RRReis
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Quality perception of Demand Responsive Transport

A CASY STUDY IN APELDOORN, THE NETHERLANDS

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Summary

As most research on the performance and quality of demand responsive transport systems has been focused on a statistical and economical point of view, this research looks at the other, more qualitative side of the perception of a demand responsive transport system. It does that by firstly introducing the term DRT and diving into its characteristics and various forms. For this study, a qualitative research method has been chosen, consisting of an online survey combined with a physical approach to people using the DRT service in Apeldoorn. The survey gathered 38 responses across several evenings of actively surveying. The main research question of this research is “How do DRT-users perceive the quality of the network DRT-service?”. In addition to testing the importance of several DRT aspects, the report also dives into the possible role of quality perception of DRT on replacing other modes of transport. It also aims possible quality improvements towards the operator. Data gathered showed that users find punctuality to be the most important factor when using the service. Furthermore, it does not seem that DRT is a replacement to modes other than the bike and regular bus currently. Lastly, the information about booking a trip could be improved.

Introduction

Background

The car has dominated the way we move around since the starting of its mass production in the early 20th century (Davison et al., 2012). The automobility regime has changed not only the way we live, but also the way we have formed our surroundings to fit the needs of car-owners. We have known for quite some time now that the earth is experiencing climate change (Houghton et al., 1990) and that car emissions are one of the prominent boosters of climate change (Timperley, 2021). It has been evident for quite some time that climate change is one of the reasons there is a need for a drastic shift to a completely new way of getting around. According to Sheller (2012), a major overhaul of the current dominant culture of automobility is needed to accomplish a sustainable way of transportation. However, there is no indication as to when such a dramatic shift in regime occurs. Until such a change happens, mankind must make do with the current transportation infrastructure. Within the *master frame* of automobility, so-called "niches" have been co-existing with traditional ways of mobility. Liveable streets, car sharing, and biking culture are examples of niches in the current regime of automobility (Sheller, 2012).

The Netherlands has a distinctive history with some of these niches like biking culture, but also implements concepts as liveable streets and promotes car-sharing. Meanwhile, the traditional public transport, consisting of train, tram bus and metro had a 14 percent share in total kilometres travelled in 2019 in the Netherlands (CBS, 2020), while the private car had over 50 percent. This proportionally low percentage could even decrease further due to the current increasing of dispersed land use patterns and the increasing number of elderly persons. In short, the existing public transport system is increasingly insufficient in terms of its general flexibility (Laws, 2009). Also, its inability to adapt to certain areas and times with lower demand only decreases further as a viable transport option to the car. These societal patterns increase the demand for different forms of public transport, like demand responsive transport, also known as DRT.

DRT can be roughly described as a combination of a taxi service and a regular bus service. Several forms of Demand Responsive Transport such as "dial-a-ride" have been imposed in the past to accommodate areas in rural and urban parts of countries with (temporary) lower demand. The first of these projects emerged as early as the 1960s, with mixed success (Enoch et al., 2006). One of the prominent examples in the Netherlands was TaxiKAN, which provided a successful DRT-service in Amsterdam. With the coming of experience and most of all technology, the later DRT systems became more successful, although certain problems still exist.

Much academic research has been done on DRT-systems, mostly focusing on comparing certain projects and the evaluation from an outsider's market-driven perspective, with predominantly quantitative research methods (Davison et al., 2012). As Konig and Grippenhoven (2020) mention, further research in DRT-systems should investigate which aspects of the service are key contributors to the perceived usefulness and quality of the service. This research will be making a case study on the DRT- service currently in operation in Apeldoorn and its perceived service quality.

Research aim

The main aim of this research is to provide insight into how users of a DRT system perceive the quality of the DRT-system and how they think it could improve, if possible.
The main research question follows from this research aim:

- *How do DRT-users perceive the quality of the network DRT-service?*

The first sub question combines the factors which have been previously identified in the literature on DRT and regular bus services. In addition, it also contains important factors the users themselves indicate. The question forms as follows:

- What factors are important in the quality perception of a DRT-service?

As mentioned before, the shift away from a car-dominant culture is needed for a more sustainable way of getting around. Therefore, it is interesting to investigate what role DRT plays in replacing other modes of transport currently.

- *What role does the perception of quality of DRT play in replacing other modes of transport?*

The third sub question is present to provide possible improvements to the DRT service, which operator RRReis can use.

- *What possible improvements can be made to ameliorate the quality of the DRT-system according to DRT users in Apeldoorn?*

Hypothesis

In this section, the hypotheses of the main- and sub research questions are outlined.

- *How do DRT-users perceive the quality of a network DRT-service?*

It is expected from the literature that the users of DRT will perceive that punctuality is the most important factor in the quality of the DRT-service in Apeldoorn. It is also expected that ease of use in booking the ride and the information about the booking system is an important factor in the quality of the DRT-system. After all, it should be easy for the entire population to find information about how to book a ride and how the booking system works in general. The booking system is likely to be of great importance to offering an accessible and attractive service.

- *What factors could influence the perception of quality of a DRT-service?*

Factors such as comfort, waiting time, ease of booking etc. are likely to all play a role in the perceived quality of the offered service in Apeldoorn. The factors arise from the literature and are being used in the survey conducted in this research.

- *What role does the perception of quality of DRT play in replacing other modes of transport?*

As the DRT service in Apeldoorn functions similarly to a regular city bus, it is expected that some portion of the passengers using the DRT service were also users of the regular bus service before the implementation of the DRT service. It is then also expected that the average user of the DRT system choses to use that form of transport because they have no viable alternatives. The perception of quality would not play a critical role in replacing other modes of transport because of this lack of alternatives, even though some users may feel negative about the quality of the DRT service.

- *What possible improvements can be made to ameliorate the quality of the DRT-system according to DRT users in Apeldoorn?*

A possible improvement which could be made is the information about the fact that you must make a reservation. It is expected that currently, the DRT-system is not known enough in the neighborhoods they operate in because of lack of public information. Furthermore, the booking system itself allow for customers to book a ride in several ways, including calling, online or in the RRReis app. However, it lacks reliability as the system is down quite often.

Theoretical framework

The concept of DRT

Firstly, it is important to clarify what is meant with DRT. Grosso et al. (2002) describe Demand Responsive Transport systems as *"an intermediate form of transport, somewhere between the bus and taxi and covers a wide range of transport services ranging from less formal community transport through to area-wide service networks."* (Grosso et al., 2002, p. 3). According to this definition, DRT systems can range from shared taxis to minibuses and thus also include private services. However, for this study the term DRT will only be used as a reference to public services.

There are several types of DRT-systems used across the world. Roughly they can be categorized into two forms: the system is either based on fixed routes or allows vehicles to take a flexible route (Enoch et al., 2021). Within these two types, a classification can be made based on the function of the service. Firstly, there are interchange DRT-systems which provide a feeder service to a rail station, for example. Secondly, there are network DRT-systems which are mostly implemented to replace conventional public transport at certain times and places with low demand or dispersion. Thirdly, destination-specific DRT provides DRT to certain areas of employment or other important places in the city or countryside. Lastly, substitute DRT encompasses a large or complete replacing of the conventional transportation in an area (Enoch et al., 2021). The DRT system researched in this paper is a network DRT because it replaces the regular city bus in the evenings when there is low demand.

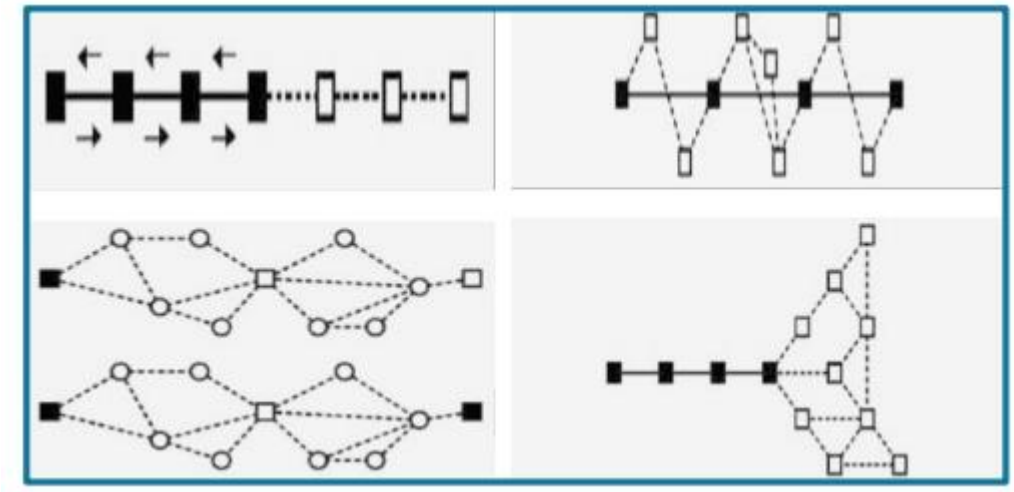

FIGURE 1: SEVERAL FORMS OF DRT. THE BLACK POINTS ARE FIXED STOPS AND THE WHITE POINTS ARE ON-DEMAND STOPPING LOCATIONS (PAPANIKOLAOU ET AL., 2017)

DRT-system characteristics

As mentioned earlier, most research on DRT has provided insight into how to assess DRT-systems from an economical and statistical point of view. However, these studies mention characteristics of DRT-systems which may have influenced the perception of quality from a user's perspective. For example, Alonso-Gonzalez et al. (2018) categorize the characteristics of a DRT-system in five blocks as seen in figure 2.

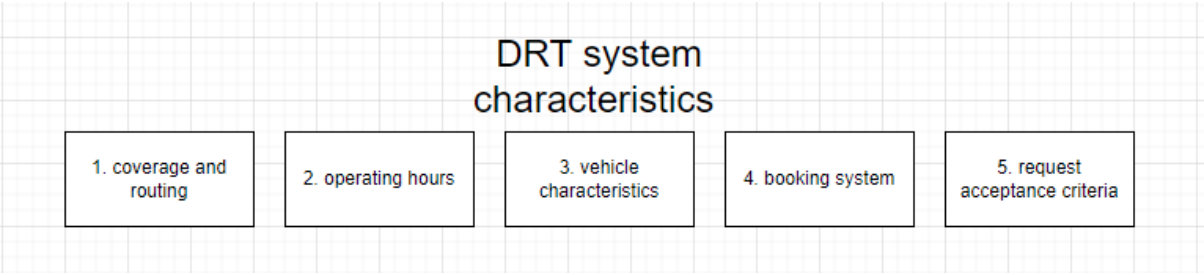

FIGURE 2: THE FIVE CHARACTERISTICS OF A DRT-SYSTEM MENTIONED BY ALONSO-GONZALEZ ET AL. (2018).

Although the point of view is that of an economical one in their study, there are some categories which are of interest for this research. Coverage and routing entail the operating area and the degree of flexibility of the DRT-system. This ranges from flexible to rigid services. With vehicle characteristics the type of vehicle and number of seats is meant. The booking system is a variable which can be defined by its ability to incorporate real-time bookings or only allow bookings made in advance. As a fourth characteristic, the request acceptance criteria fits in with the booking system, as it defines what minimum time is needed for the bus to arrive at the desired spot.

Furthermore, Eboli et al. (2007) have proposed a model which distinguishes which factors contribute to the satisfaction of a regular (non-DRT) bus service in Italy. They derive three main categories: service planning and reliability, comfort and other factors and network design. Among these three main categories, service quality attributes were divided, as can be seen in figure 3.

Attribute	Description
Bus stop availability	Availability of bus stop near home
Route characteristics	Route characteristics (number of bus stops, distance between bus stops, etc.)
Frequency	Service frequency
Reliability	Reliability of buses that come on schedule
Bus stop furniture	Availability of shelter and benches at bus stops
Overcrowding	Bus overcrowding
Cleanliness	Cleanliness of interior, seats, and windows
Cost	Cost affordability
Information	Availability of schedule/maps at bus stops
Promotion	Availability of service information by phone, mail, Internet, etc.
Safety on board	Vehicle reliability and competence of drivers
Personal security	Safety against crimes on buses
Personnel	Helpfulness of personnel
Complaints	Administrat ion of complaints
Environmental protection	Use of ecological vehicles
Bus stop maintenance	Physical condition of bus stops

FIGURE 3: SERVICE QUALITY ATTRIBUTES BY EBOLI ET AL. (2007).

Despite their study being aimed at a regular bus service, several of these factors could also play a role in investigating the quality of DRT-services as they share many physical and spatial characteristics with DRT.

Activities and experience while riding

Once in the bus, passengers engage in a range of activities. Clayton et al. (2017) investigated the activities travellers undertake when riding the bus. They show in their research that the bus is a very active environment where several activities are taking place. They found that bus riders mostly

opted for activities that relaxed them or benefited them otherwise, like reading a book or using their smartphone to listen to music. They mention that travellers craft their own experience riding the bus by using objects such as their phone or a book. It is the task of the bus service operator to provide services which enable the passengers to unlock the full potential of their activities, such as providing free wi-fi. It seems that unlocking this potential could improve the perception of quality towards public transport. Although the study is conducted on regular buses, it seems interesting to investigate if a DRT service would also benefit from additional features like free wi-fi.

Public transport vs. other transport modes

Frequent users of the car find that the car is still a symbol of independence and convenience (Steg, 2003), while the bus is seen, for example, as a service with severe limiting options in terms of direction and time. Steg et al. (2003) find that persons who use a car less frequently have a more positive view of public transport and are more likely to use it.

As this study will survey people using a DRT service, the chances of encountering people who own a car seem slim, as Steg et al. (2003) mentioned that car users are not likely to use public transport. It seems that there is not really a battle between public transport users and car users as these groups seem separate. A public transport user might not have a driving license or might find that public transport is the cheaper alternative. This also accounts for car users. Car users might question why they would ever need to use another form of transport, as the car can take them almost anywhere.

