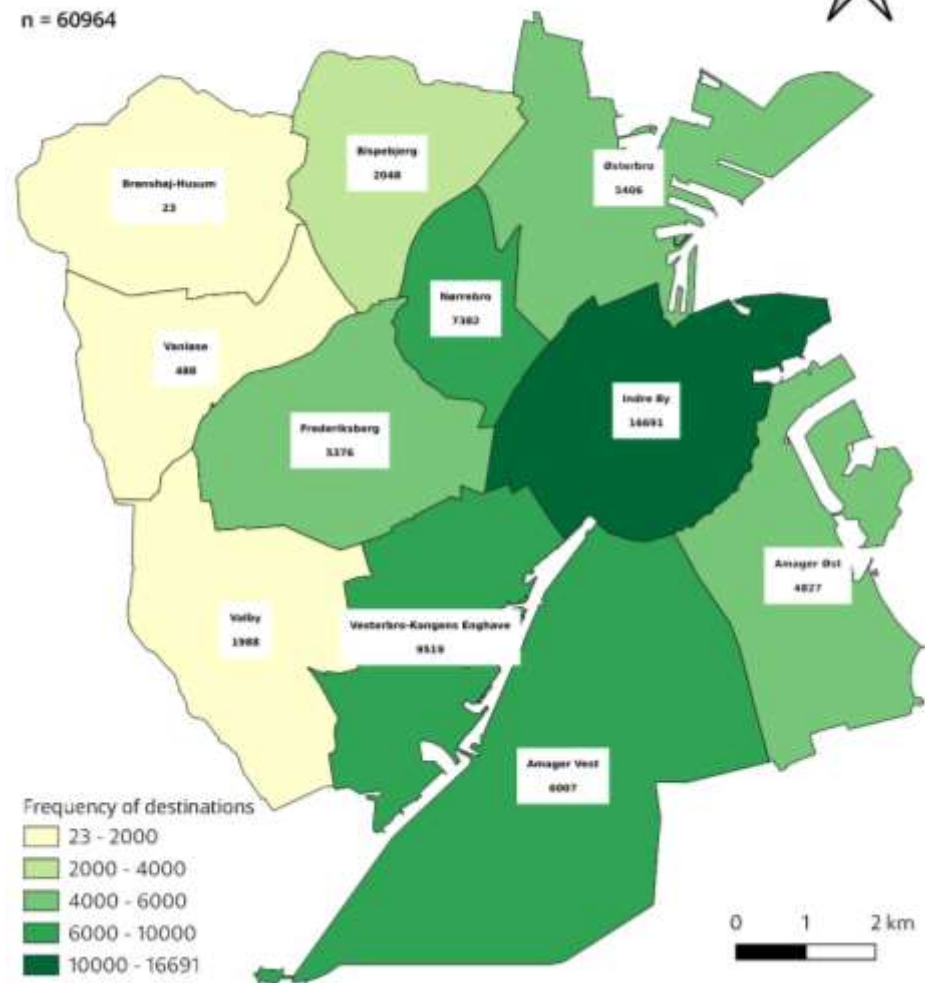


Figure 11: Frequency of rental origins (left) and rental destinations (right)

Start and ending points of rentals were associated with a certain district as well as with the nearest public transport station (DSB or Metro). To estimate the amount of trips and rentals, which begin or end at stations, the distance to those nearest public transport stations was determined. Nineteen percent of all starting and ending points are located within a distance of 150 m to a public transport station. Besides the main station (Københavns Hovedbanegård), also station with transfer options to other Metro-lines (Christianshavn, Rådhuspladsen, Kongens Nytorv, Frederiksberg) or to the s-train (Nørreport, Vesterport, Østerport and Nørrebro) are frequented origins or destinations of rentals. Eight percent of all rentals within a distance of 150 m to a public transport station start at Nørreport (9 % end here). Rentals, which began or ended at the main station (Annex E) or at Nørreport (Annex D) are visualised in the Annex.

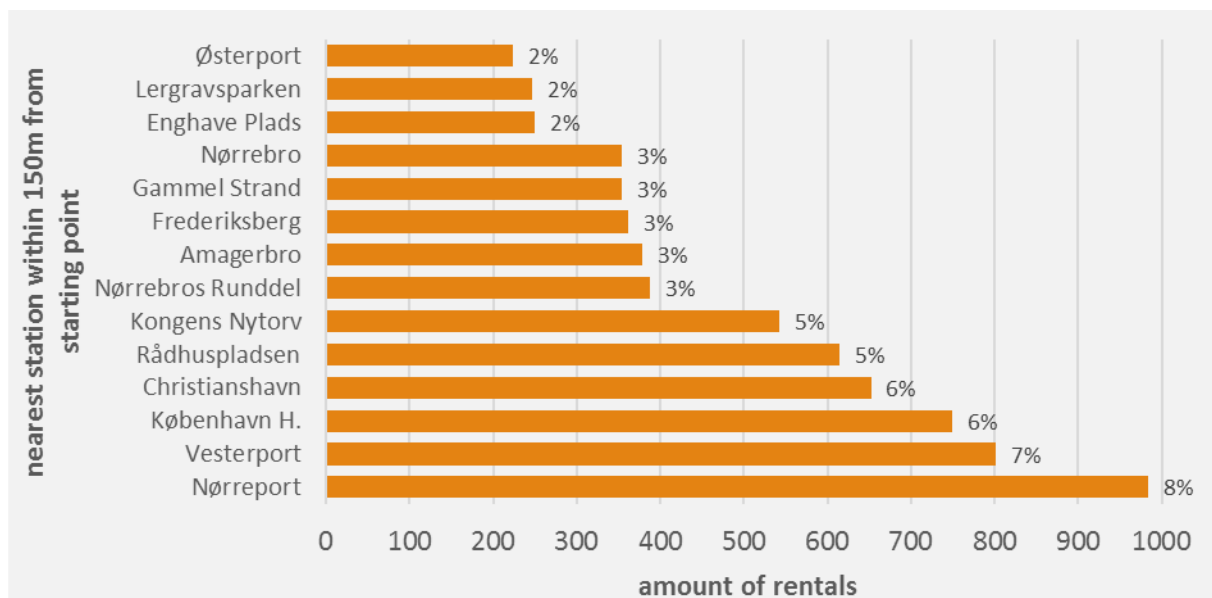


Figure 12: Most frequented public transport stations (start of rental within 150 m)

## 4.2. In-app questionnaire

The analysis of trip purposes shows that shared bicycles are used for commuting (Figure 13). Thus, Bikesharing is part of the daily mobility. 34 % of the questioned Bikesharing users state *work* as the main purpose of their trip<sup>3</sup> which is clearly more than over all transport modes (21 %, (DNTS and DTU (ed.), 2020)). Whereas the share of trips with the purpose of shopping (6 %) is lower than over all transport modes (DNTS and DTU (ed.), 2020). *Leisure activity or visiting people* is the secondly most stated trip purpose with a share of 30 %. Considering only the rentals which started in the peak hour from 6 to 8 am or 15 to 17 pm, the purpose work even makes up half of the trips with shared bicycles.

<sup>3</sup> As rentals can be trip chains, we asked for the main trip purpose.



