Demographic effects of rural bus stop relocation

CTB3000-16: Bachelor End Project

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by

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Preface

Hugo von der Thüsen
Delft, July 2025

This research was done as part of the Bachelor End Project, also known as the Bachelor Thesis, for the Bachelor Civil Engineering at Delft University of Technology. It is a mandatory course worth 10 European Credits and must be passed with a grade of 6/10 in order to complete the Bachelor programme.

I chose the subject myself as I had read many articles on the relocation and removal of bus stops in rural areas of The Netherlands. I do not live in a rural area but I have been interested in transit network design for a long time and therefore I thought this would be a subject I would find interesting to do a study on. I also think the focus in Dutch politics and public transit operations has shifted too much towards breaking even and running the most efficient network possible for the majority of the people. In doing this the focus has shifted away from the human side of transportation, getting everyone from a to b regardless of if they work, study, travel to care for family, travel for fun or any other reason.

As it is part of a course, I was assisted by several people who gave feedback, helped me gather information but most of all taught me how to perform research. I would like to thank Alexandra Gavriilidou who was my first examiner and gave critical yet very informative feedback at our weekly group meetings. I would also like to thank Konstantinos Rigos who was also present at these meetings and similarly gave all of the students in our group good feedback. To the four other students in my group who gave me weekly feedback in our peer reviews I would also like to say my thanks, so thank you Bjarne, Thijs, Ralph and Luke. I would like to thank Niels van Oort who I approached before the course to see if my subject was viable and interesting for research, Niels gave lots of papers and helped me in reaching the bus operators by asking them for passenger data even if it turned out to not be successful. And lastly I would like to thank Julia Bickel who took the time to gather passenger data for me which ended up not being used in the report as the other transport operators did not give me their data.

Doing this BEP has taught me a lot on how to conduct research, how to take surveys, interpret and analyse data and manage time. I enjoyed doing the research even though I had quite a lot of ”writer’s blocks” in the process. I am still enthousiastic about public transportation networks and will continue on this path by following up my Civil Engineering bachelor with a masters in Transportation, Infrastructure and Logistics.

Summary

Bus transportation in some Dutch villages has undergone a change in recent years. Operating companies have changed the routing of the service to increase frequencies, reduce travel time and lower operating costs. Buses are a lifeline for many people but especially for the young and elderly in our society. Having a bus stop close to the passengers origin or destination is ideal and relocating this bus stop to a location further away can have results on the mobility of specific demographics.

By use of a survey the opinions of the passengers were recorded and analysed in order to understand how the relocation has affected those that still use the service. Statistical analyses were performed to find correlations between demographic attributes and opinions of the service as well as a preference for the current or previous routing. Additionally, in-depth conversations with passenger provided valuable insights regarding the mobility of certain passenger groups. Results from the survey show an overall satisfaction with the current service and a slightly lower satisfaction with the location of the bus stop. Correlation analyses show a moderate correlation between the age of the passenger and their opinion on the bus stop location. The older the passenger gets, the less likely they are to have a positive opinion on the location. Walkshed analyses indicate that the bus stop still provides access to the entire village. A majority of the passengers are travelling either for work or education, they noted the service change as positive as it decreased their overall travel time. Conversations with passengers paint a picture of difficulty getting to the new bus stop and safety concerns at the new locations. Accessibility aspects such as stairs and ramps need to be taken into account in combination with the larger distance that now needs to be traversed. Other aspects that need to be taken into account are noise pollution, road safety and comfort.

The overall conclusion states that the relocation and paired service improvements are a net benefit for the younger and able-bodied passengers who are travelling often on a daily basis. The service change has positive and negative aspects for elderly and mobility impaired passengers as the frequency, speed and comfort increases are perceived as good but the new location is seen as a barrier to easy use of the bus stop. Nuance is taken into account regarding the ability to reach passengers who are not using the bus stop anymore since the relocation.

Contents

1

Introduction

Public buses play an essential role in the transportation of people around the country for all their day-to-day activities. Buses are also a more sustainable travel mode than private vehicles [1] and with the climate crisis we are in, sustainable modes should be encouraged as much as possible. Some transit operators have been changing their operations to account for changes in demand and shifts in financial viability of routes. Connecting large centres of population and employment is more lucrative than running a bus into small village streets to pick up a few passengers. However, public transportation also exists as a service for people who are less mobile and do not have the ability to get around using a car. A fine balance has to be found by the operators and governing bodies to assure smooth operations, financial stability and a reliable service for all passengers.

Figure 1.1: Example map of both the pre- and post-relocation routes through two villages. The purple line is the previous route through the village centre, the green line is the current route which bypasses the village whilst making a stop on the periphery [2]

In recent years bus operators in The Netherlands have been changing their services to speed up buses and increase frequency at the cost of serving village centres. Increasing frequency is directly linked to higher ridership even more than the price of the trip [3]. With the introduction of R-Net in The Nether-

lands, a network of high quality buses with good frequencies that the rider can rely on, a lot of slower regional buses have been upgraded to fit the new format. Regional passengers have similar preferences to those of their urban counterparts, the only significant difference is that they rank comfort higher [4]. In order to accommodate this format service changes had to be implemented and as such an increase in frequency and faster travel times followed. Passengers are willing to travel further to a bus stop if the frequency and speed of that service is of high quality [5]. This rerouting came at the cost of removing deviations in the route which were used to serve the centre of towns, villages and other points of interest. These deviations provided a convenient way for passengers to get on the bus near to their place of residence or destination. In some cases the disappearance of these rural routes has led to the creating of flexible transportation options such as dial-a-ride buses, demand responsive transit and shared mobility. However, passengers still prefer fixed bus routes as opposed to demand based transportation in its current form [6].

Our society is a mix of many different demographics. People of all ages, mobility ranges, race, gender and more are using public transportation for many different reasons. Especially for those of reduced mobility and passengers without access to a private vehicle the bus is one of the most important modes of transportation. This study aims to look at the effects of this removal of the deviations and the subsequent relocation of the bus stops and how it affects different demographic groups in different ways. Many studies have been conducted on the placement of bus stops in urban and rural areas but none have been done on the relocation of a stop in a rural setting. Thus the research question is as follows:

What are the different effects on demographic groups when relocating a bus stop from the centre to the periphery of a Dutch village?

Sub-questions for this research question:

1. What bus stops should be studied?
2. Who uses the bus?
3. How do passengers perceive the relocation of the bus stop?
4. How do people get to the bus stop?
5. How do changes other than the relocation influence the passenger experience?

2

Methods and data gathering

To gain insight into the effects on different demographic groups due to the relocation of a bus stop, a method needs to be devised that gathers the passenger opinions in a qualitative way. Time constraints need to be taken into account as there is only a limited set of weeks allocated to this research.