Having this in mind, this study will take a broader look into the possessions and use of other transport modes by DRT users, like the bike and the moped for example. This way, a broad overview can be sketched of what type of people use the DRT and why, while they may have other ways of getting around.

Conceptual model

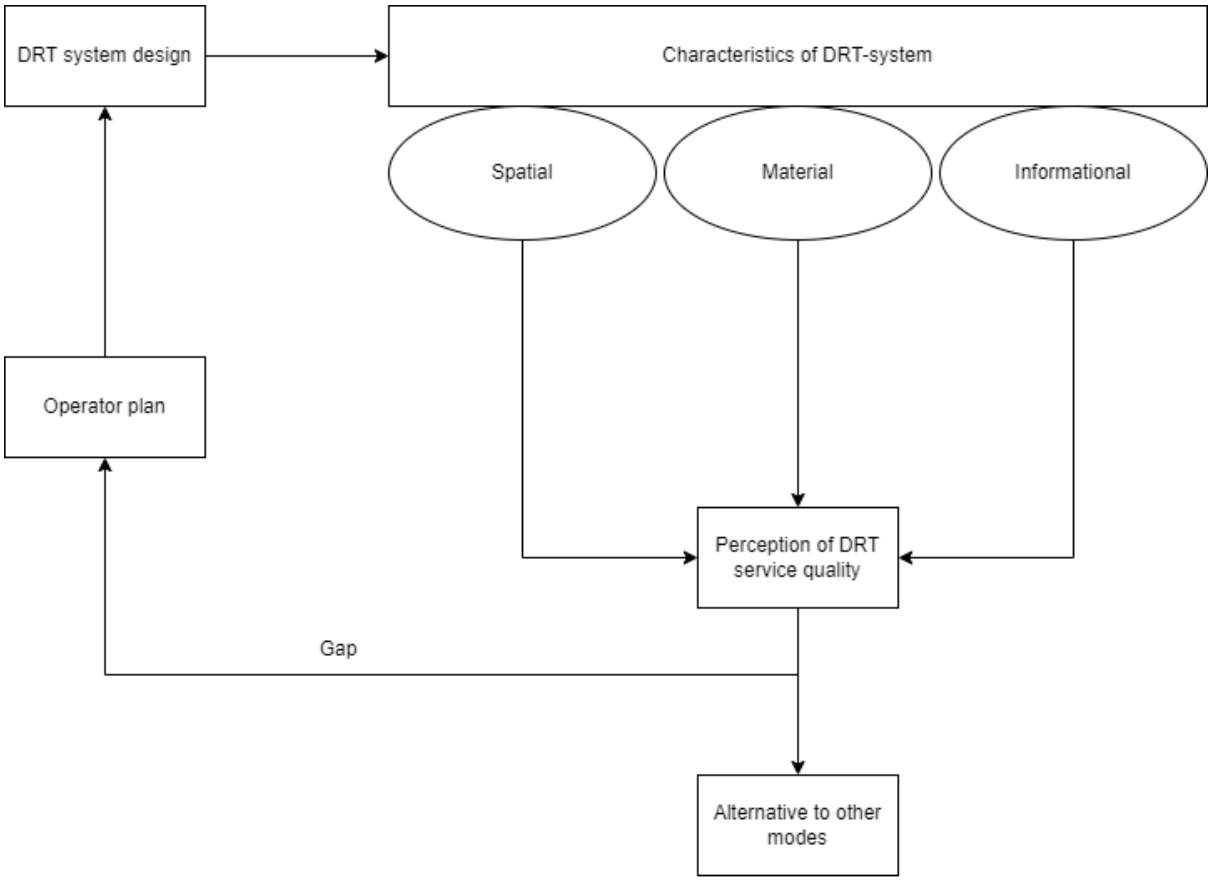

FIGURE 4: CONCEPTUAL MODEL

The conceptual model of this research explains how a procurement plan of an operator can lead to a DRT service, which has a certain set of characteristics. Firstly, the provincial institution must accept the plan for procurement that the operator has provided, after this is accepted it will be put in place. In this plan, the operator must explain in detail what they envision for their minimum of ten years in operating in the procurement area. Of course, this plan contains information about the number of buses, types of buses, stops and more. In this plan there must also be an explanation for other kinds of public transport, like DRT, which would fall under "*vraagafhankelijk vervoer*" *(*demand-dependent public transport*)*. The various DRT-systems have multiple characteristics which can be categorized in three very broad categories for simplification of this model: spatial, material and informational. Especially the informational aspect seems important for DRT, since it relies on booking in advance and thus on the quality of information on booking. However, all three categories affect how users perceive the quality of a DRT-service. This perception of quality could then play in the choice of travelers to use the DRT while they may or may not have an alternative travel mode. The research gap is in between the perception of DRT quality and the operator plan, as this "human" side of quality perception of DRT quality has not been researched much and the opinion of the users of the DRT may influence the operator's procurement plan.

Methodology

This section contains the data collection methods and its motivation. The table below provides information onto what type of data collection will be used in correspondence with which research question. An online survey is selected as the method of data collection, providing qualitative data fitting with the main research question.

Research question	Data collection method
How do DRT-users perceive the quality of a network DRT-service?	Literature/ online survey
What factors are important in the quality perception of a DRT-service?	Literature/ online survey
How can the network DRT-service be a sufficient replacement transport mode to the car?	Online survey
What possible improvements can be made to ameliorate the quality of the DRT-system?	Online survey

The existing literature on DRT-services and regular bus services will serve to analyze which factors have been used in research on passenger satisfaction and quality perception in public transport. These factors are used in the survey, which should help to answer all research questions, be it in combination with current literature or as a standalone method.

Case study

The city of Apeldoorn

Firstly, it is important to give some general information about the environment that the case study is set in. In figure 4, the location of the city of Apeldoorn is shown. It lies about 100 kilometers from Dutch capital Amsterdam, next to the countries' biggest nature reserve "*de Veluwe*". In 2021, the municipality of Apeldoorn contained 164.781 residents (CBS, 2022), which makes it a medium sized city for Dutch standards. It is known for its green character and the relatively low number of high-rise buildings, giving the city more the feeling of a large village.

FIGURE 4: A ZOOMED-OUT MAP SHOWING THE LOCATION OF THE CITY OF APELDOORN IN THE NETHERLANDS

Short history of recent changes in bus network design in Apeldoorn

At the end of the last procurement lasting from 2010 to 2020, there was an oversaturation in terms of bus stops and lines. During this procurement, there were relatively many stops and many lines, covering most parts of the city. Near the 2020, operator Keolis took over the procurement with a plan that would spark controverse. They removed 67 bus stops in the city of Apeldoorn alone and intensified several busy lines by increasing their frequencies. That procurement is still in place. The line map of the city of Apeldoorn can be seen in figure 6. It was also this procurement plan that introduced the first DRT service in Apeldoorn: ReserveerRRReis.

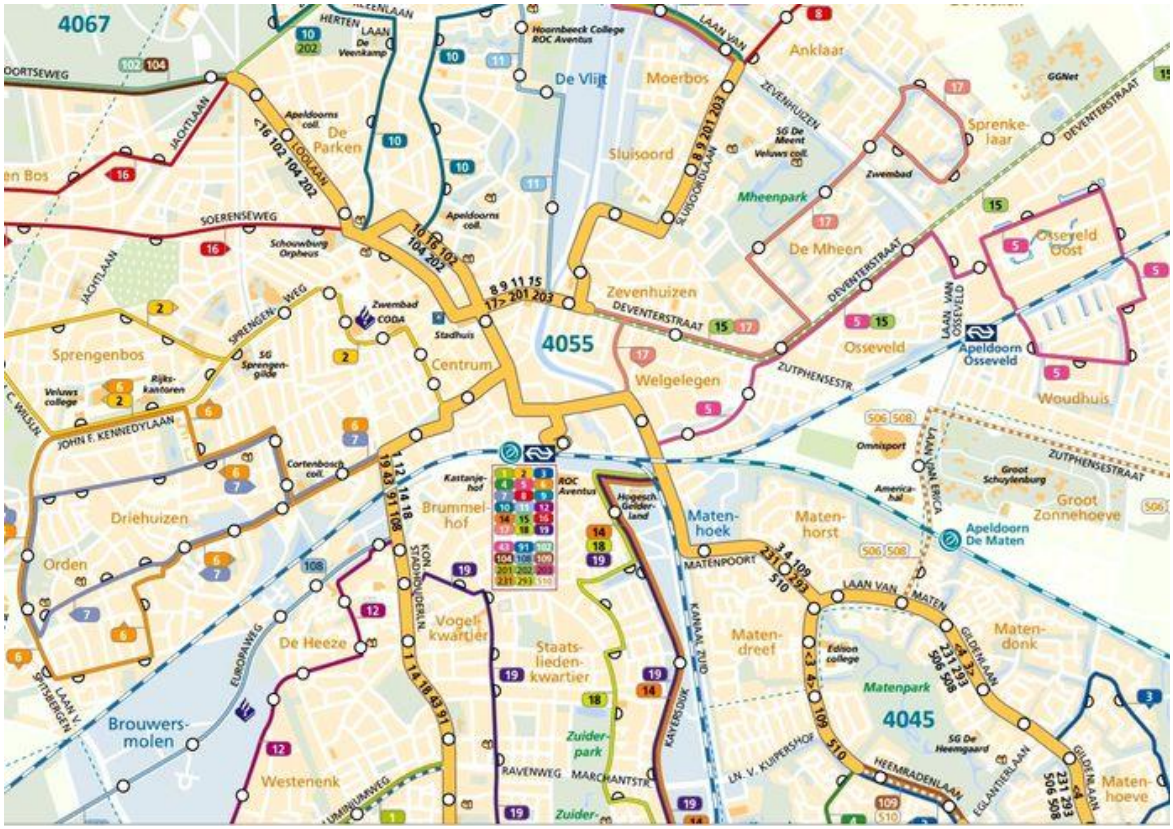

FIGURE 5: OLD MAP OF THE "VELUWE" CONCESSION IN APELDOORN DURING THE PERIOD OF 2011 TO 2020 (RUTGERS, 2018)

FIGURE 6: MAP OF CURRENT BUS LINE NETWORK IN THE CITY OF APELDOORN (KEOLIS, 2021)

ReserveerRRReis

The operator has deployed a stop-to-stop system in the city on several existing bus lines. This DRT-service operates on several lines during the week and during the weekend, replacing what would otherwise be almost empty regular buses.

The small buses offer seats to eight passengers and can also accommodate multiple wheelchairs if some seats are folded. Fares are 2,40 Euro per person, unrelated to age and distance travelled. However, on the premise of showing your valid OV-chipcard to the driver, one may travel for free. This is only a temporary measure, because the delivery of OV-chipcard readers has been delayed and thus the buses do not have the right equipment to read the OV-chipcard.

FIGURE 6: THE BUSES THAT ARE USED IN THE RESERVEERRRREIS SERVICE (*PLUSSEN EN MINNEN IJSSEL-VECHT - ROVER*).

As most DRT-systems, ReserveerRRReis uses a booking system in which users can book a ride from bus stop A to B. Users can book rides up until half an hour before the bus leaves the stop. A ride can be booked in several ways: one can use the RRReis app, dial a number or use the regular website. Users need only to fill in their starting stop, their final stop and their email address when booking.

Figure 7 shows the coverage of the several lines in the city of Apeldoorn, to give an idea of the scale of operation.

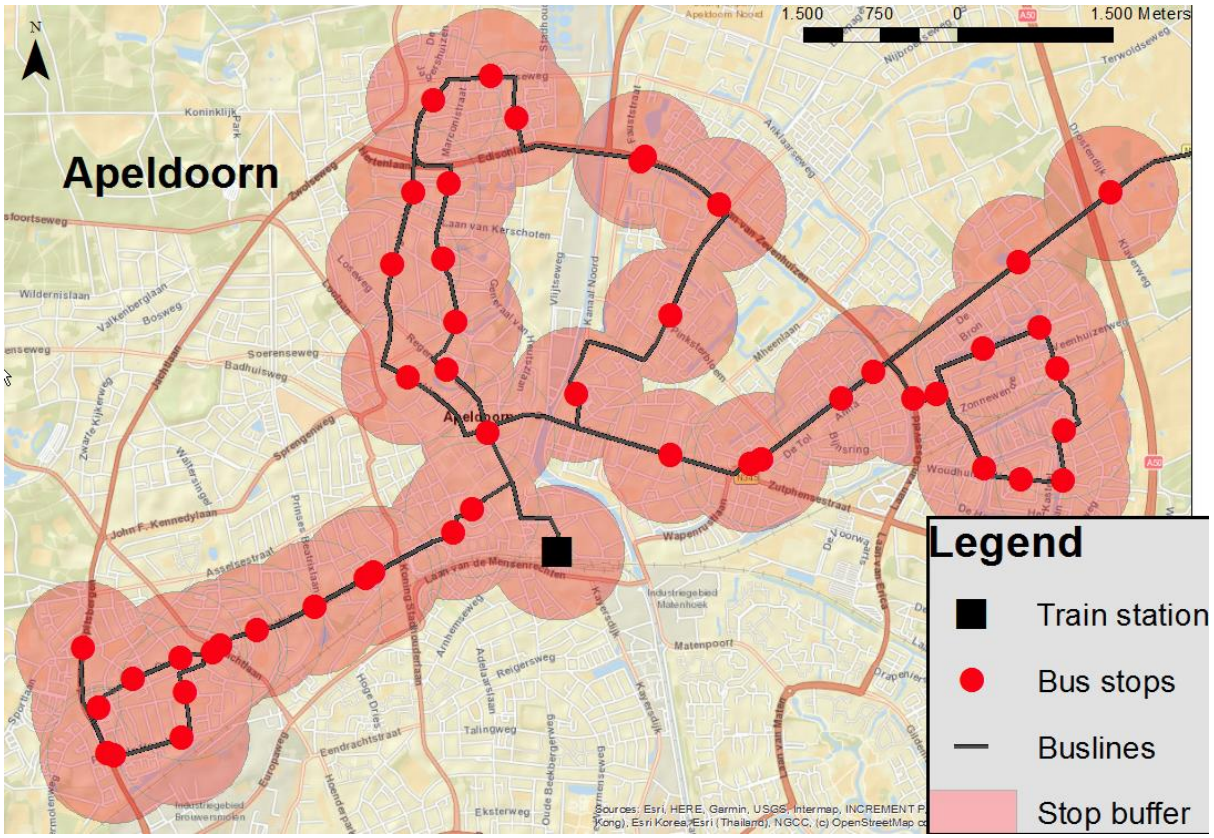

FIGURE 7: A GIS MAP OF THE DRT SERVICE IN APELDOORN. THE BUFFER IS 400M AROUND EACH BUS STOP.