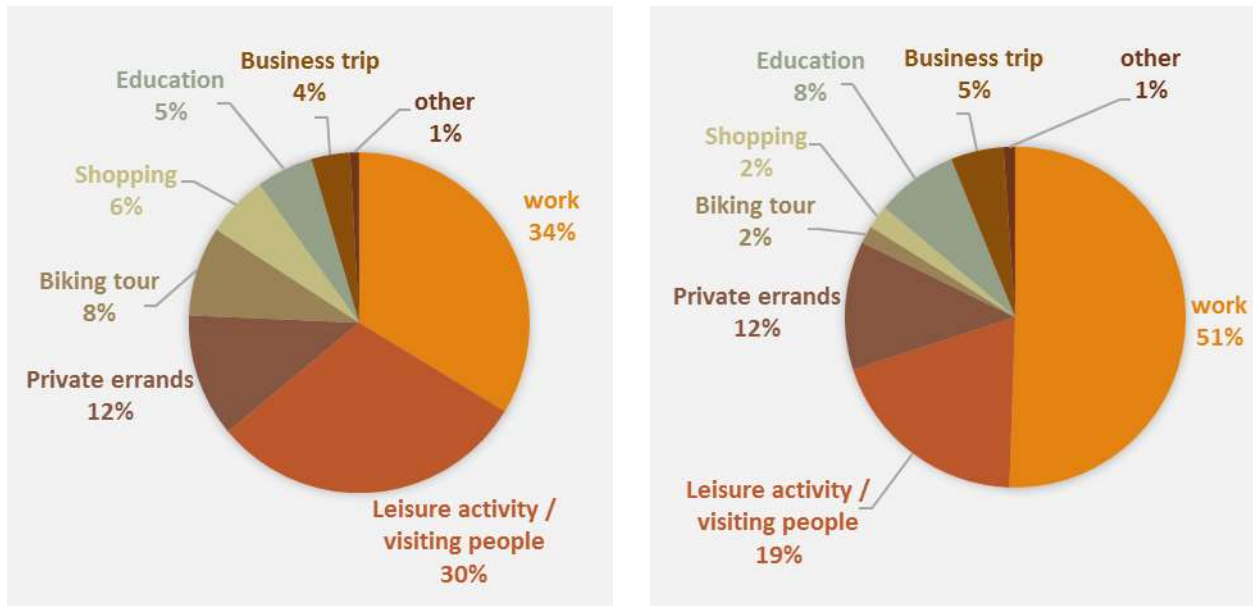


Figure 13: Main trip purpose of all rentals (left, n=905) and during peak hour from 5 to 8 am and 15 to 17 pm (right, n=180)

The potential of reducing travel with cars is relatively low (Figure 14), as the modal shift from cars is very low. The rental of shared bicycles mainly substitute journeys with public transport (43 %) or by foot (33 %). Only 3 % of the rentals do substitute private and shared cars.<sup>4</sup> The typical user of Bikeshaaring in CPH only seldom or never has access to a car (Figure 18). Thus, taking a car is no possible alternative to them. More likely Bikeshaaring is one of several transport means, which Bikeshaarers use to make up their mobility. The substitution of scooters (or other motorised two-wheeler) is slightly higher with 6 % (shared motor scooter plus shared e-scooter/e-kickbike).

An insight at the rentals during peak hours shows the potential of relieving the public transport when its capacity reaches the limit. Already today, half of the rentals with shared bicycles substitute journeys with public transport during peak hours.

<sup>4</sup> This result is comparable to other studies on impact of Bikeshaaring

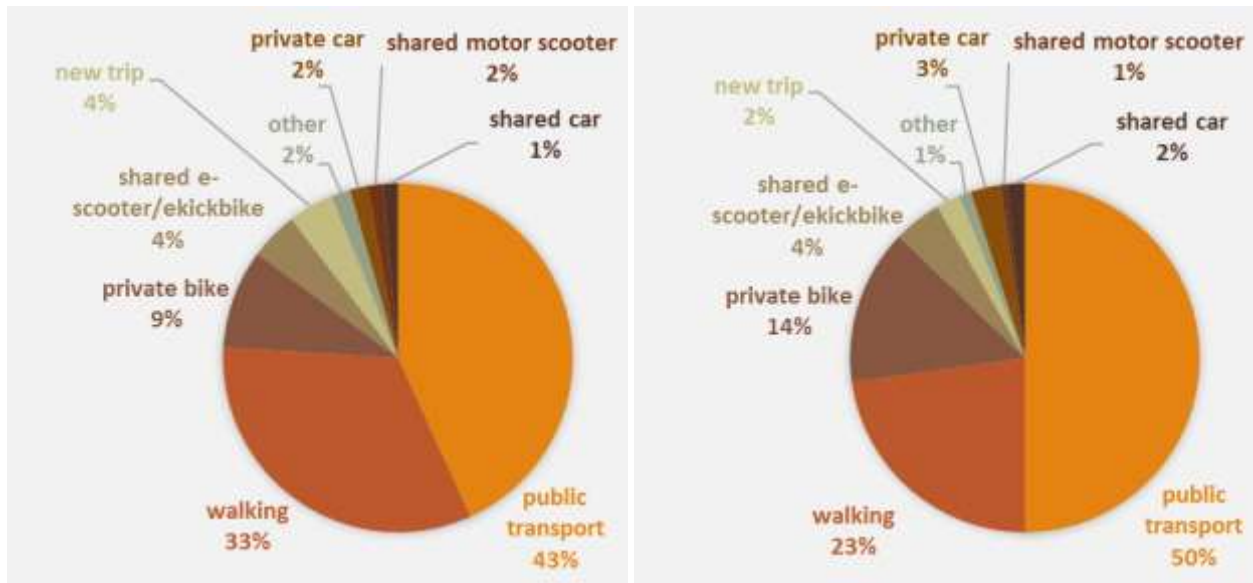


Figure 14: Potential substitution of all rentals (left, n=905) and during peak hour from 5 to 8 am and 15 to 17 pm (right, n=180)

Linking the trip data with the in-app questionnaire also enables the inspection of trips which potentially replace journey with a private bike in a map. Especially at public transport stations (central station, Frederiksberg and Nørrebro etc.) and in the districts Indry By and Nørrebro many journey start or end. Figure 15 shows this trips which have been substituted private bicycle rides in a map.