This chapter consists of three sections each explaining the methodology used to conduct the research. Before gathering the data, different study areas need to be selected to reflect the sketched situation of a relocated bus stop so that reliable and meaningful data can be collected, this is done in the first section. The second section focuses on designing the survey. Lastly the results will need to be analysed so that answers to the (sub)questions can be formed.

2.1. Research area demarcation

This study is done as a Bachelor Thesis for which only 8 weeks are allotted. This small amount of time constrains the study to not go beyond The Netherlands as it would involve a lot more bureaucracy to get data from foreign bus companies and to take surveys in foreign languages. Again due to the small amount of time for the study, bus stops should not be chosen too far away from the home of the researcher, who resides in Delft. A maximum travel time of 1 hour 30 minutes from the train station in Delft to the subject bus stops is chosen so that surveys can be taken at reasonable times and to allow for enough time to analyse the results. This ”transitshed” is illustrated in figure 2.1.

These demarcations restrict the research area to most of the province of Zuid-Holland including rural areas, southern Noord-Holland under the Noordzeekanaal, parts of Noord-Brabant around Breda, urban areas around Utrecht and the north of Zeeland. As the research is focused on rural areas the area around Utrecht is not a valid research area as only the urban parts of Utrecht can be reached within the given time frame. North-Holland is also not useful for this research as most of the parts that can be reached within the time frame are too urban and the few lines that do run through rural areas have not changed in the last ten years.

Now that the research area has been narrowed down to Zuid-Holland and parts of Noord-Brabant and Zeeland, lines that fit the description have to be found. Using old line diagrams, bus timetables and Google Streetview, a few locations are identified. The line diagrams and timetables give a specific year in which the change took place, usually when the concession changed between companies. Google Streetview shows the exact location of the previous bus stop as it is possible to look at imagery up until 2009.

Three locations are found. They are numbered according to proximity from Delft. All three are different villages.

Stompwijk and Zoeterwoude are both located on the same bus line connecting the cities of Zoetermeer (pop. 128,434) and Leiden (pop. 130,108). The line serving this route is line 400. Twelve stops are made in between of which only three are outside of Zoetermeer and Leiden. All three of those are either in Stompwijk or Zoeterwoude. As this is the fastest and most frequent connection between Zoetermeer

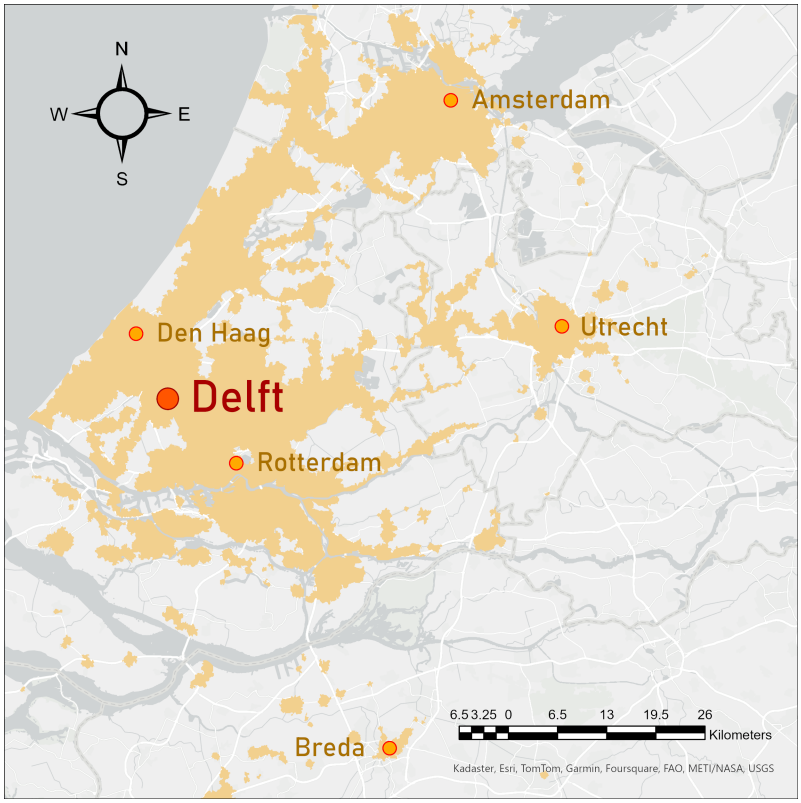


Figure 2.1: Area that can be reached within 1.5 hours from Delft station/ Made in ArcGIS using the TravelTime plugin

	Schipluiden	Stompwijk	Zoeterwoude
Population	4,250	2,355	4,855
Year of relocation	2012	2014	2014
Current operator	EBS (2019 - 2030)	Arriva (2012 - 2024)	Arriva (2012 - 2024)
Previous operator	Veolia/Connexxion (2009 - 2019)	Connexxion (2005 - 2012)	Connexxion (2005 - 2012)

Table 2.1: Research areas with relevant information

and Leiden it can be assumed that this is a preferred route for many commuters between these two cities. For this reason a fast, reliable and comfortable service is warranted. This has been achieved by taking the line off of the narrow and winding village streets in Zoeterwoude and Stompwijk and moving it to the adjacent N206 provincial road. The old route took between 34 - 37 minutes with a median travel time of 36 minutes. After the change the travel time was reduced to 30 minutes. For some years both services were operated where the local bus ran every 30-60 minutes. This local service ran until December 2014. Old route maps from 2014 show that a circulator service was run after the discontinuation of the local bus [2]. This line 176 ran through Zoeterwoude and connected the centre to the new bus stops on the N206. A newspaper article from only 4 months after the start of the service shows that it was underutilised [7]. It was discontinued in 2016. Since both villages are on the same line, comparisons can be made to see if the change affects stops along the line evenly or if there are other factors at play such as village size, proximity to larger towns, demographics or others.