The survey

The survey itself

The online survey consists of general questions and more detailed questions. The general questions are about age and what DRT line the participant uses the most, for example. The detailed questions are about spatial, informational and material aspects of the DRT service in Apeldoorn. Users are given a wide array of question types, ranging from text input to drag and drop-questions. The survey should not last much longer than five minutes, as the travel time of the small buses is short. The survey is being held for eight evenings.

Motivation

An online survey is chosen because it can encapsulate data on a relatively large population. An online survey is also both time- and cost-effective as it does not require any financial investment to use an online survey platform and the researcher does not have to interview each person in-person. Also, the participant can fill in the survey in their own time and at their own pace.

The online survey and ethical considerations

The online survey used in this research is made with Qualitrics, which allows for generating a QR-code, which users could scan and be directed towards the survey. This method is quick and easy, as one does not need to retype a link in their internet browser. RRReis operates four different DRT lines in Apeldoorn, which are all urban lines. The researcher will be accompanying the driver for a complete evening shift. When passengers enter the bus, the researcher will tell them who he is, what survey the researcher is taking and what the goal is of the survey. If they accept the invitation, the researcher will emphasize the first page in the survey, which displays a consent form which one must agree with in order to start the survey.

Results

In this section, the results of the survey will be discussed. The survey garnered the responses of 38 travellers. It was expected that many passengers would have their phone with them, because of the options to book a ride with your phone. This assumption seems well made in the end, as there were only two people who refused to participate. The following results section will be divided by research question.

What factors are important in the perception of quality for a DRT service?

As mentioned in the theoretical framework, characteristics of a DRT system like those mentioned from Alonso & Gonzales et al. (2018) and also regular bus system characteristics mentioned by Eboli et al. (2007) are used as the basis for providing participants with the characteristics to judge a DRT-system. In addition, the findings of this research regarding the role of bus operators acting as facilitators of passenger experiences investigated by Clayton et al. (2017) will also be discussed. At the end there will be a short profile sketch of the needs of the average DRT user in Apeldoorn.

Broader DRT characteristics

As seen in the pie chart below, punctuality, frequency, hygiene, comfort, ease of booking and ease of transfer are aspects of a DRT-service that have been chosen for the last question of the survey. This question let users drag and drop aspects from place one up to six, where place one is for the aspects they found the most important. The pie chart in figure 8 indicates the percentage of participants that have chosen a certain aspect as their most important.

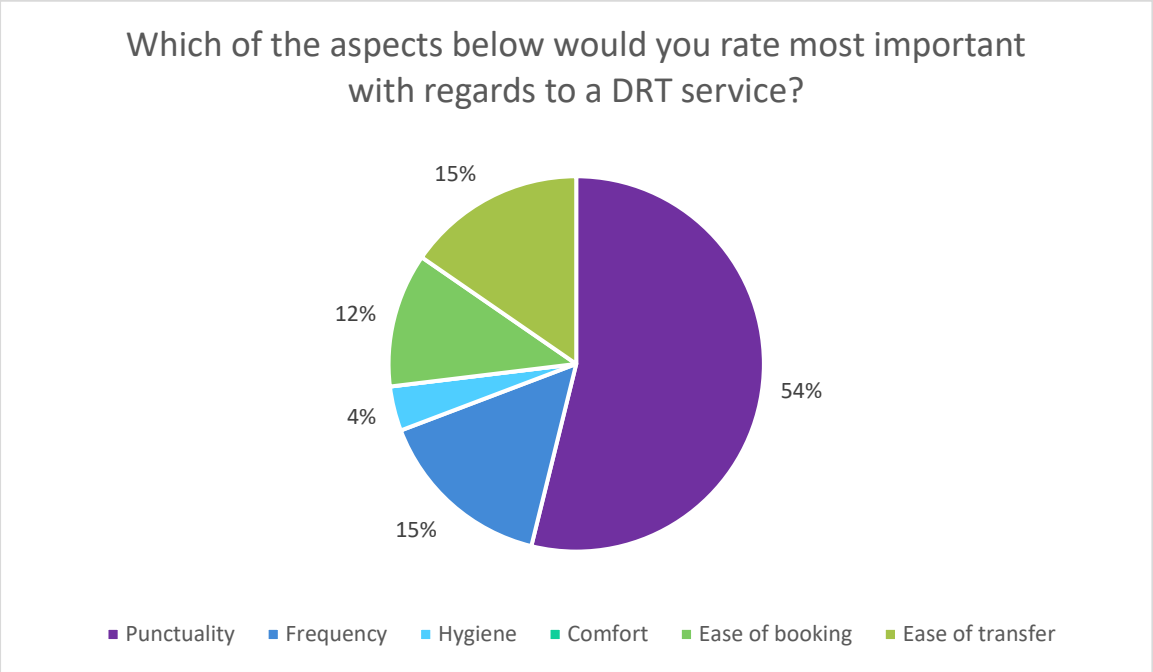

FIGURE 8: RESULTS OF QUESTION 24

These aspects are conforming to what has been found in the existing literature about important aspects to public transport users. Eboli and Mazzulla (2012) for example, mention in their paper that service reliability is one of the most important factors contributing to the rating of public transport. They also mention service availability as an important aspect and stress the role of service frequency as well. Ease of booking was expected to be an important factor to a larger percentage of people, since it forms a vital part of a DRT service. Apart from aspects like ease of booking, which is a DRT-

only aspect, the most important aspects for the participators seem to be roughly the same as for a regular bus service.

Inside the DRT bus

Clayton et al. (2017) mention in their article that bus operators should focus less on providing a better bus service by looking at the traditional aspects like frequency and type of buses, but instead focus on becoming a facilitator of the needs of the passengers. For example, adding wi-fi or USB ports in buses would increase the attractiveness of bus travel, because the average traveler indicated that they would like to have the option to connect to the internet and charge their devices, for example. Their research was conducted on regular busy commuter buses, but as the DRT-service in Apeldoorn functions as a replacement service for the regular buses, it is interesting to investigate possible impacts on the quality of service in a smaller DRT bus.

Question 11 to 13 of the survey were formulated to simulate what Clayton et al. (2017) also asked in their interviews. It should find out what activities passengers undertake during their time inside the vehicle, what facilities they would like to see and what use they would have in their eyes.

Question 11 asked participants about what activities they undertake during the trip. The question allowed people to click on more than one answer. It totaled 56 clicks, where 23 clicks were for the “I am on my phone” option. In addition, there were four people who put in the textbox that they listen to music on their phone, which is counted as being on your phone as well. This makes that a total of 27 people indicated that they use their phone in the buses.

At question 13, participants could answer whether they think their trip would be more enjoyable if the operator incorporated for example wi-fi in the small buses. It seems that it would make no difference for the experience of more than half of passengers if there would be such facilities onboard, as 56,67 percent indicates. As there is no overwhelming result in favor of the operator implementing technological facilities, it would seem based on these findings that the role of facilitator as Clayton et al. (2017) introduce and recommend on regular bus services does not readily apply to this DRT service.

Combining the discussed results for this sub question, it seems that the average DRT user in this research is in favor of a no-nonsense service with a few key aspects. Firstly, it must be easy to book a trip using one of the many ways to do so. Secondly, the frequency is important. Currently, most DRT buses depart twice per hour, which seems to be adequate, as at question 7 in the survey, most people (60 percent) answered that they were content with the current frequency. When people wait at the bus stop, the DRT bus should be on time. Lastly, when people arrive at the main train/bus station, it should be easy to transfer to other public transport. This primarily means that the timetables of the DRT should fit with that of other buses and trains.

What role does the perception of quality of DRT play in replacing other modes of transport?

To answer this research question, it is needed to sketch a profile of the mode choice and possession of the average DRT user. For this to happen, it is important to firstly investigate what mode of transport the current users of the DRT buses used before the service was implemented. Secondly, asking about what modes of transport the participants have access to is equally important. Then, one can look at their current most used mode of transport. Of course, this is only one side of the sub question. The general opinion of the participants on the quality of the DRT service is needed to make

a connection between the quality perception and the role it possibly plays as a replacement mode to the bike or regular bus, for example.

Sketching a profile of DRT users' transport options and choices

Regarding question 19 of the survey, participants were asked what type of transport they used the most before the implementation of the DRT service. 17 people indicated that they used the regular city bus the most before, while six participants mentioned the bike as their most used mode of transport at the time. The car was chosen zero times.

When looking at the modes of transport which participants are in possession of, currently, the bike stands out the most, with 27 answers out of 37 at question 20. Here, the almost inexistent presence of car owners is obvious: only two participants mentioned they own a car.

At question 21, users could indicate what type of transport they use the most currently. 13 out of 30 participants indicated that they used the regular city bus the most, while seven others mentioned the bike as their main mode of transport. The car was mentioned one time, further stressing the almost non-existent role of car-users in the survey.

In terms of creating a profile of mode access and choice of the average DRT user, it seems that most of the participants traveling come from a background of bus- and bike use. Most of the participants currently possess a bike, but most participants seem to prefer taking the regular bus over their two-wheeler.

The research suggests that the majority of DRT users in Apeldoorn are people with little access to other transport modes than the DRT bus, bike and regular bus. At question 22 when users were asked about the reason they chose the DRT at the moment of partaking in this research, 16 out of the 36 respondents mentioned that they have no other choice in transport mode when asked about their choice to use the DRT service at that time. The reason they have "no other choice" is one only to be guessed, as it is not asked in the survey. Seeing that most of the users possess a bike, external factors like the weather in combination with the comfort of a bus in comparison to a bike could be having an impact in mode choice of users in the winter months, when this survey was taken.

The car and DRT

As mentioned in the introductory text of this research, the shift away from the dominant car culture towards a more sustainable way of getting around has been proven to be difficult. This is also clear in this research. While the overall quality perception of the DRT in Apeldoorn is good and the tickets are free for most users, it seems that the service is still not attractive enough to cater to car-users, as they are a minority in the survey. It could also be very likely that such a service as that of the DRT cannot be made attractive towards car-users. As Steg et al. mentions, the car-user is not likely to be pulled away from their car just because of financial reasons. They also hold an emotional bond to their vehicle and find that it can take them anywhere whenever they want to. That last reason can be partly covered by a more flexible type of DRT service, but such systems have been known to be expensive to maintain over a longer period of time and have proven to be unreliable in terms of travel time.

What possible improvement(s) can be made to ameliorate the quality of the DRT-system according to DRT users in Apeldoorn?

In the survey, participants could grade several aspects of the DRT service throughout different questions. In this part of the paper, the results regarding the judgement of those aspects will be investigated. At

multiple questions, participants could grade using the Net Promotor Scale or NPS. The NPS gives the results in three categories: criticaster, passive/neutral persons and promotors. Criticasters give a grade from zero to six, passive people a seven or eight and promotors give a nine or ten. The overall score can range from -100 to +100, where a score of more than 1 can be seen as relatively good. The survey results indicate that users find that certain informational aspects can be improved.

Complaints and possible improvements in the informational realm

Users are overall negative in their opinion on the booking system overall, which they were asked for at question 18. 40 percent is criticaster and the score is -26.67, which is to be seen as a very low score. This could be due to most people's first experience with the booking system. Eight users noted that their first experience with the new DRT system was not pleasurable: they waited for the regular bus, which did not arrive, which in turn left them stranded.

Because the change from a regular bus service to a DRT service encompasses one large change -not being able to walk out the door anymore without preparing your journey- such a change should ideally need to be announced before it is implemented. This could be via social media, or physically with billboards, for example. Although information about from what time one needs to book a bus is visible at each bus stop information sign, it Is printed very small. But most importantly, when one does read it, it is already too late since one needs to book at least half an hour in advance. To change this, the operator could promote information on places which travelers look before they leave the house, like social media. In addition, the operator could also inform people about an oncoming change in transport modes using pamphlets or signs in the regular buses. This should be effective, since it is becoming clear that users of the regular bus are also likely to be users of DRT.

How do DRT-users perceive the quality of a network DRT-service?

The DRT users who participated in this research find that a DRT service in general should be punctual, frequent and easily bookable. In the case of the service in Apeldoorn, these aspects were well graded with the exception of the overall booking system. Aspects like hygiene and comfort tend to not be seen as very important. Simply put, it seems that users just want a service that works without additional features, like the discussed technological enhancements, being USB ports or free wi-fi. The service in Apeldoorn is currently not flawless. Although the booking side of the system is not rated the highest in importance, it is the most complained about feature. The DRT in Apeldoorn could be improved with regards to the information about the fact that one must book in advance, but then the information about how to actually make a reservation must also be clear.

Discussion

This paper makes statements about the satisfaction and opinion of users of the DRT system in Apeldoorn. There are several things that should be kept in mind with regards to this research.

This research investigates only one of the many types of DRT systems employed around the world. In this case, a network DRT system was in place, which replaces the regular bus during times of low demand. Other types of DRT systems work in different ways, are aimed at a different crowd or are set in a completely different environment. Therefore, it is difficult to relate this study to other places and thus can only refer to this type of DRT in this environment. Also, as this study managed to capture no people above the age of 35, it is likely that people from missing age groups have different opinion on aspects of the survey, which Morton et al. (2016) also suggest.