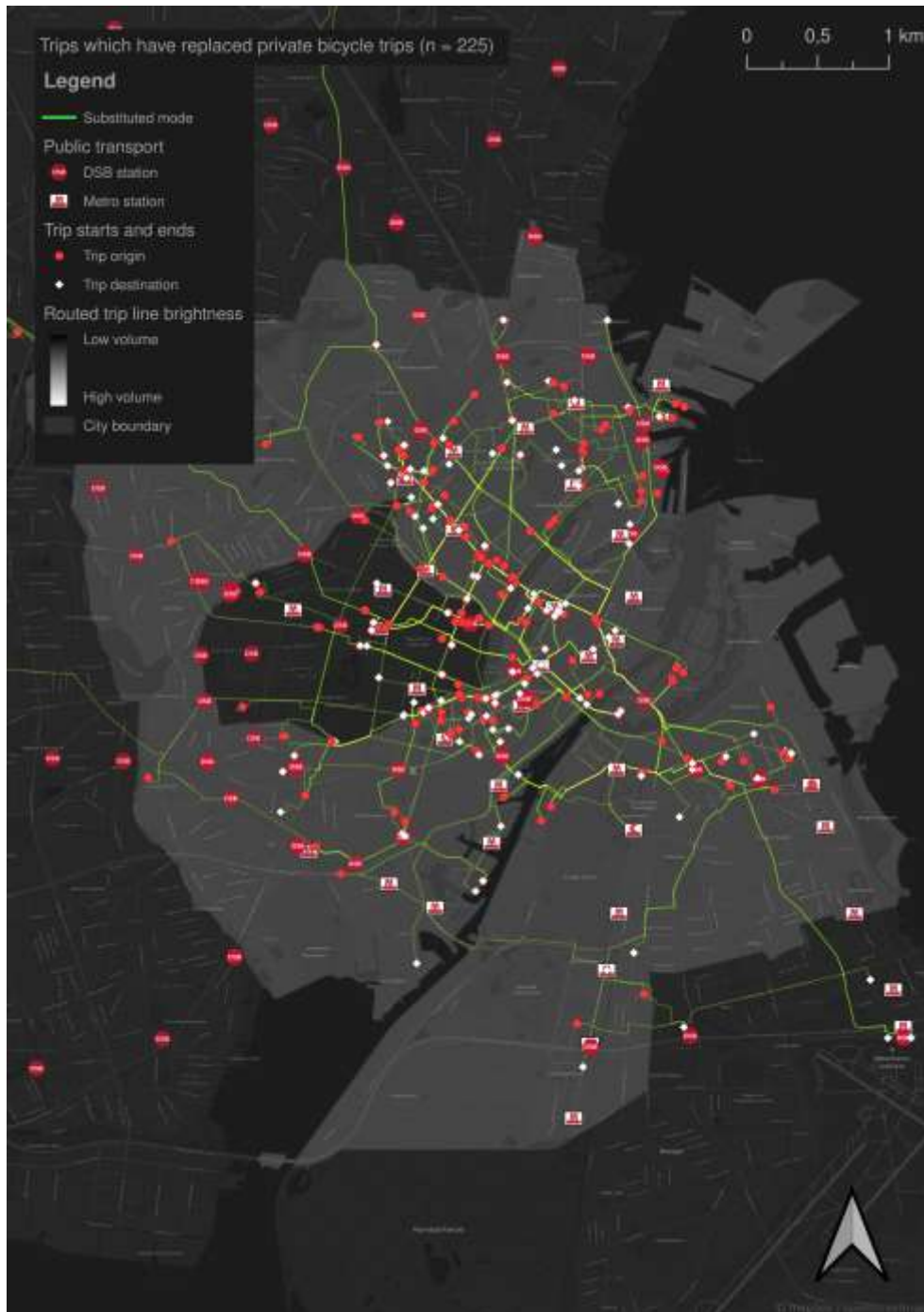


Figure 15: routed trips which potentially substitute journey with a private bike

### 4.3. Online Survey send via mail

Looking at the sample

Male (62 %) persons answered the questionnaire more frequently than female persons did (37 %) and 1 % stated divers as their gender. Persons from 10 to 71 years participated in the survey whereas most participants are between 20 and 35 years old (Figure 16). On average participants are 34 years old (SD=11 years).



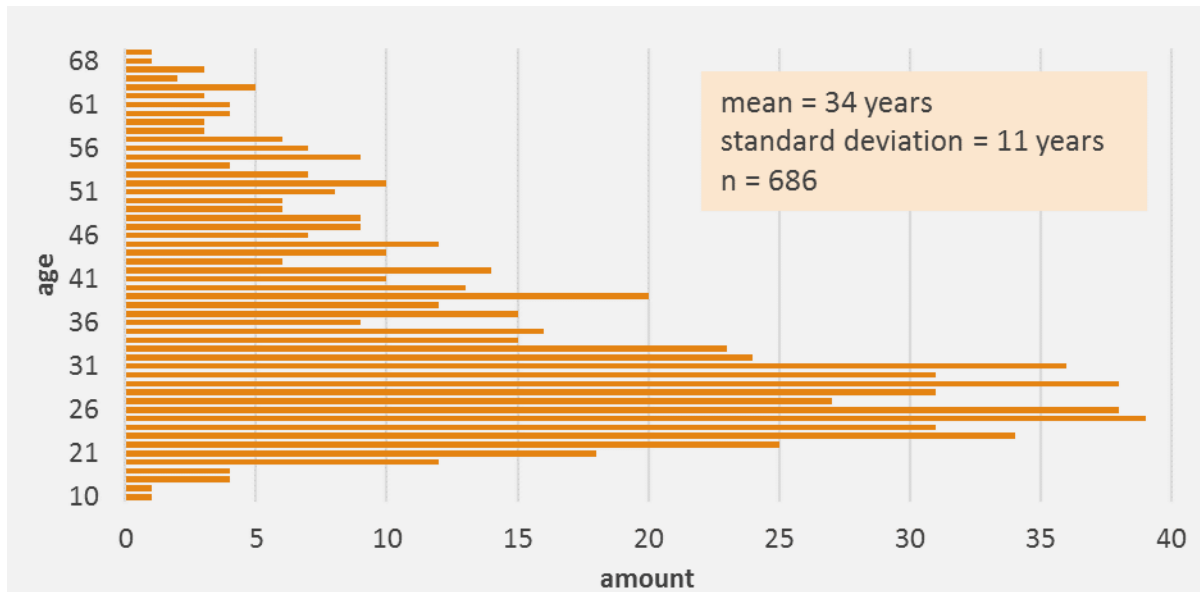


Figure 16: Participant's age, n=686 (3.7 % prefer not to say their age)

Forty percent of the survey participants were non-residents of Copenhagen (CHP). Those participants are younger than the residents ( $T(-5.839)=438.900$ ,  $p<0.00$ ,  $r=0.3$ ). Fifty-eight percent of the participants own any type of season ticket for public transport and even 41 % of non-residents own a season ticket for public transport. Those non-residents participating in the survey are probably not only typical tourist visiting the city, but people coming to CPH on a regular basis or during a longer period.

#### Mobility equipment and routines

The majority of all participants hold a driving licence (86 %, Figure 17), but non-residents state more often that they hold a driving licence compared to CPH residents ( $\chi^2(1)=9.252$ ,  $p<0.00$ ,  $\Phi=-0.1$ ).