Schipluiden is a small village just South West of Delft. A single bus line originating at Delft station runs around the village on the N468 provincial road after which it continues through the village of Maasland to the town of Maasluis (pop. 35,832) where it connect to the Rotterdam Metro network. This line primarily serves the inhabitants of the villages along the route and not so much a connection between Delft and Maasluis. It runs twice hourly on weekdays and hourly in the evenings, holidays and weekends. In

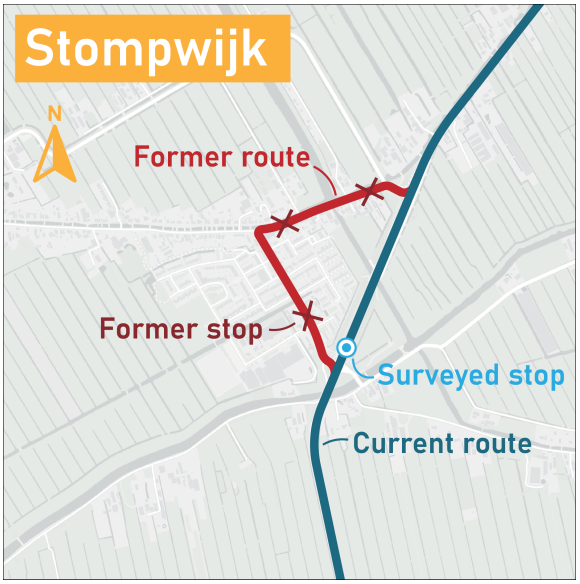


Figure 2.2: Map of previous and current bus routes through Stompwijk

Figure 2.3: Map of previous and current bus routes through Zoeterwoude

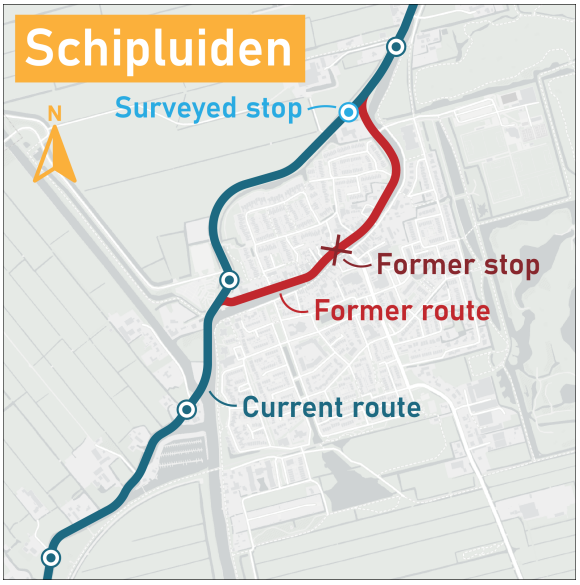


Figure 2.4: Map of previous and current bus routes through Schipluiden

Figure 2.5: Map of the area with all villages that will be researched. The blue lines are the bus routes with 33 and 400 being the route numbers

December 2012 operator Veolia changed the routing of the line which, up until then, ran through the centre of the village. Multiple unverifiable sources say that this was because of the narrow streets which prohibited the use of regular buses and instead mandated the use of smaller so-called ”midi-buses”. Although the sources can not be verified, a quick glance at the road the bus used to run on clearly supports this fact. Not only is it narrow, it winds it way through the village, runs past restaurant terraces and supports traffic in both directions. Since the change the new operator Connexxion has been running full sized buses on the route. The central bus stop was replaced by two stops on the peripheral road.

When at the stops, observations will be made to see what amenities are present at the stops. If present, bicycles will be counted which could indicate how many people cycle to the stop. The amenities at the stops such as shelters, benches, departure boards and level boarding could indicate a higher passenger comfort which could positively impact their opinion on the service.

2.2. Survey

To understand the human factor in this service change a survey has been designed. The survey consists of ten questions. The first four questions are asking the respondent for their opinion on the service. The four questions after that are asking them about their travel habits. The last two questions are on the socio-demographic characterisation of the respondents. First, the process of designing the survey will be explained. Secondly a data analysis method is formulated.

2.2.1. Designing the survey

Designing a survey requires a lot of thought and detail. In order to get results that can be used in the analysis, certain methods of questioning need to be applied. A few conditions have to be met regardless of the desired result. Compliance with the TU Delft Human Resources Ethics Code is required. This code includes limits on certain questions. It also prescribes ways to formulate questions on matters such as gender, ethnicity and occupation.

The survey will be taken at the bus stops which means that people could be in a hurry and, if they time their arrival correctly, will only be at the bus stop for a few minutes at most. Because of this time variable, only a few questions can be asked and they all have to be useful in answering the research question. There are no open questions in order to speed up the survey. At the end there is a field where the passengers can write any remarks on the service or survey, however this is optional. The questions that are most important to the study should be asked first. This allows passengers to quit the survey when their bus arrives and still give the most relevant answers.

Sub-question 3, *How do passengers perceive the relocation of the bus stop*, gives a good starting point for some of the questions. The general question *How do you experience the current bus service at this bus stop?* should be asked so that it can be compared to demographic questions. Giving the respondent a set number of choices will speed up the answering process. It also increases the usefulness of the answers in statistical analyses. Reliability does not substantially increase if more than five variables are used [8] therefore the Likert scale will be used [9]. This scale has five answers, Very bad, Bad, Neutral, Good and Very good.

Survey questions answered with a Likert scale are subject to acquiescence bias which occurs when respondents answer positively to all questions. *“Acquiescence is most common when a question is difficult (Gage, Leavitt, & Stone, 1957; Hanley, 1962; Trott & Jackson, 1967) and when respondents have become fatigued by answering many prior questions (e.g., Clancy & Wachsler, 1971)”*, Peter Marsden writes in his 2010 handbook on survey research [10]. Passengers could also be scared of a service change and therefore answer positively to the current service even though the research is done separately from the bus operator. This last influence can partially be taken away by making it clear that the research is done for TU Delft and not by the bus operator, this will be achieved by wearing a branded high-visibility vest when taking the survey and by branding all the surveys with the TU Delft logo. The other acquiescence factors can be addressed by making the questions easy to understand and by limiting the amount of questions.

The second questions builds upon the first question but asks about the satisfaction of the bus stop location rather than the overall service. This is an important question to answer because passengers might be happy with the overall service due to external factors but be unhappy with the location and since the relocation is the main subject of this research this follow-up question is of great interest. This question will also use the Likert scale. The question is worded: *“How satisfied are you with the location of the bus stop?”*

Next the passengers will be asked to give their preference for either the current or the former routing of the bus. First the respondent is asked if they used the bus before the relocation. The question is phrased in such a way that it is not apparent that the respondent is asked about the relocation, this is done to eliminate bias as passengers might be sentimental about the previous service. To accomplish this, only the year of the relocation is given and the question is formulated as: *“Did you use this bus before 20xx”* with 20xx being the year that the relocation had taken place. Respondents can answer with ”Yes”, “No” and “Unsure”. After it has been established if the passenger has used the bus service before the relocation, they are asked which routing they prefer. This is done using two maps of the village on which the two routes are visualised including the stops. The first image is the previous

situation, the second image is the current situation. The respondent is not made aware that these are former and current situations, they are only asked which one they prefer. A concise description of the route is provided as not everyone is able to read maps very well. An example of the descriptions is: “A - Through Stompwijk” and “B - Past Stompwijk over the N206”. The question is worded as: *“Which situation do you prefer?”*

The next four questions are on the travel habits of the passengers. Firstly they are asked *”For what reason do you travel on this bus most often?”* where they have a choice of six answers: Work, School, Leisure, Shopping, Family/Friends, Other. The ”Other” option leaves room for explanation. This question is asked because there could be a correlation between reason of travel and satisfaction of the service. For example, passengers travelling for work and school might appreciate the improvement in travel time more despite the relocation, whereas passengers travelling for leisure or shopping might be more inclined to say they dislike the new service as they have to walk further to the bus stop and do not care so much for the travel time.