It should be noted that one limitation of the survey could have been that it is aimed at people with a smartphone at hand. Although there were no people over the age of 35 present at the time of surveying, it might as well have been the case. Elderly people tend to either not have a capable smartphone on them or distrust using it in the way that is needed for this research. Consequently, they may not be represented in the type of survey that is used in this research. To not exclude this group of people, a paper questionnaire taken before people enter the bus could be an option.

It has been mentioned in this research that DRT does not seem attractive for car-users. One reason next to the known literature could be because of the way the DRT in Apeldoorn is set up. As the service acts like a regular bus, it also has the same lack of flexibility in terms of time and destinations as a regular bus. However, more flexible DRTs have been proven to be costly to operate. Although this dilemma has been present for decades it is still a relevant problem, certainly with regards to climate change. Future research on DRT attractiveness could focus on the flexibility of DRT in combination with a relatively cost-effective service. There could be a large role for technological advancements in terms of communication and new transport platforms like Mobility as a Service (MaaS) in such research.

Conclusion

The aim of this research was to find out how users of a DRT service perceive the network quality. An online survey in combination with a physical approach was used in order to gather qualitative data. It did this by formulating the research goal as the main research question, as well as diving deeper into what factors are important in said network quality, as well as finding out what role the perceived quality plays in the light of a possible future mode shift. Finally, the possible improvements for the DRT service in Apeldoorn which were brought up by participants of the survey were also discussed.

Informational, spatial and material aspects of a DRT service were investigated. It was expected that punctuality and several informational aspects like ease of booking and ease of finding information about booking would be essential aspects chosen by participants. While punctuality was indeed seen as the most important, informational aspects were expected to be equally if not more important. Instead, ease of transfer was found to be of high importance to passengers. The punctuality of the buses was rated very well, while on the other side the booking system is not perfect. Due to lack of travel information, users had trouble when trying to use the DRT service for the first time, as many indicate they still waited for the regular bus to arrive.

The results of this research have confirmed that this DRT-system does not seem to be a replacement to the car. The number of car-users in the survey are negligible, despite the service being free for most users. The car user and the bus user remain populations which do not seem to mix very much. On the one hand, the car user chooses to not use DRT, while on the other hand the DRT user has limited other options than public transport. To achieve the sustainable transport system Sheller (2012) is referring to, it is vital for future research to investigate how DRT can become a competitor towards to the car.

In addition, future research on the qualitative side of evaluating DRT systems could be more focused on the informational side of a DRT system. This aspect in turn holds many interesting research areas. For example, it would be interesting to know how people living in the vicinity of a DRT bus line unknowingly can be informed in a better way. Also, if they choose not to use it, it would be interesting to find out why they do not use it and what it would take for them to change their mind.

To close, DRT is not a new concept at all, but many attempts with failed projects and low passenger numbers, it is vital to not only look at the statistics, but also towards to human aspect of demand responsive transport.

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Appendix 1: Interview guide English

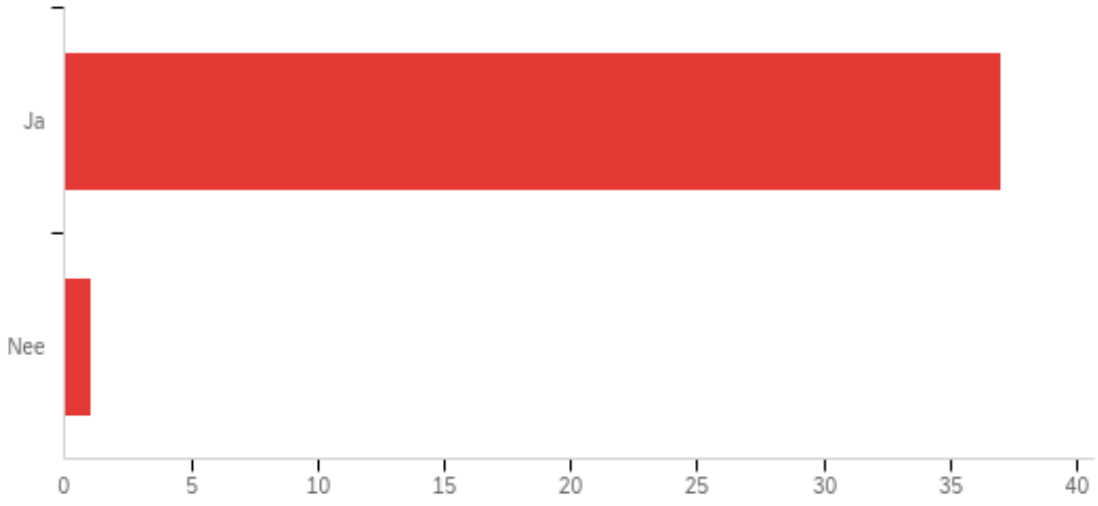
Question number	Question in English	Answer options in English
Q1	Consent Form Subject: Research into the perception of quality of demand-dependent transport in Apeldoorn. I hereby declare that I have been informed in a manner that is clear to me about the nature, method and purpose of the research. I understand that: - I can stop participating in this research at any time and without giving any reason - Data is processed anonymously, without being traceable to an individual person I declare that: - I am willing to participate in this study voluntarily - The results of this interview may be incorporated into a report or scientific publication Contact: Roan Hurenkamp / r.k.a.hurenkamp@student.rug.nl Thesis supervisor: F. Bahrami / f.bahrami@rug.nl Would you like to participate in this research? The research will only take up to 5 minutes.	Yes/no
Q2	In which age category do you fit?	18-24/25-34/35-44/45-54/55-64/65+
Q3	How many days per week do you travel with ReserveerRRReis?	This is my first time/less than one day per week/1-2 days/3-4 days/5-6 days/every day of the week
Q4	Which DRT-line in Apeldoorn do you use the most?	Line 12/line 13/line 14/line 15/line 16
Q5	Which rating would you give the punctuality of the DRT buses?	Rate 1/10 (very bad/ excellent)
Q6	If the DRT buses would stop in between bus stops, would you make use of it? This would cost you extra travel time and money	That would not matter to me, 2x per hour is enough/ I would find that useful
Q7	How would you like it if the frequency of the demand-driven service went up? This would cost you extra money.	Good/usually good/usually not good/often not good

Q8	What rating do you give the comfort of the vehicles used for the demand-driven service?	Rate 1/10 (very bad/excellent)
Q9	What rating do you give the hygiene in the vehicles used for the demand-driven service?	Rate 1/10 (very bad/excellent)
Q10	How often do you have a seat on the demand-driven bus?	All the time/most of the time/rarely
Q11	What do you do once you are in the demand-driven vehicle? You can select multiple answers.	I look at my phone/looking out the window/daydreaming/talking to my fellow travelers/calling someone/other, please specify
Q12	Why are you doing that? You can select multiple answers.	I enjoy it/to kill time/to shut myself off from the world around me/other, please specify
Q13	Would the journey be more pleasant if there were more facilities on board, for example USB ports or free wi-fi?	I would like that, I would use it/that would not make any difference to me
Q14	What other facilities would you like to have on board?	Text entry
Q15	How did you find out that you needed to book in advance?	Through friends/family/in a travel planner/on social media/trough a driver/other, please specify
Q16	How do you usually book a trip?	Over the phone/via the website/via the RRReis app/I usually get on at the station and do not need to book a trip/other, please specify
Q17	What was it like for you to find information about booking?	Rate 1/10 (very bad/excellent)
Q18	What rating do you give the booking system in general?	Rate 1/10 (very bad/excellent)
Q19	Which means of transport did you use most before the arrival of the demand-driven vehicles?	Ordinary city bus/car/bike/scooter, moped/does not apply to me/other, please specify
Q20	Which means of transport do you currently own? You can choose multiple answers.	Car/bike/scooter, moped/none/other, please specify
Q21	Which mode of transport do you currently use most often in Apeldoorn?	Demand-driven service/ordinary city bus/car/bike/scooter, moped/other, please specify
Q22	Why do you choose this service instead of any other means of transport?	It is faster/it is cheaper/it is more comfortable/it is easier to transfer to other public transport/I have no other choice/other, please specify
Q23	If the ticket price were the same as the city bus (2.40EUR one way), would you still take the demand-driven service?	Yes/no, I would choose another mode of transport, specifically:
Q24	How important do you think the following general aspects of a demand-driven service are? Drag the aspects in order from important on 1, to unimportant on 5.	Punctuality/frequency/hygiene/comfort/ease of booking/connection with other public transport

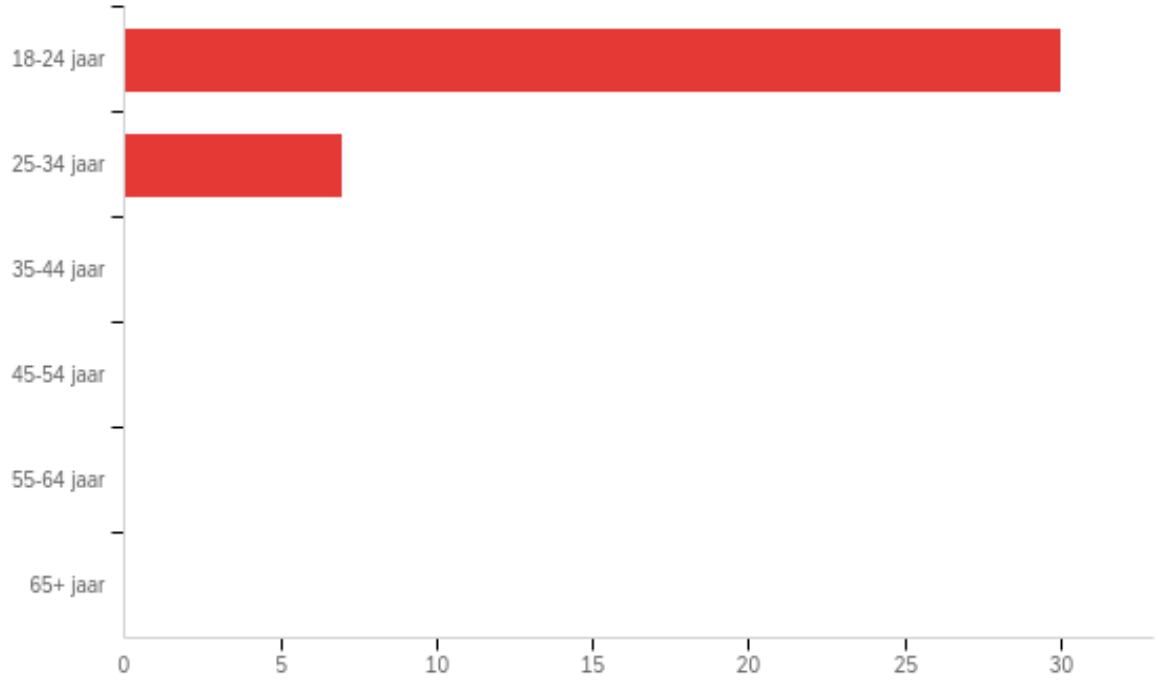
Appendix 2: Result report survey Dutch

Default Report

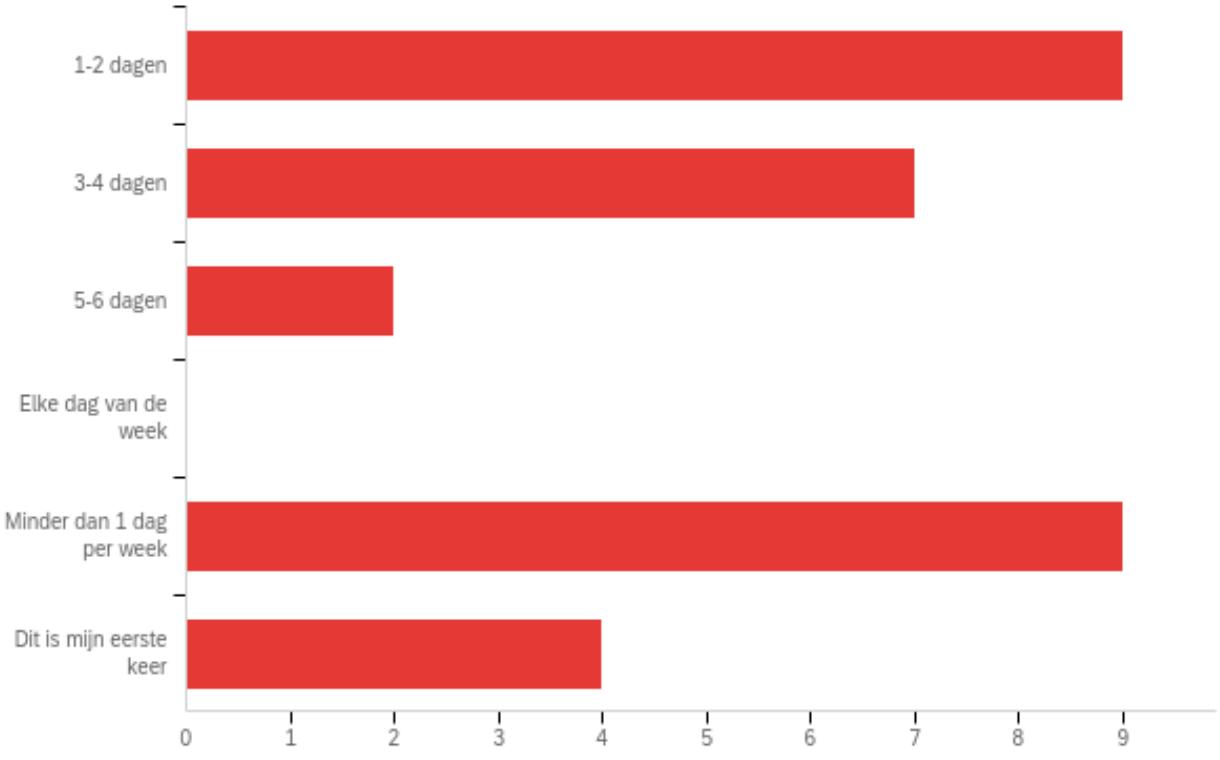
Q1 - Toestemmingsformulier onderzoek vraagafhankelijk vervoer Ik, Roan Hurenkamp, onderzoek de perceptie van kwaliteit van het vraagafhankelijk vervoer in Apeldoorn. Hieronder volgt het toestemmingsformulier welke verplicht is om te accepteren om mee te doen. --------- Ik verklaar hierbij op voor mij duidelijke wijze te zijn ingelicht over de aard, methode en doel van het onderzoek. Ik begrijp dat: - Ik mijn medewerking aan dit onderzoek kan stoppen op ieder moment en zonder opgave van reden - Gegevens anoniem worden verwerkt, zonder herleidbaar te zijn tot de persoon Ik verklaar dat ik: - Geheel vrijwillig bereid ben aan dit onderzoek mee te doen - De uitkomsten van dit interview verwerkt mogen worden in een verslag of wetenschappelijke publicatie Contactgegevens: Roan Hurenkamp / r.k.a.hurenkamp@student.rug.nlScriptiebegeleider: F. Bahrami / f.bahrami@rug.nl Wilt u meedoen aan dit onderzoek? Het onderzoek duurt max 5 minuten.