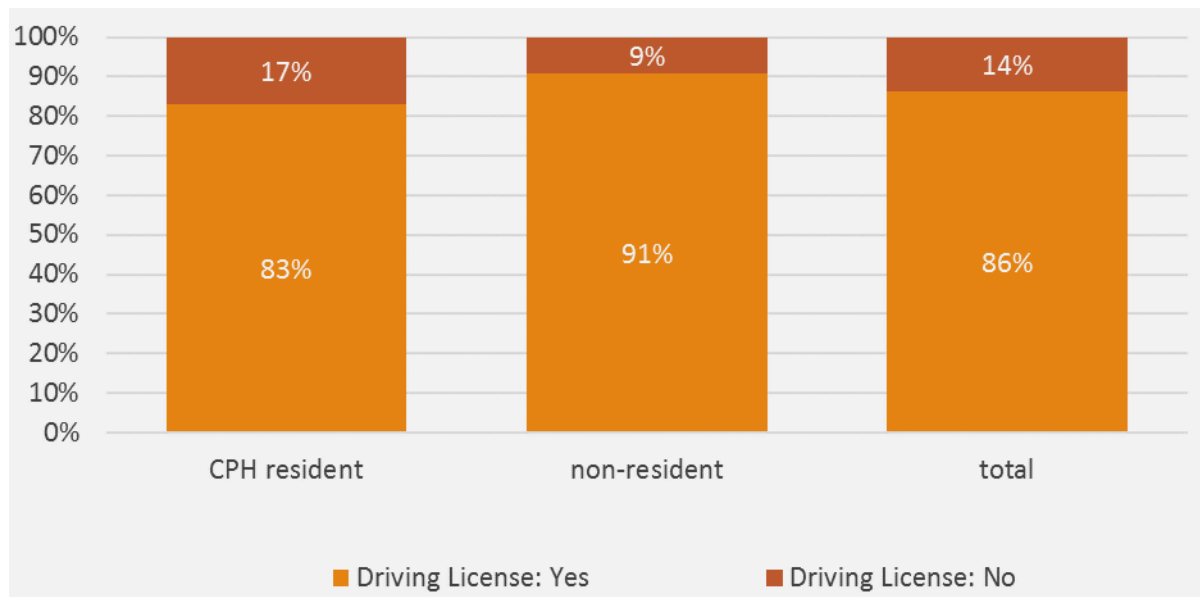


Figure 17: Holdings of driving licences (n=712)

More than one third of the participants always have access to a private car and 26 % percent have access to a car upon agreement (Figure 18). The accessibility to a private car among non-residents is clearly higher in the sample compared to CPH residents ( $U=40663$ ,  $p<0.00$ ,  $r=0.3$ ).

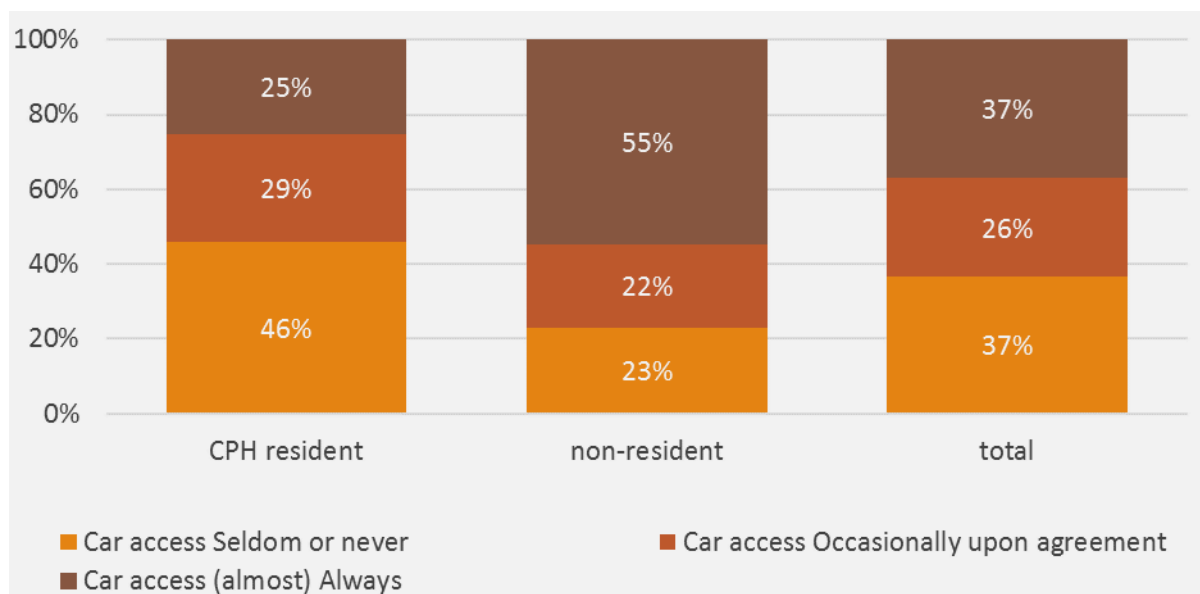


Figure 18: Access to a private car (n=712)

Those participants who state that they *seldom or never* have access to a car, where in addition asked for the reason (Figure 19). Mostly participants answered that a car is not required (63 %), that a car is too expensive (56 %) or that a car is unsuitable in a city (43 %).

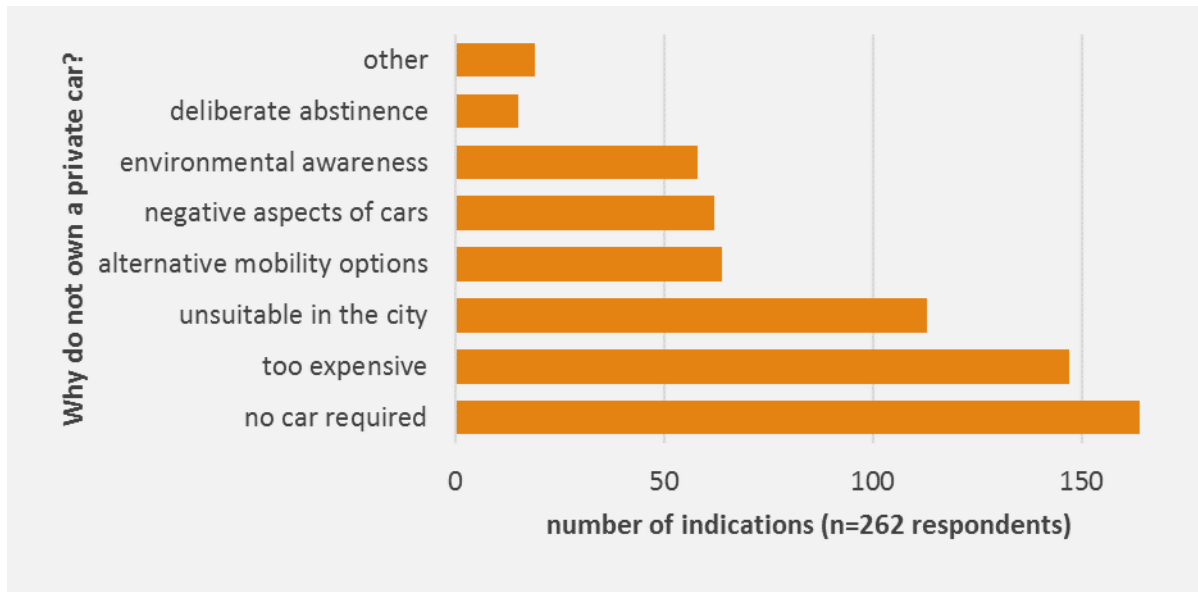


Figure 19: Reasons not to own a private car.

The bike-ownership in the sample is clearly greater than the access to a car. Seventy-three percent do own at least one bicycle and further 10 % own a bicycle, which was not working at the time of the survey (Figure 20). Interestingly CPH residents less frequent state to own a bicycle compared to non-residents ( $\chi^2(2)=12.072$ ,  $p<0.00$ ,  $\Phi=-0.1$ ). However, this does not result in a more frequent usage of private bicycles among non-residents.