Question 6 asks the respondent how often they travel on the bus. To keep the answering fast and minimise the amount of possible answer, only four options are given. These are: 4+ days per week, 1-3 days per week, 1-3 days per month, Almost never.

Questions 7 and 8 combine together to be able to make a catchment area for the bus stop. The relocation of the stop might mean that passengers have to travel further distances than they used to before. To see how far passengers travel now they are asked their primary mode of travel to and from the stop and how long it took them to get there. The options for the mode are: On foot, By bike, By car and Other. The travel time is a set of ten options starting with 2 minutes and going up to 20+ in increments of 2 minutes.

The last two questions are purely demographic. The first asks the respondent their age. To increase the amount of passengers that want to fill in this question, answer is given as an age-range. People are less likely to fill in their precise age, but as the research focuses on demographic groups and age is a great way of designating groups this question is vital to the research. The age ranges are: 0-17, 18-24, 25-34, 35-44, 45-54, 55-64, 65-74, 75-84, 85+ and “I’d rather not say”.

The last question asks the respondent to assign themselves a category according to their current employment/educational situation. The categories are: In school, Student, Working full time, Working part time, Retired, Unable to work/Disabled, Other and I’d rather not say.

Surveys will be handed out to the passengers to fill in themselves, this is why extra attention has gone into making the printed survey as easy to read as possible. For this two graphic design books were used which focus on the use of grids and human attention for text [11][12]. In testing the survey on seven people, the fastest completion time was 45 seconds and the longest was 110 seconds. On average it took 75 seconds.

The full survey including the Dutch translation can be found in Appendix A.

2.2.2. Taking the survey

The survey will be conducted at the bus stops. It is hard to get an estimation of the amount of passengers using the bus without passenger data from the operators. It can be assumed that most passengers travel in the peak periods of 06:30 - 09:00 and 16:00 - 18:30. A time that overlaps one of these periods should get a good amount of responses. In order to also target non-commuters who are travelling for leisure, family or other reasons, surveys should also be conducted outside of these hours. The time of 08:00 - 12:00 is chosen to conduct the surveys with possibilities to extend if not enough responses are gathered. The passengers will be handed the survey to fill in themselves. If asked it can be taken verbally and filled in by the researcher. This can also be done for people who are unable to fill it in themselves.

Since people are primarily there to get on a bus it could happen that someone will not have enough time to fill in the survey before their bus arrives. For this case an online survey with the same questions has been made which can be accessed by scanning a QR code. However it is preferred that passengers fill in the physical survey as scanning a QR code does not guarantee that the person will fill it in.

	Question	Answer options
1	How do you experience the current bus service at this bus stop?	Very bad Bad Neutral Good Very good
2	How satisfied are you with the location of the bus stop?	Very bad Bad Neutral Good Very good
3	Did you use the bus before 20xx?	Yes, No, Unsure
4	Which situation do you prefer?	Current & previous situations illustrated
5	For what reason do you travel on this bus most often?	Work School Leisure Shopping Family/Friends Other
6	How often do you travel on this bus?	4+ days per week 1-3 days per week 1-3 days per month Almost never
7	How did you travel to the bus stop today?	On foot By bike By car Other
8	How long did it take you to get here today?	Scale of 2-20+ in minutes with increments of 2 mins.
9	What is your age?	Age groups as give in table 2.3 I'd rather not say
10	What most accurately describes your current situation?	In school Student Working full time Working part time Retired Unable to work/Disabled Other I'd rather not say

Table 2.2: Questions and answer options that will be included in the survey

2.2.3. Analysing the survey

Due to the way the questions can be answered a simple linear regression analysis can not be performed. Some responses are on the Likert scale which is an ordinal and non-parametric ranking scale often used in surveys. These answers can not be assigned a simple 1-5 for use in statistical models as the ”strongly agree” and ”agree” options can not be assumed to have the same interval as the ”agree” to ”neutral” responses. Because of this other, non-parametric models need to be used.

First and foremost it can be very valuable to just look at the answers quantitatively. If one questions stands out to show that, for example, passengers experience the current service to be much better than the previous service, that already says a lot about the effects of the relocation. Therefore the first analysis that will be performed on the gathered responses will be just a general look at the results.

In order to compare some answers and find trends a Spearman analysis is performed which does give each answer a rank even though it is previously stated that assigning numbers to Likert scale responses is not possible. This is done to see if, for example, a higher age corresponds to a certain experience of the bus stop. The Spearman analysis looks to see if a higher value for one of the variables corresponds to a higher or lower value for another variable. If an increase in Variable 1 always results in an increase in Variable 2 then Spearman's ρ will be 1. Similarly, if Variable 2 decreases when Variable 1 increases, Spearman's ρ will be -1. If there is no correlation between the two variables, Spearman's ρ will be 0.

To perform this correlation analysis, the non-parametric values of the questions need to be converted to parametric, numerical values. In the case of the age this will be done by ranking the age groups in ascending order. The numerical value given to each age group can be seen in table 2.3. The category N/A is left out as we can not assume the age of that respondent.

0-17	18-24	25-34	35-44	45-54	55-64	65-74	75-84	85+
1	2	3	4	5	6	7	8	9

Table 2.3: Numerical values given to survey age groups to perform Spearman correlation

Spearman's ρ can be calculated using equation 2.1 where d_i is the difference between the two variables and n is the total number of observations. A Spearman's ρ under $|0.1|$ is generally considered as statistically insignificant whereas a ρ above $|0.9|$ is generally considered as very strong relevance [13]. In the same study it is mentioned that any correlation between $|0.1|$ and $|0.9|$ is disputable and depends on the research. Table 2.4 shows a possible interpretation of the calculated Spearman's ρ based on the cited study. Due to the low amount of responses that are expected (less than 100), a small amount of passengers giving the same answer perchance has a large influence on the Spearman calculation. Therefore the Spearman's ρ will only be used as a means of comparing and validating the answers given in the survey. Only when the calculation has been performed on the gathered data in subsection 3.1.2 can an interpretation of the Spearman's ρ be made.

$$\rho = 1 - \frac{6 \sum d_i^2}{n(n^2 - 1)} \tag{2.1}$$

Absolute magnitude of the observed correlation coefficient	Interpretation
0.00-0.09	Negligible Correlation
0.10-0.29	Weak Correlation
0.30-0.59	Moderate Correlation
0.60-0.89	Strong Correlation
0.90-1.00	Very Strong Correlation

Table 2.4: Correlation interpretation based on 2018 study [13]

3

Results

3.1. Survey results

Conducting the three surveys went well albeit with a disappointing number of passengers at Schipluiden. Most passengers were willing to fill in the survey. The short amount of time needed to fill in the survey meant that all but three passengers were able to fill it in before their bus arrived. Most passengers took around one minute to fill in the survey. No passengers filled in the QR-survey. Five passengers needed help filling in the survey due to difficulty reading or writing, those surveys were taken verbally and also included some conversation which turned out to be very valuable for the research. Three passengers declined to fill in the survey. Since the researcher was alone, only one direction could be surveyed at a time. The busiest direction was chosen which was based upon observations when arriving. The time that the survey was conducted at each stop was 08:00 to 12:00 which included the morning peak hours.