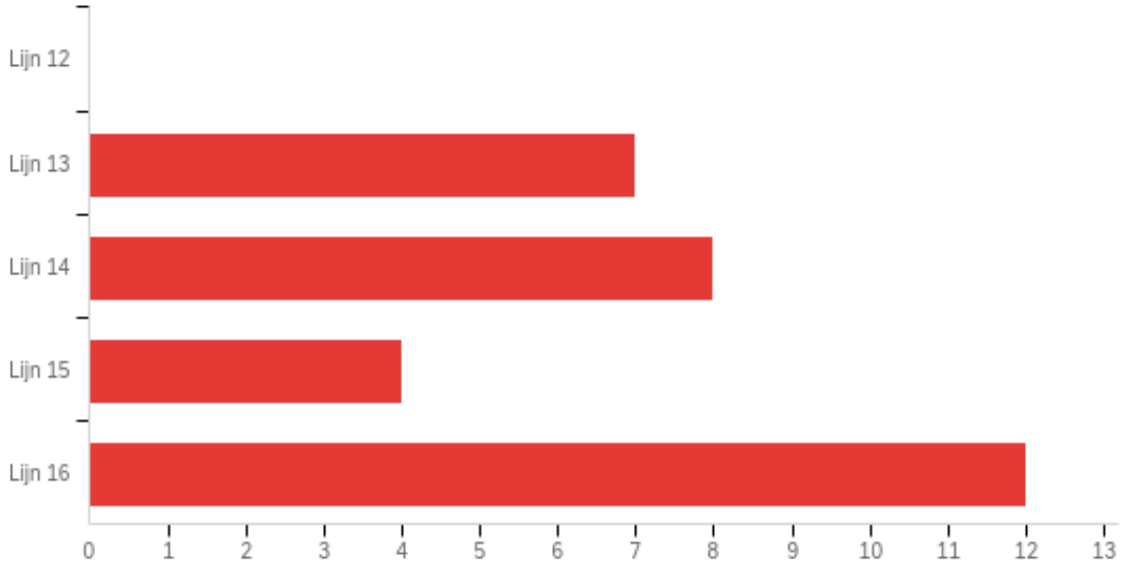
Q2 - In welke leeftijdscategorie bevind u zich?



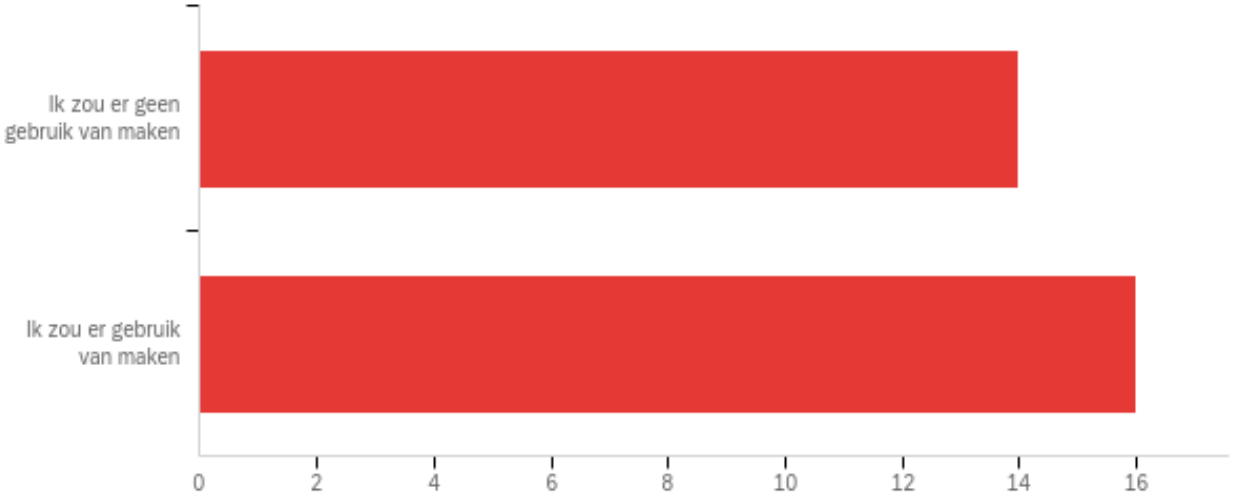
Q3 - Hoeveel dagen per week reist u met ReserveerRRReis?



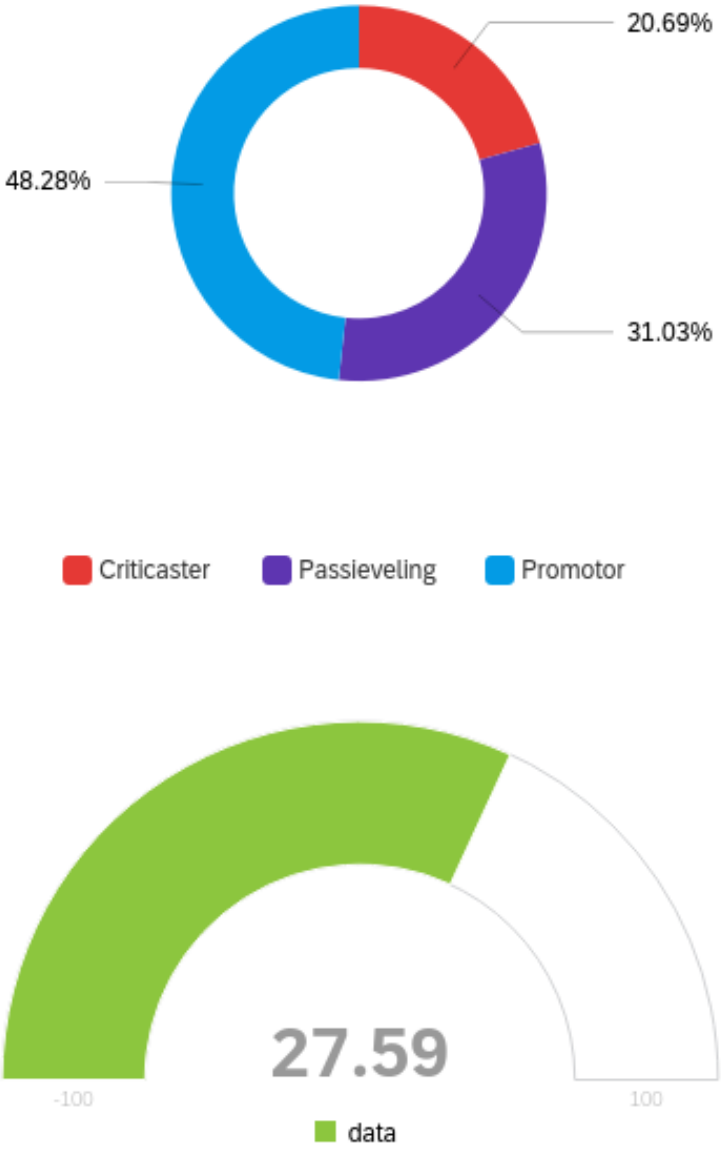
Q4 - Welke reserveer lijn in Apeldoorn gebruikt u het meest?



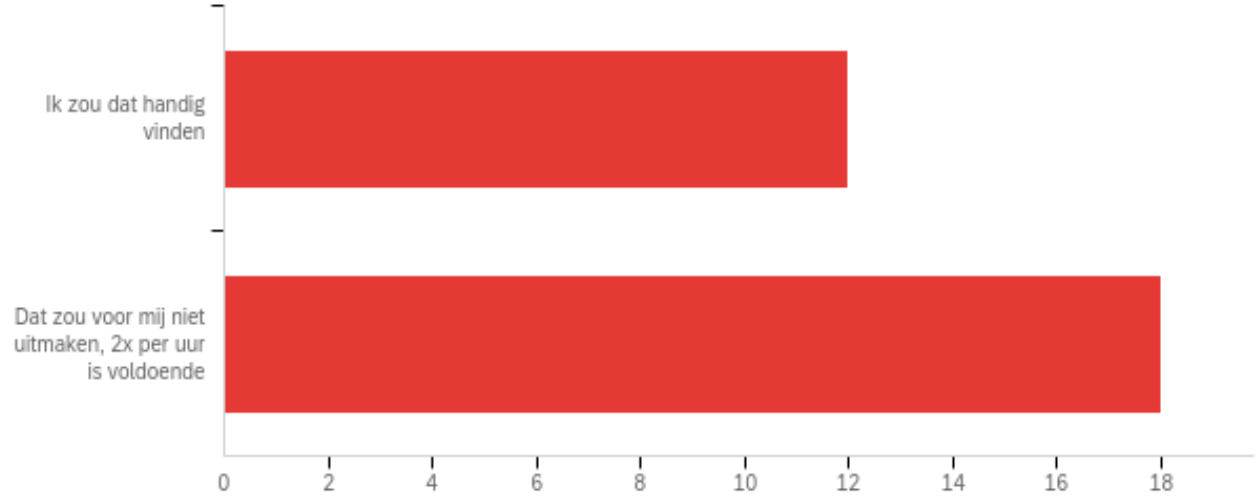
Q6 - Als de reserveerbusjes ook zouden stoppen tussen bushaltes in, zou u daar dan gebruik van maken? Dit kost u dan wel extra reistijd en geld.



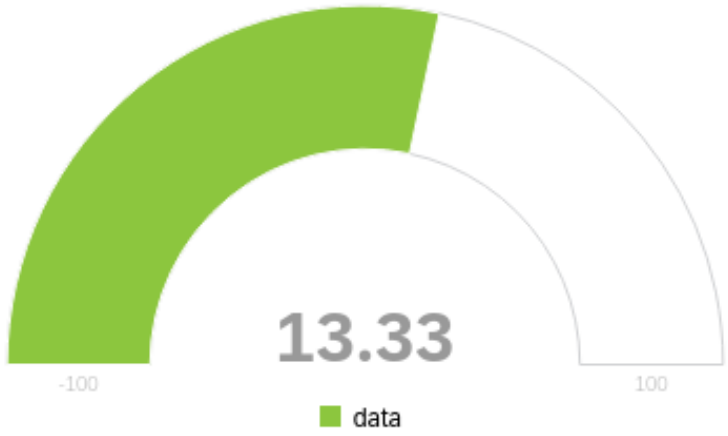
Q5 - Welk cijfer geeft u de punctualiteit van de reserveerbusjes?



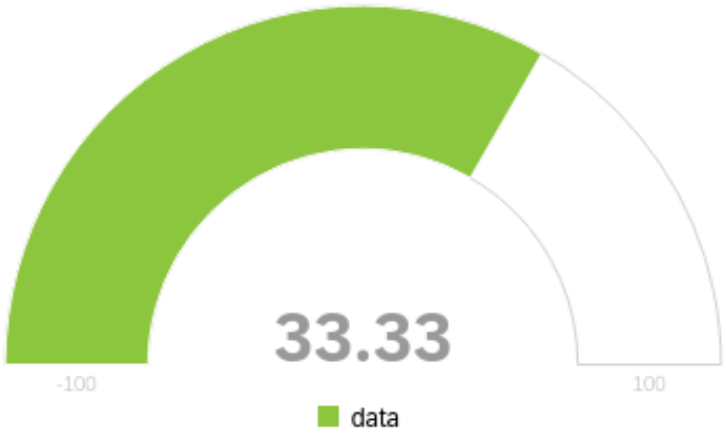
Q7 - Hoe zou u het vinden als de frequentie van de reserveerbusjes omhoog gaat? Dit kost u dan wel extra geld.



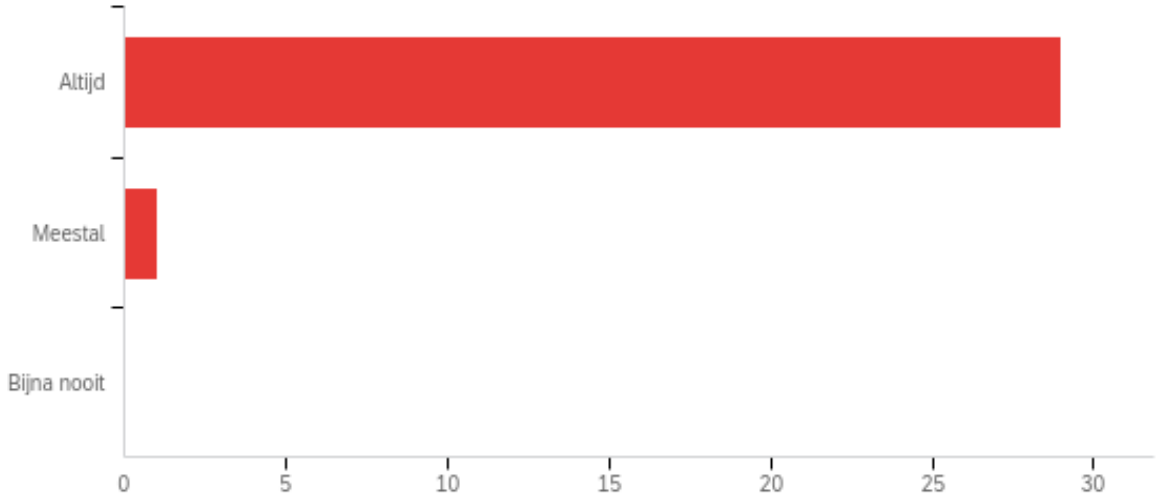
Q8 - Welk cijfer geeft u het comfort van de reserveerbussen?