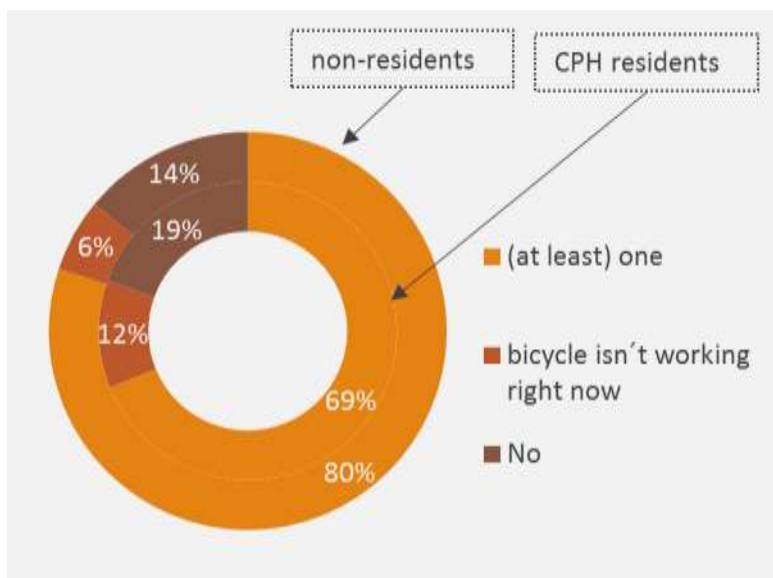


Figure 20: Ownership of a private bicycle (n=712)

Those participants who state that they do not own a bicycle, where in addition asked for the reason (Figure 21). Mostly participants answered that a bicycle is not necessary (37 %), because of responsibilities with ownership (34 %) or high costs (28 %).

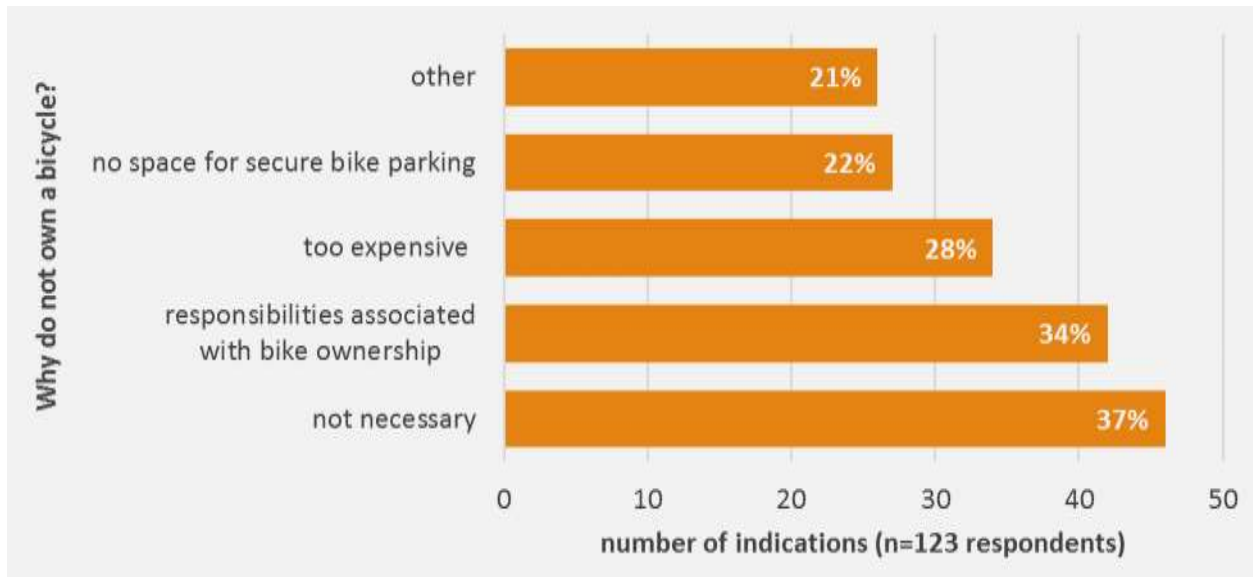


Figure 21: Reasons not to own a bicycle.

The most frequent used transport mode in the sample is the bicycle (Figure 22). Almost half of the participants state to use the bicycle *(almost) daily* with no significant difference between CPH residents and non-residents. Walking is the secondly most used transport mode (29 %). The car or Metro/DSB trains are used similarly often. Bikesharing also is used often with 10 % using it *(almost) daily*. CPH residents though use Bikesharing more often than non-residents ( $U=41196$ ,  $p<0.00$ ,  $r=0.3$ ) and female residents do use Bikesharing slightly more frequent than male persons ( $U=50793$ ,  $p<0.02$ ,  $r=0.1$ ). In contrast the car is more frequently used by non-residents ( $U=35159$ ,  $p<0.00$ ,  $r=0.4$ ).

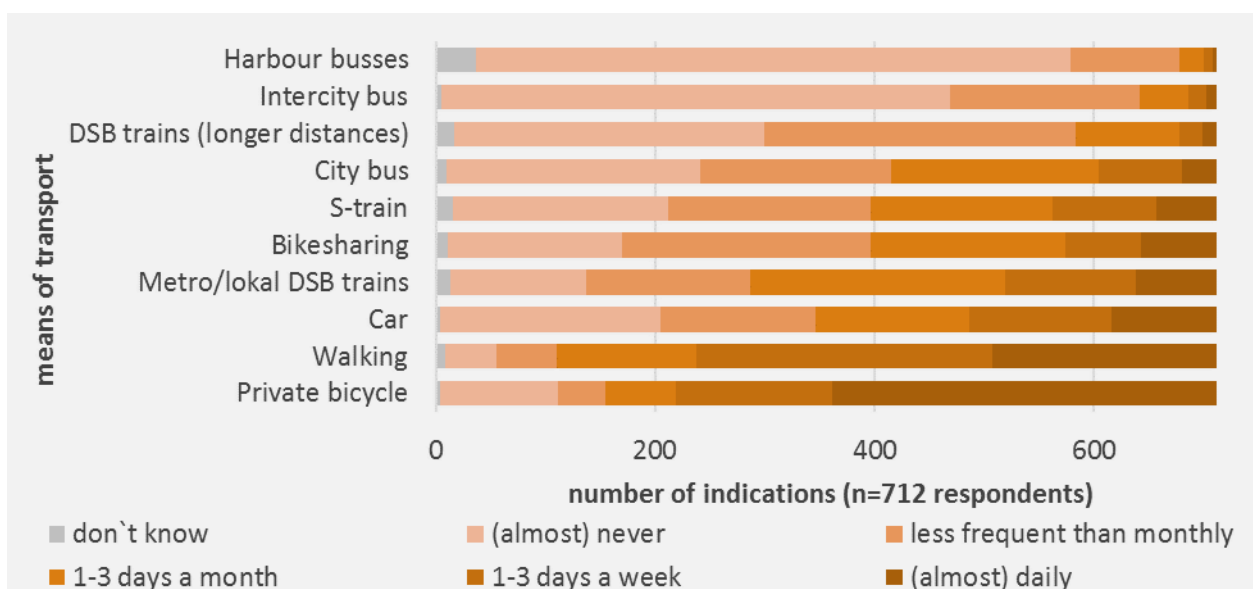


Figure 22: Frequency of using different transport modes

## Motivations

The subjective perception of cycling as enjoyable, but also pragmatically reasons seem to motivate persons in the sample to cycle. The most important motivations to cycle are flexibility (50 %), enjoying cycling (50 %) and the timesaving aspect of cycling (49 %). While non-residents are motivated more often through the enjoyments of cycling ( $\chi^2(1)=12.686$ ,  $p<0.00$ ,  $\Phi=0.1$ ) and the aspect of environmental awareness ( $\chi^2(1)=19.127$ ,  $p<0.00$ ,  $\Phi=0.2$ ), CPH residents are more often motivated through the time-saving ( $\chi^2(1)=15.916$ ,  $p<0.00$ ,  $\Phi=-0.2$ ) and cost-saving quality of cycling ( $\chi^2(1)=11.175$ ,  $p<0.00$ ,  $\Phi=-0.1$ ).