Zoeterwoude and Stompwijk had enough ridership to be statistically relevant on their own, Schipluiden did not. All the results will be analysed simultaneously so that a statistically relevant conclusion is possible. Nuance per stop will be given as there are some differences apparent from the results.

3.1.1. General observations and demographics

Each stop had a clear direction in which most passengers travelled during the observation time. During the taking of the survey the number of (de)boardings were noted, these numbers can be seen in table 3.1. Zoeterwoude was clearly the busiest stop observed, this is logical as it is one of the larger villages and located closely to Leiden with good bus frequencies. Schipluiden had significantly lower ridership. This can most likely be attributed to the poorer service with 30 minute frequencies all day compared to 5-10 minute frequencies at the other two stops. Zoeterwoude had quite some peak hour de-boardings, mainly employees of the nearby mental health facility.

Direction	Boardings	Deboardings	Surveys filled in
Stompwijk to Zoetermeer	26	2	18
Stompwijk to Leiden	20	3	2
Zoeterwoude to Zoetermeer	19	10	1
Zoeterwoude to Leiden	42	3	25
Schipluiden to Delft	13	0	9
Schipluiden to Maassluis	6	0	0
Total	126	18	55

Table 3.1: Observed passenger numbers during survey taking

Table 3.1 shows the ages of the respondents which varied only a little per stop with a very clear higher ridership amongst younger people. With 30 total passengers the 18-24 age category was the most populated. These were mostly students travelling to their education. No passengers older than 85

travelled, since only 2.4% of the Dutch population is older than 85 [14] it is not statistically significant that no one older than 85 travelled and as such no conclusions can be drawn from it. One person declined to give their age, this respondent will not be included in correlation analyses where age is one of the variables.

When looking at the distribution of public transportation passengers in The Netherlands (Table 3.2) it can be seen that the studied bus stops have a much lower usage by people aged 30-65 than the national average. Note that the age categories for this data are different than those in the survey. 55% of passengers travelling at the studied bus stops were between the ages of 18-24 compared to 29% on the national average. A reason for this could be the timing of the survey which was taken during the morning peak. Passengers who use the bus in the afternoon were missed and those could have been passengers who fit the other age groups more.

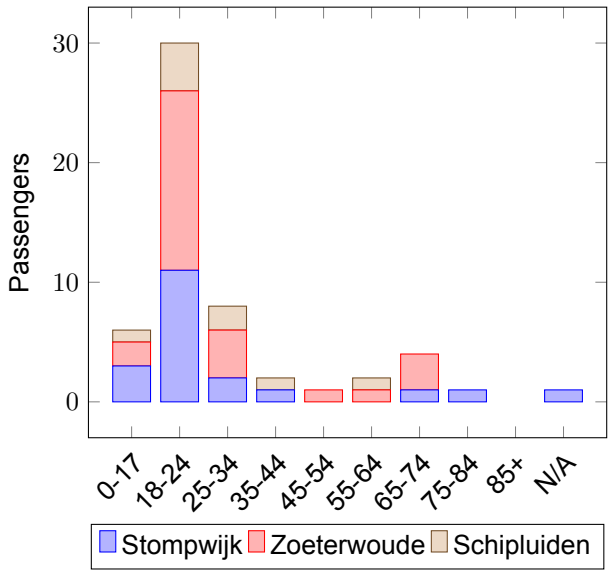


Figure 3.1: Observed passenger numbers per age category for all three stops

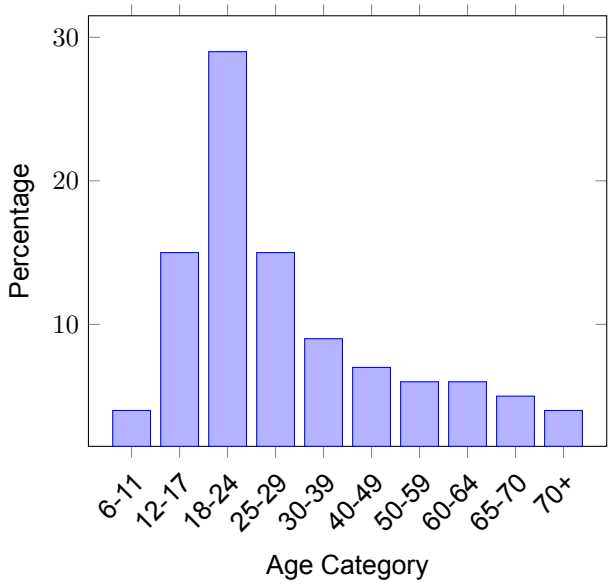
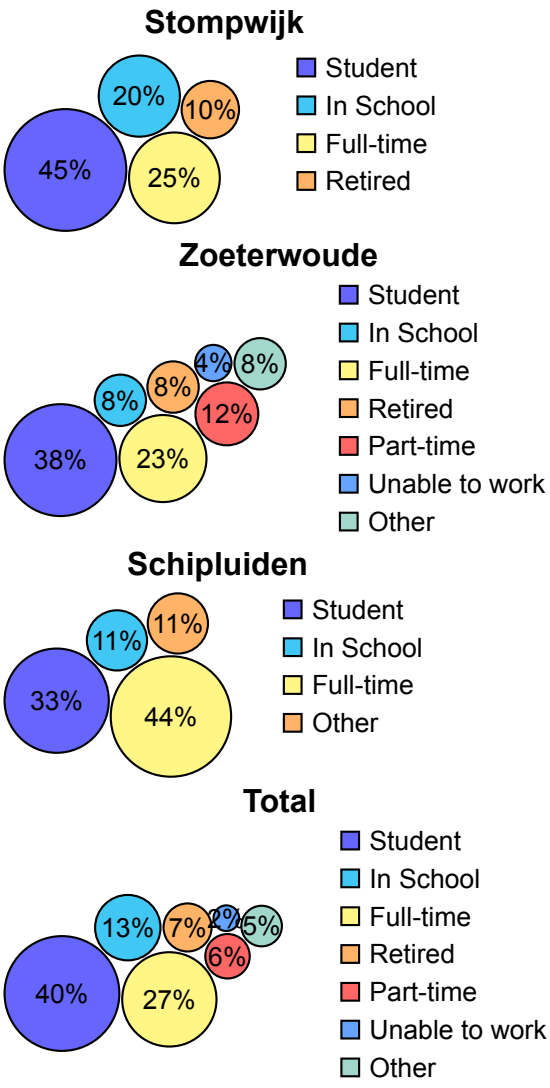