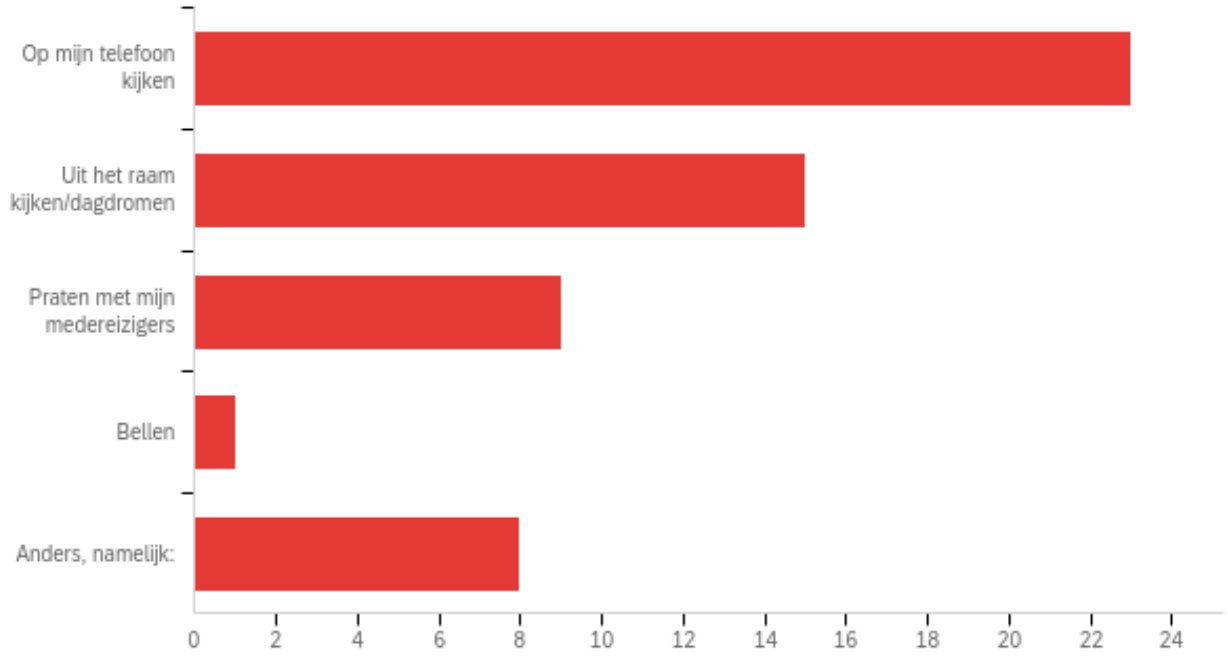
Q9 - Welk cijfer geeft u de hygiene in de reserveerbussen?



Q10 - Hoe vaak heeft u een zitplek in de reserveerbus?



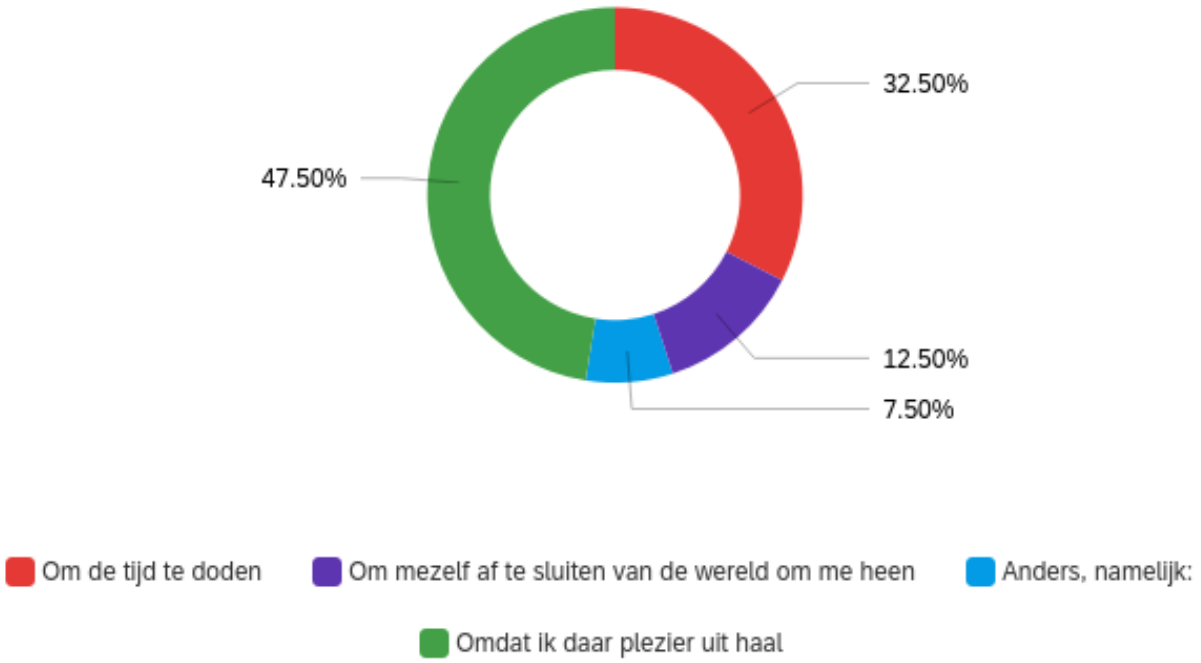
Q11 - Wat doet u als u eenmaal in de reserveerbus zit? U kunt meerdere antwoorden selecteren.



Q12_6_TEXT - Iets anders, namelijk:

Anders, namelijk: - tekst
Praten met de chauffeur
Muziek luisteren
Lezen
Muziek luisteren
Kletsen met de chauffeurs
Muziek luisteren
Listen to music
Muziek luisteren

Q12 - Waarom doet u dat? U kunt meerdere antwoorden selecteren.



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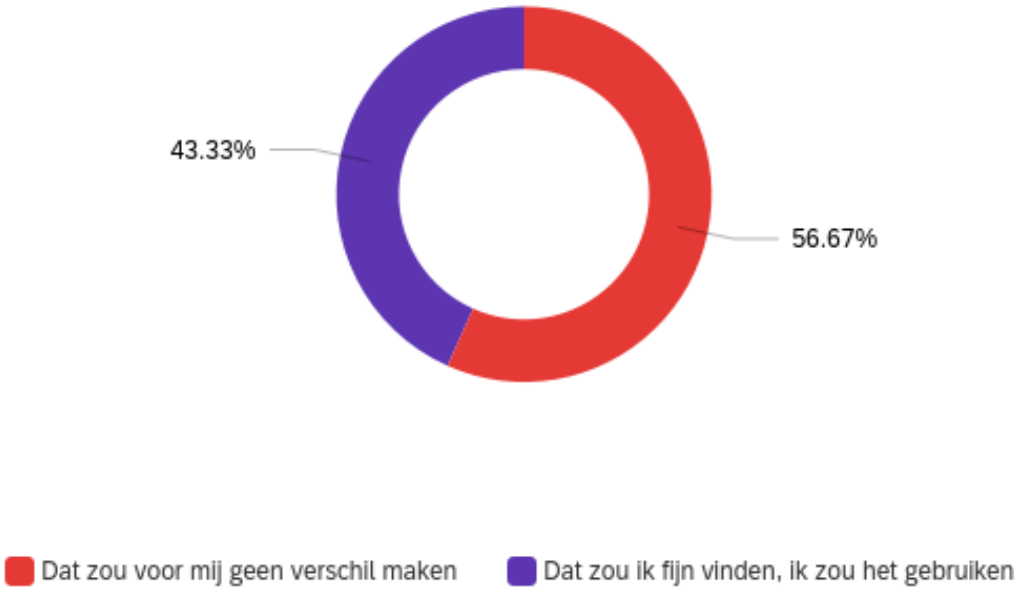
Q13_3_TEXT - Anders, namelijk:

Anders, namelijk: - tekst
Om anderen ook een leuke dag te bezorgen
/
Om persoonlijke zaken te regelen

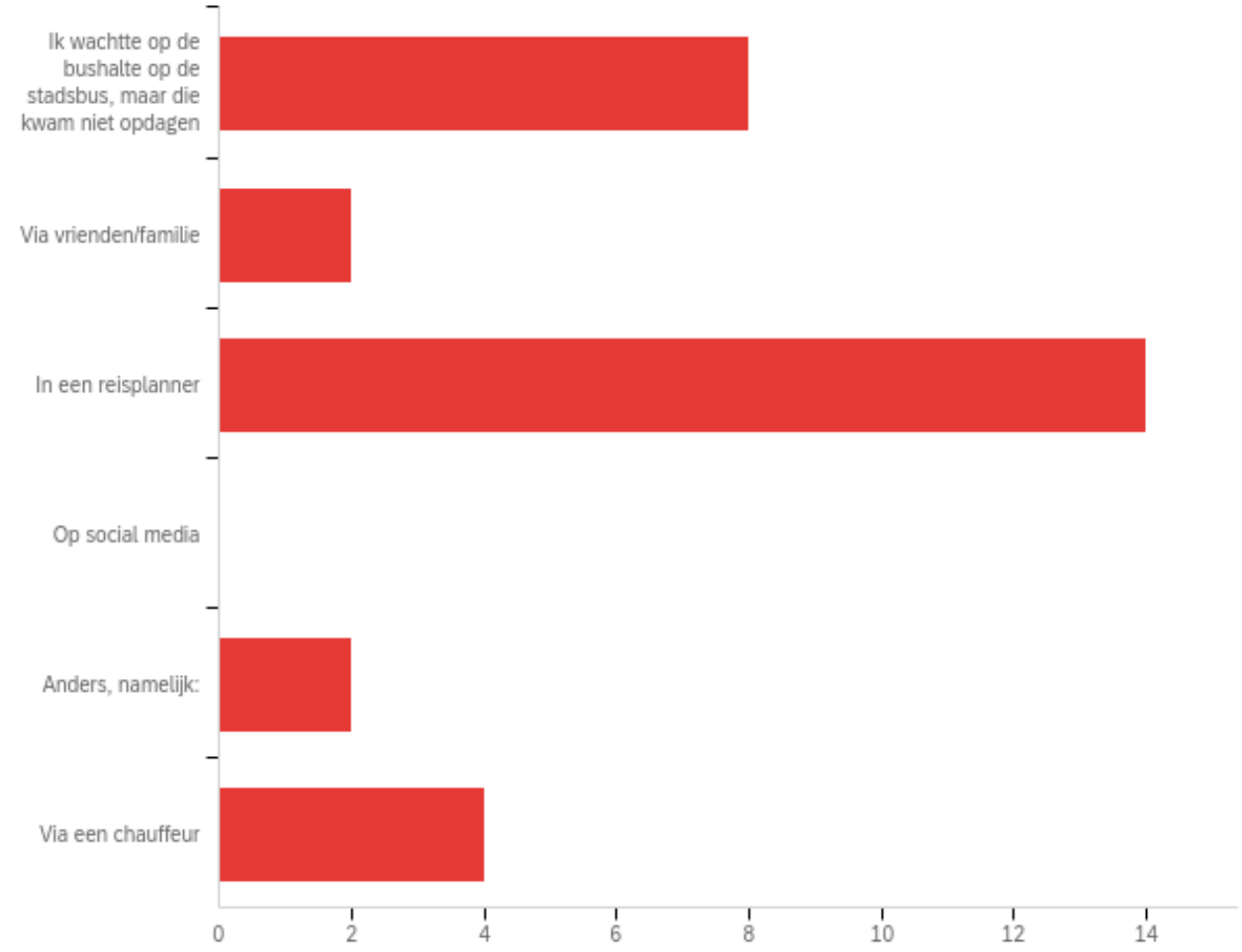
Q13 - Zou de reis aangenamer zijn als er meer faciliteiten aan boord zouden zijn, bijvoorbeeld USB-poorten of gratis wi-fi?



Q14 - Welke andere faciliteiten zou u eventueel graag hebben aan boord?

Welke andere faciliteiten zou u eventueel graag hebben aan boord?
/
Een stop knop
Flesje water of leuke muziek
Geen
Not having reserve all the time
Geen
Nvt
Ov scanners

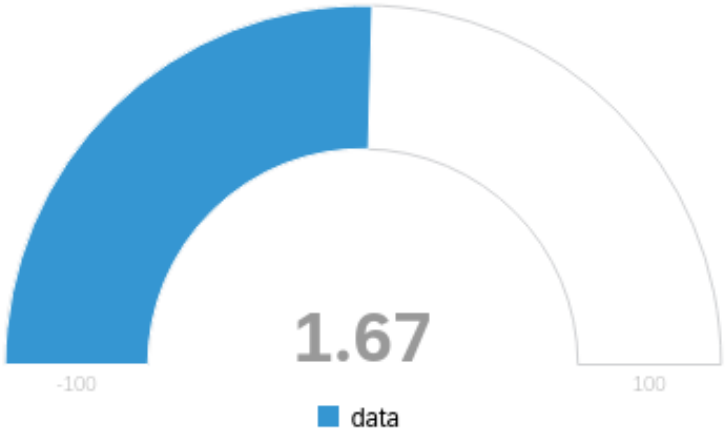
Q15 - Hoe bent u erachter gekomen dat u moest reserveren van tevoren?