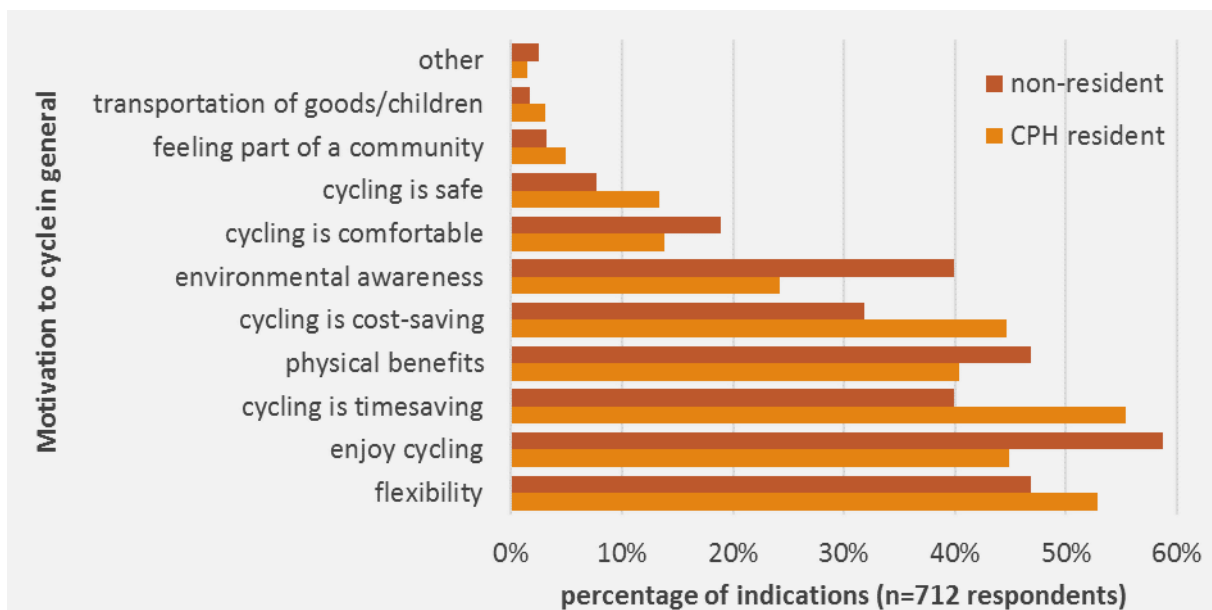
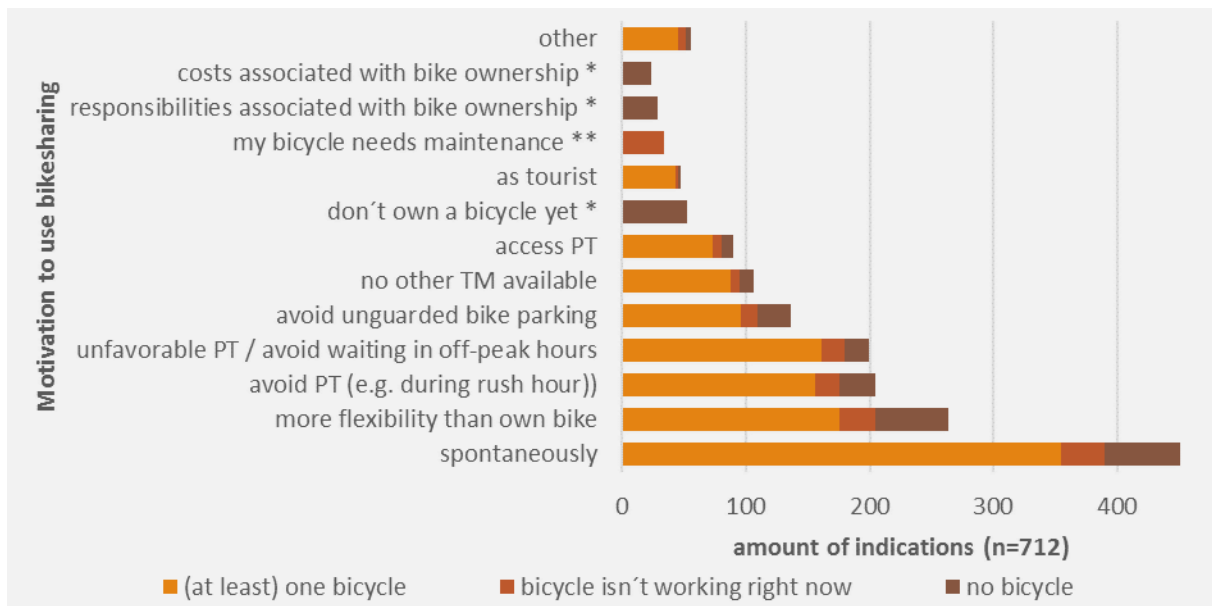


Figure 23: Motivation to cycle among CPH resident and non-residents

For Bikesharing spontaneity (e.g. for convenience instead of walking) is the most stated reason (63 %). Flexibility compared to an own bicycle is stated by 37 % in the sample as a motivational factor. More than one-third of the sample though perceive Bikesharing to be more flexible in contrast to a private bicycle. Furthermore some perceive Bikesharing to be a good alternative to public transport during peak hours (29 %) and if public transport is unfavourable or to avoid waiting in off-peak hours (28 %).

Concerning public space and the limited capacity for bicycle parking, these advantages of Bikesharing illustrate the potential of Bikesharing to save up space for bicycle parking. Especially in the centre of Copenhagen, where 55 % of the rentals begin or end (Indre By, Nørrebro or Vesterbro-Kongens Enghave), the capacity for bicycle parking is limited. Also at metro- and train-stations, where 19 % of all rentals begin or end, space for bicycle parking is an issue.



\* asked only, if no private bicycle is available

\*\* asked only, if a private bicycle isn't working right now

Figure 24: Motivation to use Bikesharing

Those who stated to use Bikesharing to access public transport (n=90), where asked to indicate what would be the most probable reaction, if Bikesharing would not be available (Figure 25). Half of them indicate to walk to the station instead. Thirty-eight percent indicate to use their own bike instead to take it into public transport (14 %), cycle the entire trip (13 %) or park it at the station (12 %).