Figure 3.2: Distribution of passengers ages in public transportation in The Netherlands [15]



A majority of passengers were using the bus to get to their education, 53% total. Another 33% were on their way to work and the remaining 14% were either retired, unable to work or other. This result is not surprising seeing as the majority of passengers were travelling during the peak and were of a relatively young age. Zoeterwoude had a significantly higher percentage of passengers that were going to work, especially when looking at the passengers who were alighting at this stop. Zoeterwoude is home to a large mental health facility with over 340 patients [16]. This facility has 24/7 staffing and is situated a twelve minute walk away from the bus stop. None of the villages has a secondary school which is why 13% of passengers are in school. In this case ”In School” means elementary or secondary school, ”Student” means tertiary education. This is not a clear distinction in the English language but in Dutch the two words are clearly different and therefore this separation of Student and In School can be made. Schipluiden has too few respondents to draw conclusions on its own, however they are added to the total. The ”other” group consists mainly of passengers who did not know to which group they belong, this includes people who had a gap-year and people who felt they belonged to multiple groups at once.

Although people indicate what situation they are in employment and education-wise, that does not mean that that is their main reason for travel. In the survey the question ”With what reason do you travel with this bus service most often?” was asked. The results to this question can be seen in figure 3.3.

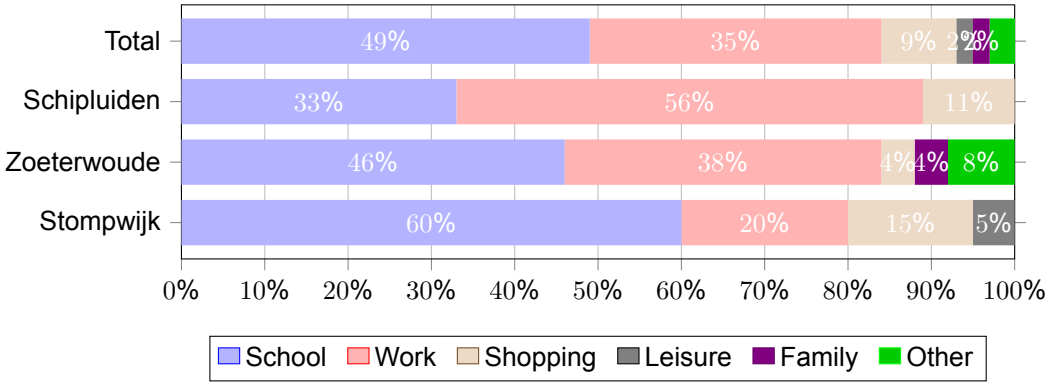


Figure 3.3: Answers to question 5: ”With what reason do you travel with this bus service most often?”

3.1.2. Perception of current service

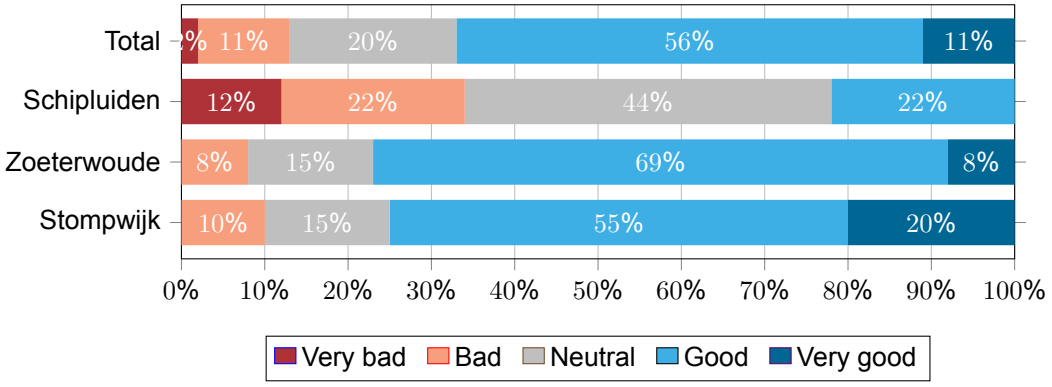


Figure 3.4: Answers to question 1: "How do you experience the current bus service at this bus stop?"

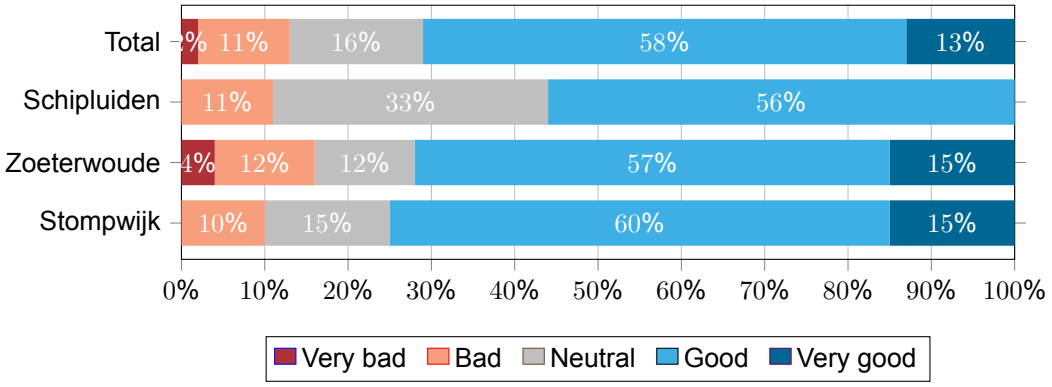


Figure 3.5: Answers to question 2: "How satisfied are you with the location of the bus stop?"