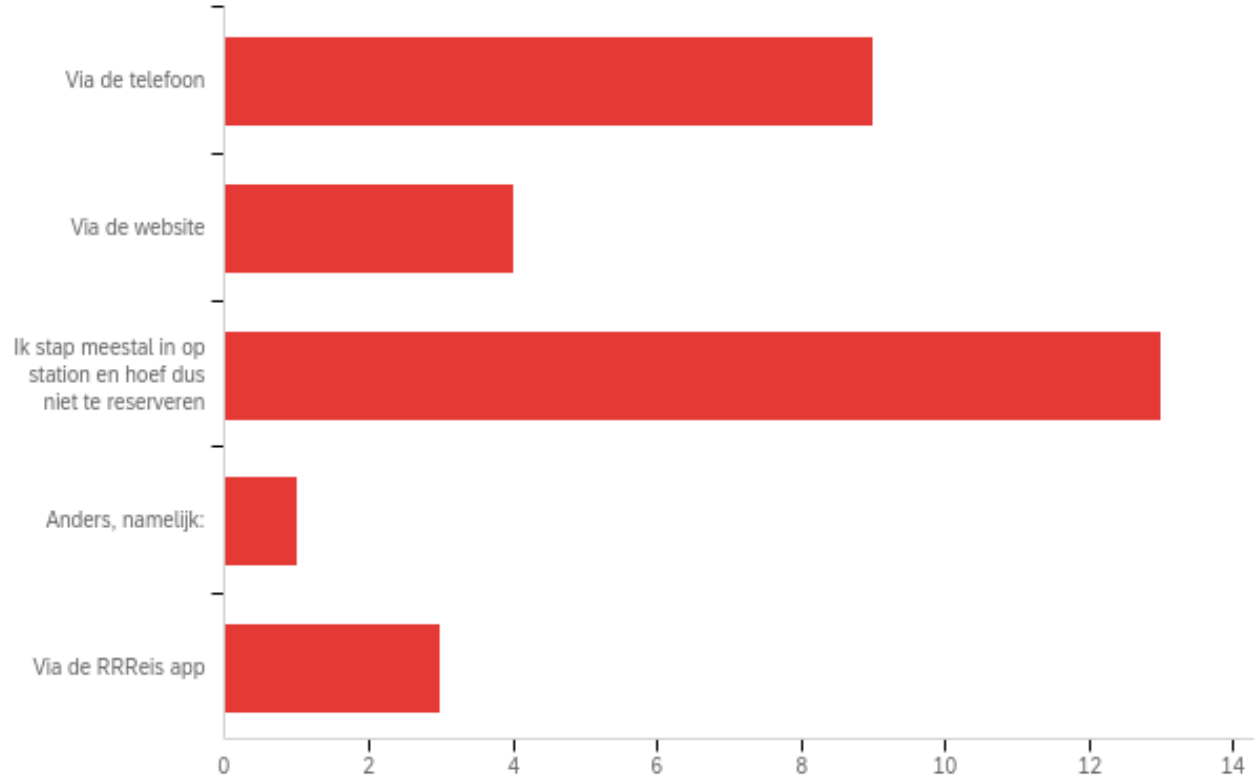
Q16_5_TEXT - Anders, namelijk:

Anders, namelijk: - tekst
Via een medepassagier van de reserveerbus
Via de nieuwe dienstregeling die op de site van keolis staat

Q17 - Hoe was het voor u om informatie te vinden over het reserveren?



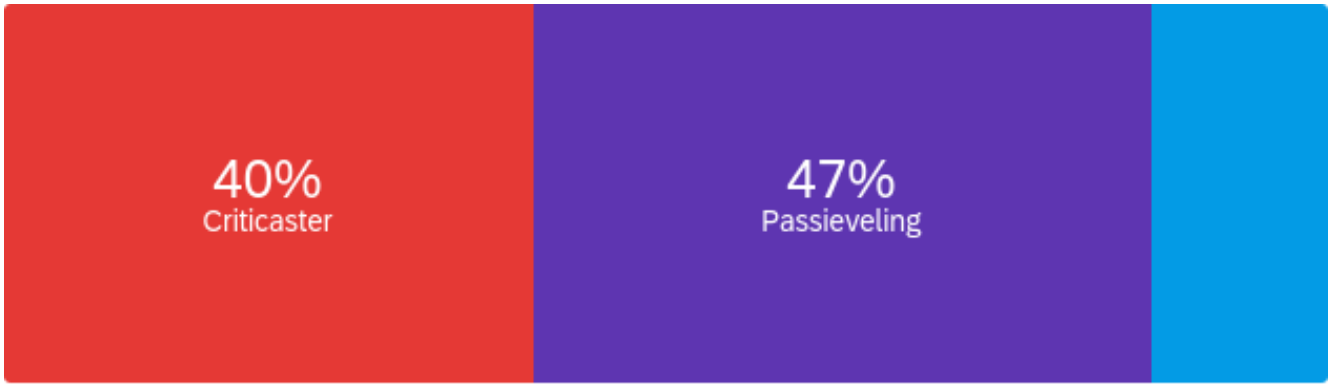
Q16 - Hoe boekt u meestal een ritje?

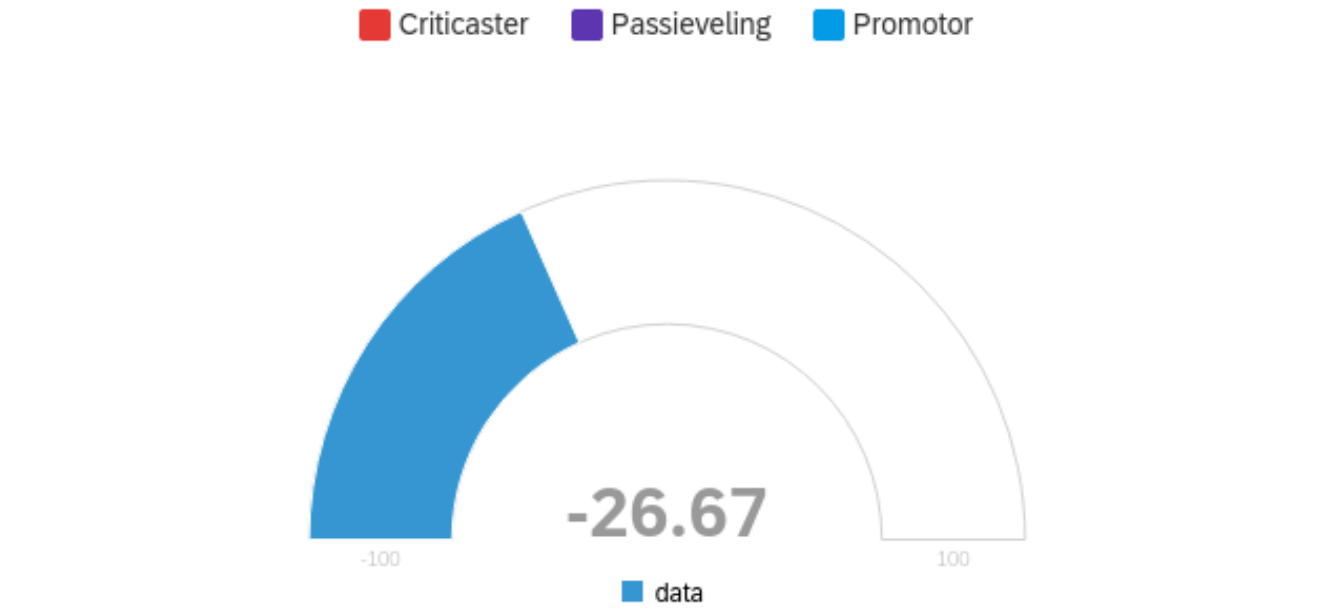


Q18_4_TEXT - Anders, namelijk:

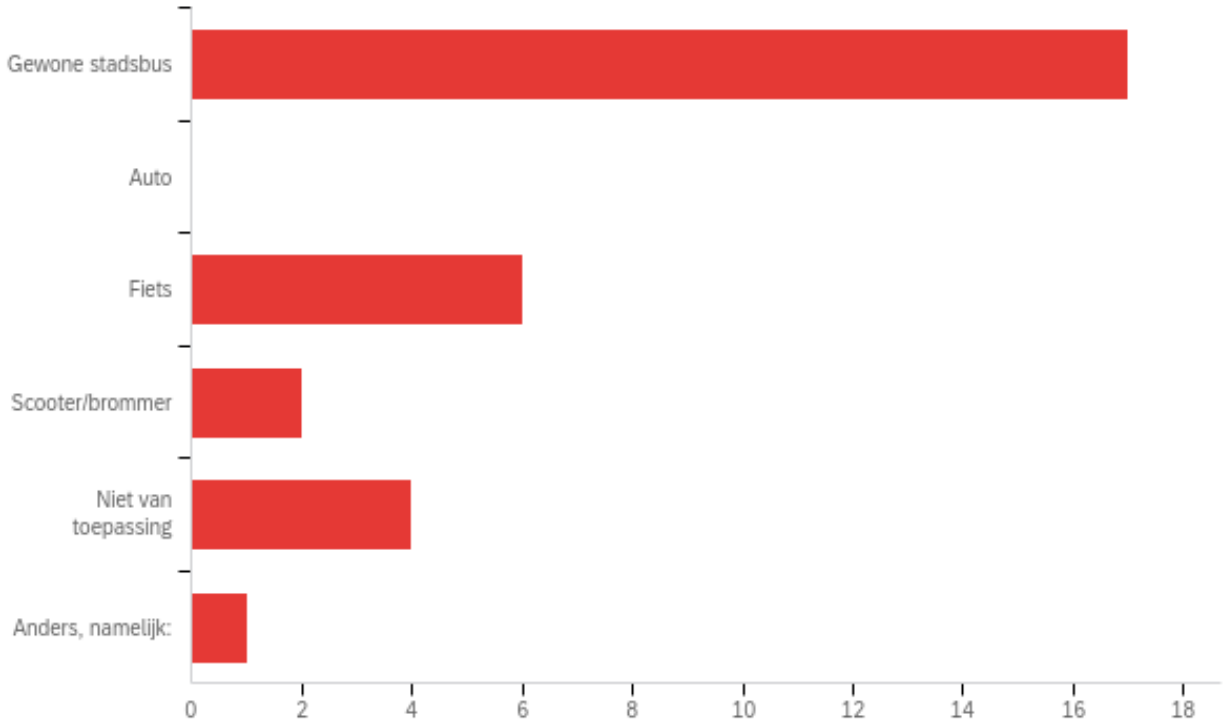
Anders, namelijk: - tekst
Via de 9292 app

Q18 - Welk cijfer geeft u het reserveringssysteem over het algemeen?





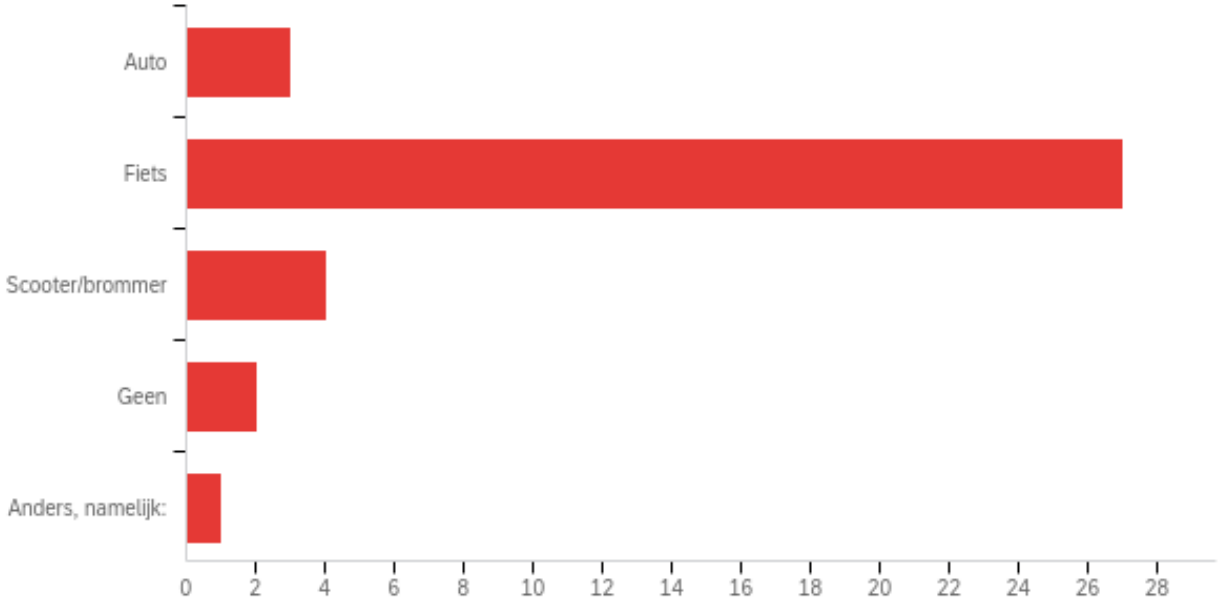
Q19 - Welk vervoersmiddel gebruikte u het meest voor de komst van de reserveerbussen?