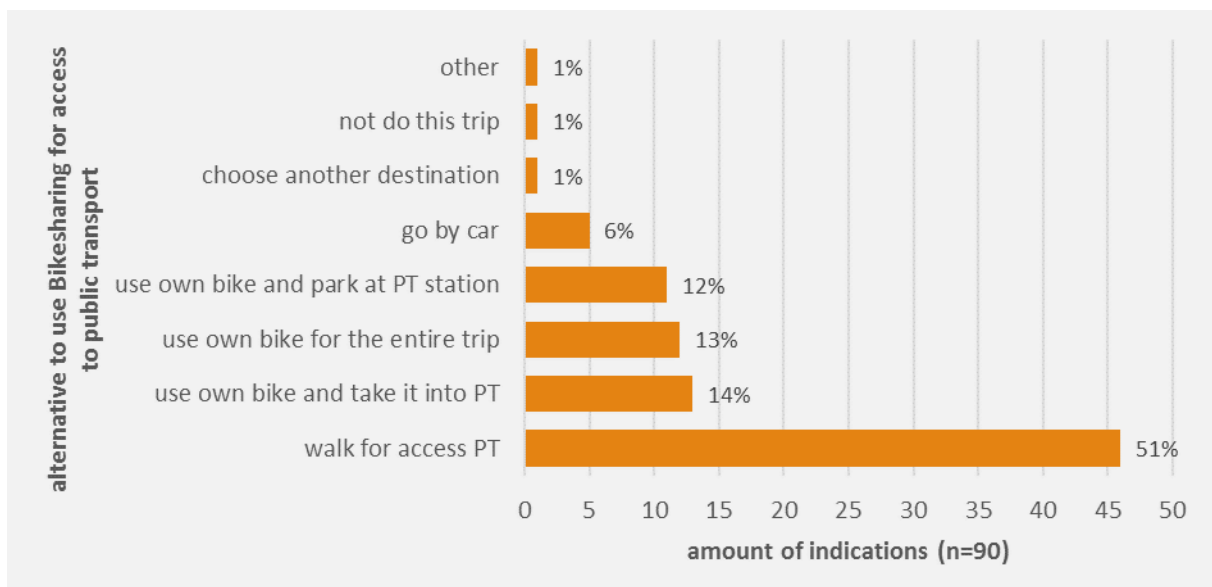


Figure 25: alternative to use Bikesharing for access to public transport

## Impact of Bikesharing on individual mobility

Although 18 % reported no changes in the (planned) individual travel behaviour through Bikesharing at all (or did not answer), the questionnaire indicates that Bikesharing mostly has an impact. The strongest impact concerns the (planned) frequency of cycling. Forty-six percent state that they already cycle more and 41 % plan to cycle more. Furthermore, 25 % do link cycling more often with other transport more or plan to do so (24 %). Thus, Bikesharing has a positive impact on intermodal travels. Almost half of the participants state however that they use public transport less often through Bikesharing. Especially during peak hours, Bikesharing might relieve the public transport capacity at its limits.

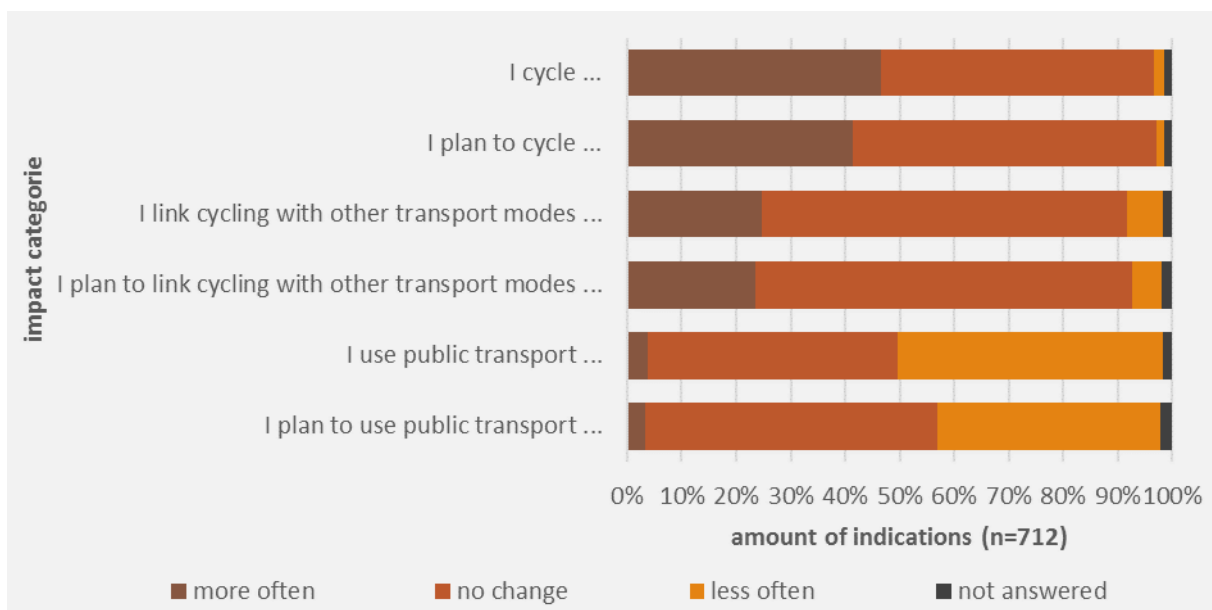


Figure 26: Impact of Bikesharing on individual travel behaviour

## 5. Conclusion

Those five questions formulated at the beginning of the evaluation can be answered sufficiently with the realised methods of data analysis and questioning of Bikesharing users.

### 1. How much travel with cars (private cars, car shares, taxis/ride-hailing) can be replaced by donkey rides?

The potential to replace travel with cars is relatively low, as the modal shift from cars is very low. The rental of shared bicycles mainly substitute trips with public transport (43 %) or by foot (33 %). Only 3 % of the rentals do substitute private and shared cars. Those 3 % of rentals correspond to 4 % of the total rental distance cycled, as rentals substituting journeys with a car have an average length of 9 km (compared to other trips with an average distance of 5 km). One journey with a shared bike substituting a car hence can reduce about 2 kg of greenhouse gas emissions \*.

The typical user of Bikesharing in CPH only seldom or never has access to a car and taking a car though is no possible alternative. More likely Bikesharing is one of several transport means, which Bikesharers use to make up their mobility.

\* assuming an average of 143 g greenhouse gas emissions per travelled km with a car with an occupancy of 1.5 (UBA 2020, TREMOD 6.14)

### 2. How much parking of the cars in the city can be reduced?

About half of the rentals of shared bicycles, which substitute a journey with a car, start or end in the city centre. To quantify the number of potentially reduced parking spots the sample size though is too small. Only nine of all rentals who substitute a journey with a car (3 % and 27 in total) start in Indre By, Nørrebro or Vesterbro-Kongens Enghave and 11 end here.

### 3. Is there a reduction of private bike parking in high-pressure areas?

High-pressure areas, where capacity of bicycle parking is limited are districts in the centre of Copenhagen and stations for metro and DSB trains. Especially in the centre of Copenhagen, where 55 % of the rentals begin or end (Indre By, Nørrebro or Vesterbro-Kongens Enghave), the capacity for bicycle parking is limited. Also at metro- and train-stations, where 19 % of all rentals begin or end, space for bicycle parking is rare. For those rentals bike parking is just occupied until another customer starts a new rental.



More than one-third of the questionnaire perceive Bikessharing to be more flexible in contrast to a private bike. Furthermore some perceive Bikessharing to be a good alternative to public transport during peak hours (29 %) and if public transport is unfavourable or to avoid waiting in off-peak hours (28 %). Concerning public space and the limited capacity for bicycle parking, these advantages of Bikessharing also illustrate the potential of Bikessharing to save up space for bicycle parking. Nine percent of the questioned persons even indicate to substitute a ride with a private bicycle through Bikessharing.

#### **4. Can bike-sharing rides reduce bike travel in DSB trains?**

Only few participants of the survey state to use Bikessharing instead of taking their own bike into the train. Thirteen percent of all survey participants state that access to public is a motivation to use Bikessharing. Of those 14 % would otherwise take the bicycle into DSB trains. Two percent of the participants hence use Bikessharing instead of taking their own bicycle into DSB trains.