Looking at the overall answers to questions 1 (*"How do you experience the current service at this bus stop?"*) and question 2 (*"How satisfied are you with the location of the bus stop?"*) in figure 3.4 and 3.5 shows an overall satisfaction with the current service for Zoeterwoude and Stompwijk. Both the current bus service as well as the location of the bus stop have a 75% approval rating with only 10% rating it as *Bad* and none as *Very bad*. A reason for this could be the demographic that was surveyed as most passengers were using the bus for their day-to-day commute for whom frequency and reliability are the highest priority [17]. Schipluiden paints a different picture. Here an overall neutral and unsatisfactory sentiment resided with the surveyed passengers. Note that only nine passengers filled in the survey here so no conclusions can be taken from the answers to the survey alone. One can however compare the service at the three bus stops and see a clear difference in the service provided at Stompwijk and Zoeterwoude versus Schipluiden. The 30-minute frequency in Schipluiden has to be a factor in its low ridership. Passengers can not just "turn up and go" as in the other two locations, they have to plan their journey in advance so they do not run the risk of having to wait half an hour. When comparing the answers to Q1 and Q2 for Schipluiden it is also clear that the location of the stop is not the main problem for the surveyed passengers, it is the overall service.

To understand the correlation between variables a Spearman correlation can be performed. The correlation method has been explained in chapter 2. In order to perform the correlation, the software SPSS was used. The most important correlation will be the one between the age and the answers to questions 1 and 2 which are both on the experience of the passenger with regards to the service and location of the bus stop respectively. The answers to these questions were given on a Likert scale and need to be ranked in order to perform the correlation. *Very bad* is ranked as 1 and *Very good* is ranked as 5. This is also the case for the ages which have been ranked in table 2.3.

Performing the correlation in SPSS yields the following table 3.2. The important correlation values are highlighted in blue. These values represent the correlation between the Age and the answers to Q1 and Q2. As can be seen, the correlation between the age and the answer to question 1 is very weak.

This can be backed up by looking at the distribution of answers in figure 3.6 which shows that younger people are just about as likely to consider the service to be good or poor as older people. The low amount of passengers already contributes to this as there were only five passengers older than 65 who participated in the survey. From this the conclusion can be drawn that there is no correlation between the age and the perception of the service at the bus stops.

		Age	Q1	Q2
Age	Correlation Coefficient	1.000	.008	-.192
	Sig. (2-tailed)	.	.956	.160
	N	55	55	55
Q1	Correlation Coefficient	.008	1.000	.502
	Sig. (2-tailed)	.956	.	<.001
	N	55	55	55
Q2	Correlation Coefficient	-.192	.502	1.000
	Sig. (2-tailed)	.160	<.001	.
	N	55	55	55

Table 3.2: SPSS output when performing Spearman correlation between the Age and answers to questions 1 and 2

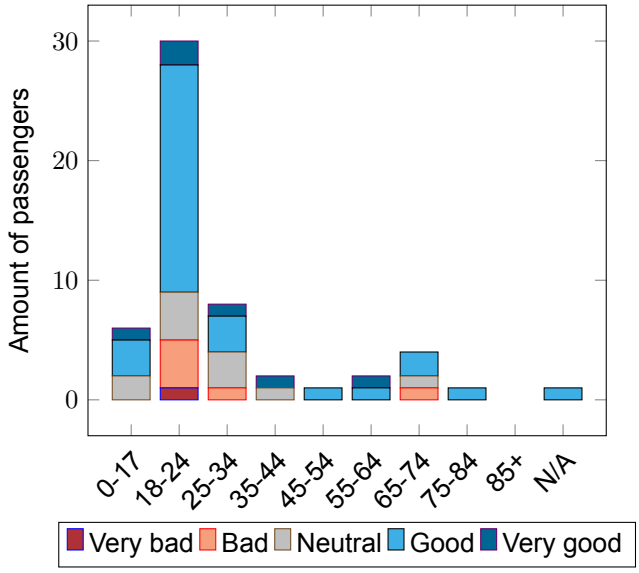


Figure 3.6: Answers to question 1 grouped by age

The correlation between the age and the answers to question 2 is higher at -0.192. According to the interpretations by coefficient set in table 2.4 this should be seen as weak correlation. It was mentioned in the same section (2.2.3) that due to the low amount of responses the correlation coefficient can not be taken at face value as a small amount of passengers have a large influence on the outcome. The relatively low correlation can however still be seen as proof that, in this research, a higher age did not automatically mean a larger dissatisfaction in the location of the bus stop. This low correlation however is not due to older passengers answering “Bad” and “Very bad” to the question, it is because a few younger passengers also found the location of the bus stop to be poor. This can be seen in figure 3.7 which shows little difference from figure 3.6 except that younger passengers are more likely to rate the location as good and older passengers are more likely to rate it as bad. This is why the correlation coefficient of Age-Q1 is so much lower than Age-Q2. However, due to the fact that 2 passengers age 18-24 answered “Bad” and quite some passengers under 45 answered “Neutral”, the correlation coefficient is not very high. Looking at the raw data is quite telling. It shows a general dissatisfaction for the location of the bus stop with the elderly passengers. No passenger aged 65 or older rated the location as good or even neutral which shows that the location of the bus stop is a barrier to using the bus service for elderly passengers.

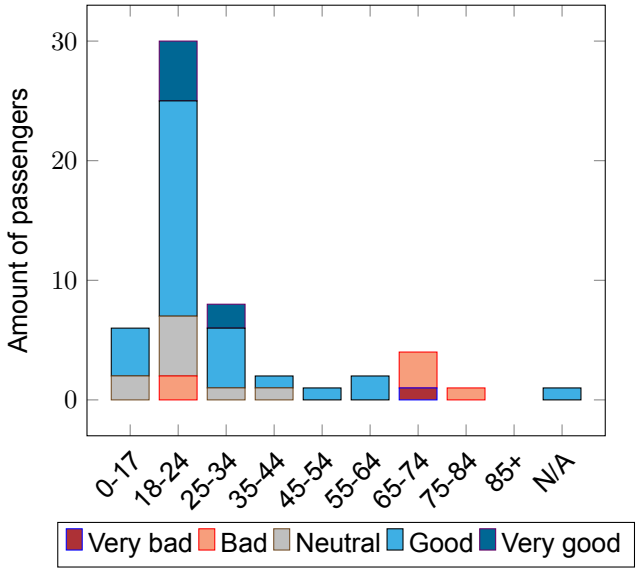


Figure 3.7: Answers to question 2 grouped by age

3.1.3. First and Last mile

Three different modes were used by passengers to get to the bus stops. Table 3.3 shows the distribution of modes used. Stompwijk has a significantly larger amount of passengers travelling to the bus stop on foot than Zoeterwoude. This is most likely due to the size of the villages as the furthest away you have to walk in Stompwijk to get to the bus stop is around 10 minutes whereas in Zoeterwoude it could be as much as 20 minutes.

Passengers also filled in the amount of minutes it took them to get to the bus stop. Combining the modes and the time can give us a catchment area of the different bus stops. These walksheds and bikesheds can be seen in figures 3.8, 3.9 and 3.10. The light blue shaded area represents the distanced travelled on foot by the bottom 50% of foot passengers, the dark blue represents the top 50%. The same goes for the shades of pink which represent passengers who arrived on a bicycle.