Q22_6_TEXT - Anders, namelijk:

Anders, namelijk: - tekst
Lopende

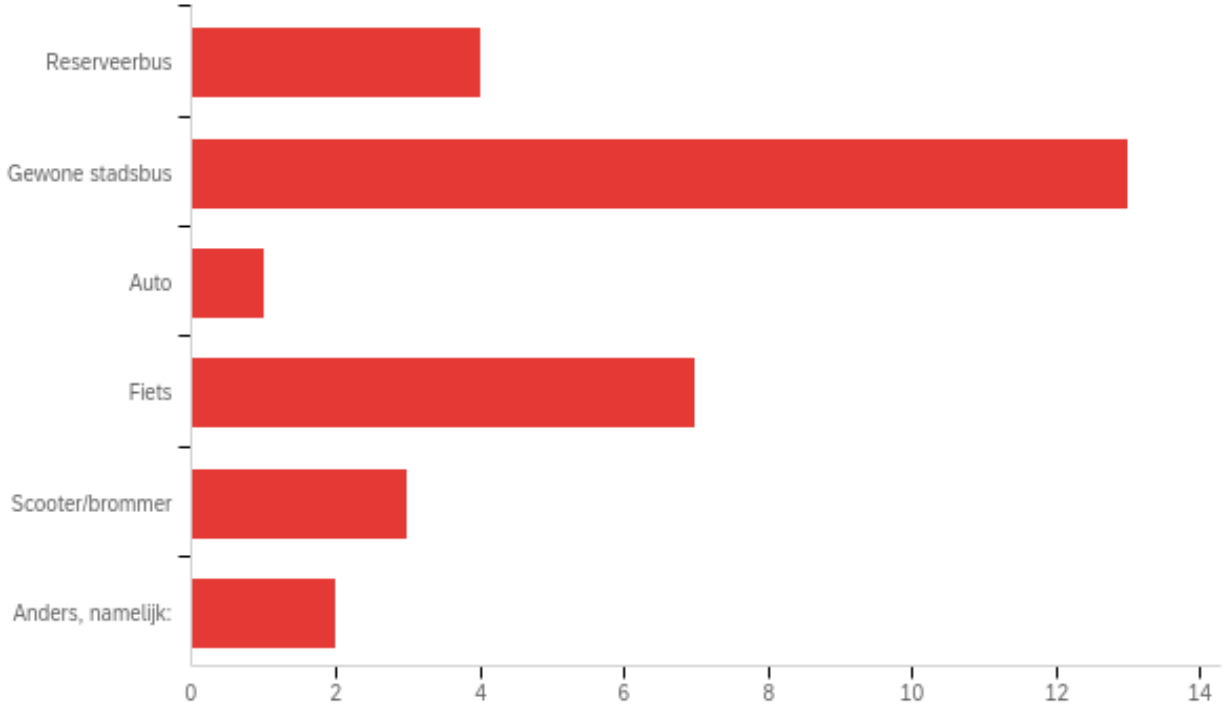
Q20 - Welke vervoersmiddelen bezit u op dit moment? U kunt meerdere antwoorden kiezen.



Q20_5_TEXT - Anders, namelijk:

Anders, namelijk: - tekst
My legs

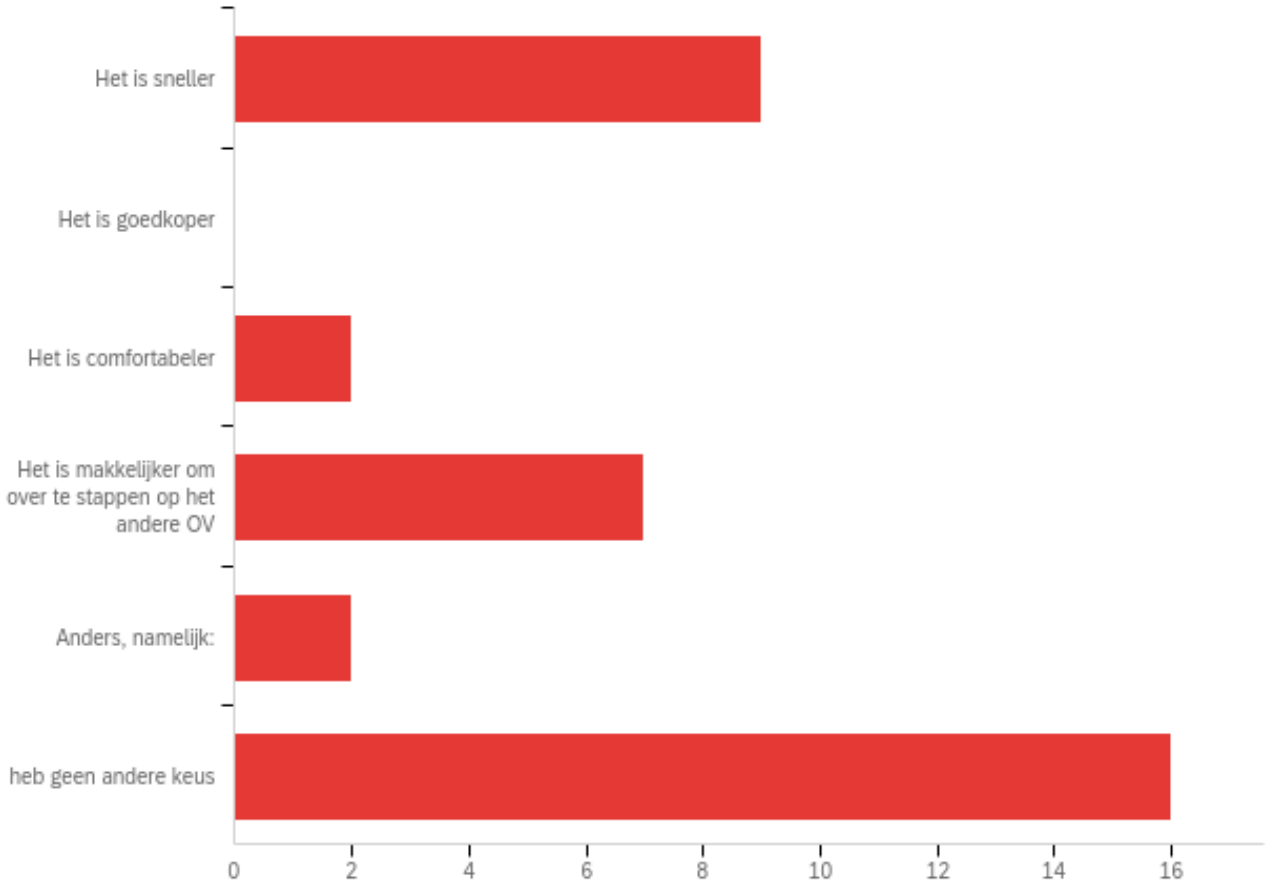
Q21 - Welk vervoersmiddel gebruikt u op dit moment het vaakst in Apeldoorn?



Q21_6_TEXT - Anders, namelijk:

Anders, namelijk: - tekst
Lopen
Overdag de stadsbus 's avonds de reserveerbus

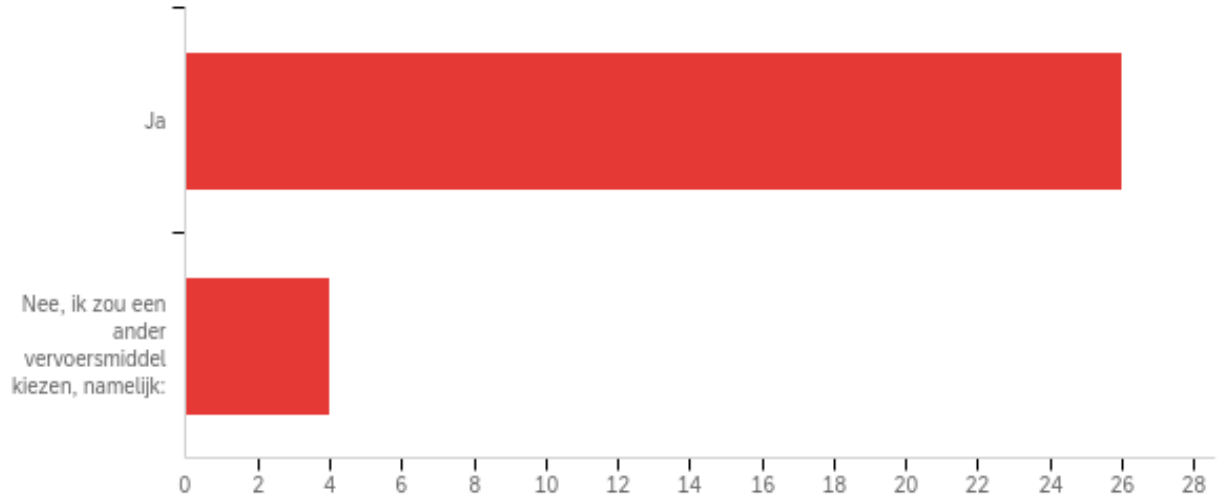
Q22 - Waarom kiest u nu voor dit busje in plaats van eventuele andere vervoersmiddelen?



Q23_5_TEXT - Anders, namelijk:

Anders, namelijk: - tekst
Bij lange afstanden of na alcoholgebruik
Geen andere keuze van af mijn halte na 8 uur s'avonds

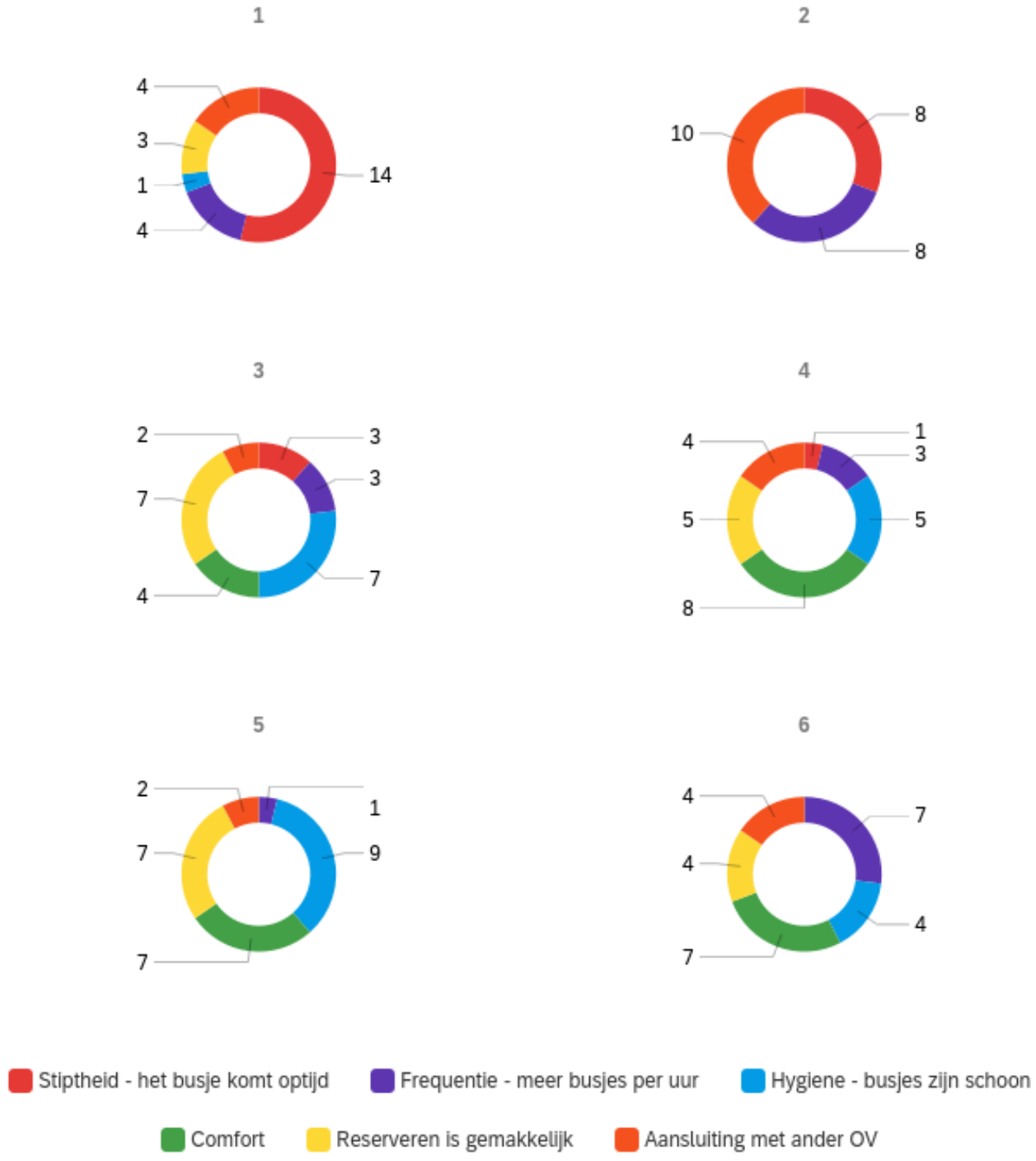
Q23 - Als de ticketprijs hetzelfde zou zijn als de stadsbus (2.40EUR enkele reis), zou u dan nog steeds de reserveerbus nemen?



Q24_18_TEXT - Nee, ik zou een ander vervoersmiddel kiezen

Nee, ik zou een ander vervoersmiddel kiezen, namelijk: - tekst
Fiets
Anything but demand driven service

Q24 - Hoe belangrijk vind u de volgende algemene aspecten van een reserveerbus? Sleep de aspecten op volgorde van belangrijk op 1, naar onbelangrijk op 5.



Q25 - Wilt u nog wat toevoegen over ReserveerRRReis of over deze enquete zelf? Vul het dan hieronder in.

Wilt u nog wat toevoegen over ReserveerRRReis of over deze enquete zelf? Vul het dan hieronder in.
Prima enquete
/
Fijne enquête, niet te lang en duidelijke vraagstelling. Voor de rest erg tevreden over de Reis bussen!
Vind het top!!
Its a nightmare for elderly people. I have seen many stranded not knowing how to make it work.
Het is jammer dat sommige chauffeurs doorrijden terwijl je er staat. En dan extra kosten moet maken d.m.v. het boeken van een taxi. Omdat je dan niet meer de volgende bus kan reserveren. Omdat dit max. 30 min van te voren moet.
aardige chauffers

Q33 - Hoe sluit de reserveerbus aan op het andere OV?