#### **5. Is there an Impact of bike sharing in terms of cycling modality for individuals who live in the city and already have a bike**

Individuals who live in Copenhagen use Bikessharing. Ten percent of those even state to use Bikessharing even daily. Most of them also have an own bike (69 %, n=712), but motivations of using Bikessharing indicate the convenience of Bikessharing compared to an own bike. Spontaneity (e.g. for convenience instead of walking) is the most stated motivation (63 %, n=712). Flexibility compared to an own bicycle is stated by 37 % in the sample as a motivational factor. More than one-third of the sample though perceive Bikessharing to be more flexible in contrast to a private bike. In the sample 9 % of all

## Annex

# Please help Donkey Republic to promote biking in Copenhagen.

Thanks for taking a ride with us!

We would like to ask you two simple questions about today's rental. By participating, you support a research project on mobility in Copenhagen.

You just made a trip with a shared bike. Which was the main purpose of this trip? If you just made a return trip, please state the activity you came from.

- ☐ Way to / from work
- ☐ Business trip while at work
- ☐ Education (e. g. school or university)
- ☐ Shopping
- ☐ Private errands
- ☐ Leisure activity / visiting people
- ☐ Biking tour, e. g. for recreational reasons
- ☐ *other ....*

If no shared bike had been available, how would you have made this last trip instead?

I would have ...

- ☐ Not made the trip
- ☐ Walked
- ☐ Used my private bike
- ☐ Used public transport
- ☐ Used my private car
- ☐ Used a private motor scooter, motor cycle
- ☐ Used a taxi / Uber
- ☐ Used a shared car
- ☐ Used a shared e-scooter (electric kickbike)
- ☐ Used a shared motor scooter
- ☐ *other ....*

Your Participant ID - PLEASE DO NOT EDIT THIS FIELD

Just to make sure you have an account with us. Please do not change the value in this field.

## Annex B: Online Questionnaire Part 2

### You are ...

- ☐ Male.  
☐ Female.  
☐ Diverse.

### Your age?

### Do you live in Copenhagen?

- ☐ Yes  
☐ No

### Do you hold a driving license (for passenger cars)?

- ☐ Yes  
☐ No

### How often do you have access to a private car (as driver or fellow passenger)?

- ☐ (almost) Always  
☐ Occasionally upon agreement  
☐ Seldom or never

### Do you have any kind of season ticket for public transport (e.g. Rejsekort)?

- ☐ Yes  
☐ No

### Do you have bicycle?

- ☐ Yes, I have (at least) one that is working.  
☐ Yes, but my bicycle isn't working right now.  
☐ No.

### Please state how frequent you use the following means of transport?

(Please check every row)

	(almost) daily	1 – 3 days a week	1 – 3 days a month	less frequent than monthly	(almost) never	don't know
Car (driver or fellow passenger)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Private bicycle	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bikesharing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Trips exclusively by walking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Intercity bus (e.g. Flixbus)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Metro or lokal DSB trains	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
S-train	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
City bus	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Harbour buses	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
DSB trains for longer distances	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### What is your motivation to cycle in general?

(Please state the three most important reasons)

I cycle because...

- ☐ cycling is cost-saving.
- ☐ cycling is comfortable.
- ☐ cycling is safe (e.g. risk of infection with COVID 19).
- ☐ cycling is timesaving.
- ☐ I enjoy cycling.
- ☐ I need to transport goods/children.
- ☐ of physical benefits.
- ☐ of environmental awareness.
- ☐ of flexibility (e.g. with finding a parking space).
- ☐ as an cyclist I feel part of a community.
- ☐ other reason \_\_\_\_\_

### Which are the most important reasons for using Bikesharing?

(Please state up to three important reasons.)

I use bikesharing ...

- ☐ if the public transport connections are unfavorable or to avoid waiting in off peak hours.
- ☐ to avoid needing to park my private bike unguarded for longer times (prevent bicycle theft or vandalism).
- ☐ because my bicycle needs maintenance.<sup>5</sup>
- ☐ to avoid public transit (e.g. during rush hour).
- ☐ because of costs associated with bike ownership.<sup>6</sup>
- ☐ because of more flexibility compared to use an own bike.
- ☐ because I don't own a bicycle yet.<sup>2</sup>
- ☐ spontaneously, e.g. for convenience instead of walking.
- ☐ because no other modes of transport are available.
- ☐ because bikes from Donkey Republic are safer than my own bike.
- ☐ because of responsibilities associated with bike ownership.<sup>2</sup>
- ☐ for access to or exit from public transport.
- ☐ other reason \_\_\_\_\_

### Does bikesharing have any impact on your traffic behavior?

	less often	no change	more often
I cycle ...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I <b>plan to</b> cycle ...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I use public transport ...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I <b>plan to</b> use public transport ...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

<sup>5</sup> Filter: if (Do you own a bicycle?)=Yes, but my bicycle isn't working right now.

<sup>6</sup> Filter: if (Do you own a bicycle?)=No.

I link cycling with other transport modes ...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I <b>plan to</b> link cycling with other transport modes ...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I use <input type="text"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	shorter trips	no change	longer trips
I cycle ...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I <b>plan to</b> cycle ...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Are there any other changes in your mobility behaviour due to the availability of bikesharing?**

Did the availability of bikesharing for example influence your decision to buy (or not to buy) a bike, get a season ticket or sell your car/not buy a car?

Additional questions with filter

access to private car: *seldom or never*

**Z1. Why do you not own a private car?**

(Please state up to three important reasons)

- ☐ unsuitable in the city
- ☐ no car required/not necessary
- ☐ too expensive (purchase or maintenance)
- ☐ alternative mobility options
- ☐ health reasons
- ☐ deliberate abstinence
- ☐ for reasons of age
- ☐ environmental awareness
- ☐ negative aspects of cars (e. g. hassle or space issues)
- ☐ other reason \_\_\_\_\_

Do you own a bicycle?: *No.*

**Z2. Why you do not own a bicycle?**

(Please state up to three important reasons)

- ☐ not necessary
- ☐ too expensive (purchase or maintenance)
- ☐ health reasons
- ☐ for reasons of age
- ☐ cannot ride a bike.
- ☐ no space for secure bike parking
- ☐ responsibilities associated with bike ownership
- ☐ other reason \_\_\_\_\_

Which are the most important reasons for using Bikesharing?: *for access to or exit from public transport.*

**Z3 You stated that you use bikesharing for access to or exit from public transport. What would be your most probable reaction in case bikesharing would not be available?**

I would ...

- ☐ walk for access to or exit from public transport.
- ☐ use my private bike and take it into public transport.
- ☐ use my private bicycle and park it at the public transit station.
- ☐ take my own bike for the entire trip.
- ☐ go by car.
- ☐ choose another destination.
- ☐ not do this trip at all.
- ☐ other reaction \_\_\_\_\_

Annex C: Descriptive statistics of rentals (n=60964)

<b>trip</b>	<b>duration [min]</b>	<b>length [km]</b>	<b>average speed [km/h]</b>
mean	53,85	5,16	10,47
median	20	3	11
minimum	1	0	0
maximum	11693	468	25
25%	12	2	8
75%	37	6	13



Annex D: Bikesharing trips ending (left) and beginning (right) at Nørreport station





Annex E: Bikesharing trips ending (left) and beginning (right) at Copenhagen central station