The maps show that most people who live inside of the village walked to the bus stop and only people that lived in the outer edges of the village and out in the countryside commuted by bike. This can clearly be seen by looking at the overlap of the pink and the blue shaded areas which is minimal in Schipluiden and Zoeterwoude and non-existent in Stompwijk.

Passengers older than 65 arrived on foot and by bike about evenly which is an indication of the good bicycle infrastructure in The Netherlands. Younger passengers tend to arrive on foot more than by bike and they also walked longer distances. As time went on more people arrived by bike and less on foot. The times travelled by the passengers also decreased although the distance did not since the mode of travel meant a higher travel speed.

It needs to be noted that humans are inherently bad at estimating time and thus the times given by the respondents needs to be taken with some error in mind.

Stop	On foot	By bike	By car
Schipluiden	67%	33%	0%
Stompwijk	74%	26%	0%
Zoeterwoude	56%	40%	4%
Total	64%	34%	2%

Table 3.3: Transportation modes used by passengers to get to the bus stops

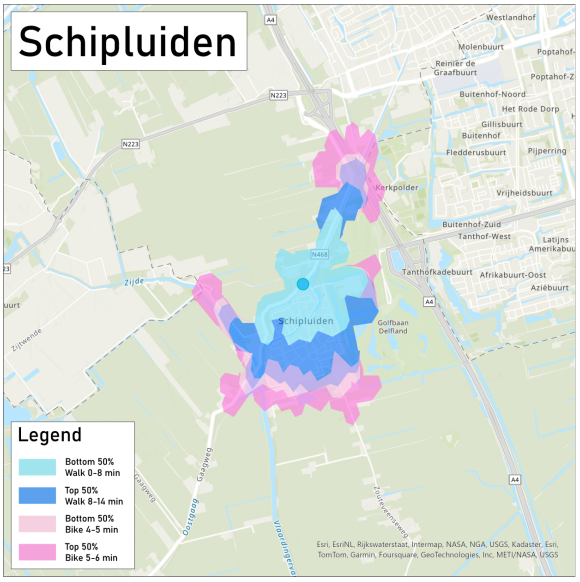


Figure 3.8: Walk/bikeshed of passengers in Schipluiden

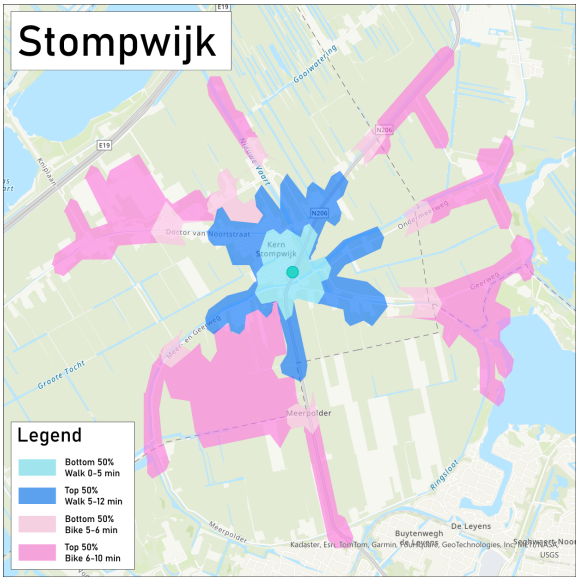


Figure 3.9: Walk/bikeshed of passengers in Stompwijk

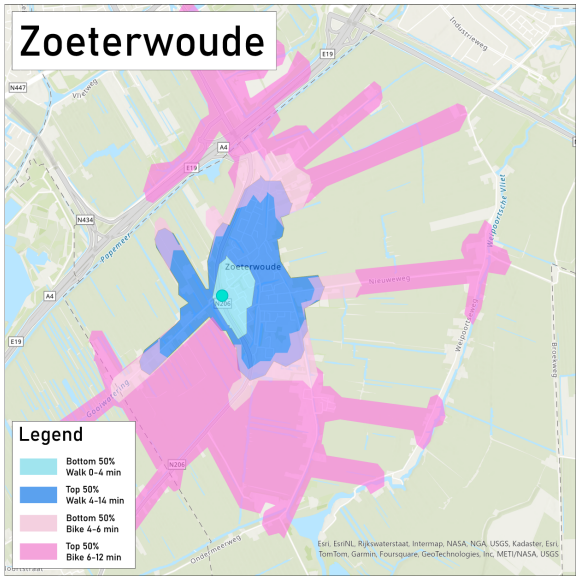


Figure 3.10: Walk/bikeshed of passengers in Zoeterwoude

3.2. Observations at the bus stops

3.2.1. Stompwijk

The bus stop in Stompwijk is located on a busy provincial road connecting the cities of Zoetermeer and Leiden. The bus stop has a modern feel and has all the amenities a rural bus stop needs. There is a shelter with a bench and a map. Live departure times are displayed on a large LED sign that includes a button which activates a speaker that reads the live departure times out loud. There is another bench outside the shelter with a garbage bin. The entire stop has tactile paving for the visually impaired. Both sides are identical except that the stop towards Leiden has a little glass wall in the shelter which is positioned to block the noise from the cars, no reason was found as to why this noise barrier was not included on the southbound stop. There was space for around 40 bicycles in a roofed parking structure. At the peak there were 33 bicycles parked.

As the stop is on a busy road, vehicular noises are always present. They are especially noticeable during the peak hours. It felt unpleasant to be at the stop for longer than five minutes due to this noise.

Figure 3.11: Stompwijk Northbound bus stop. Own work

There is no security at the stop. No CCTV cameras but more importantly, no social security from neighbours. This could scare people away from using the stop at night as only people in the passing cars can see what is happening at the stop. This sentiment did not come up with any of the passengers at this stop but some did mention it at the other two stops.

3.2.2. Zoeterwoude

The bus stop at Zoeterwoude was very similar to Stompwijk. The same infrastructure was present as was the busy road. The only difference was the physical separation between the vehicle lane and the bus stop in the form of a curb and the sound barrier which separated the road from the neighbourhood behind it. This sound barrier, although made out of glass, made it feel like you were on an island surrounded by car infrastructure with the noise generated by the passing traffic being reflected off the wall and into the ears of the waiting passengers. This was not the case for the southbound lane.

Figure 3.12: Zoeterwoude Southbound bus stop. Own work

Connecting the two travel directions was an underpass adjacent to a small road and a canal. To use this underpass, passengers either had to use steep metal stairs or walk 250 metres to use the incline of the road. The sidewalk on this inclined part of the road was not wide enough for strollers or mobility scooters so those passengers would need to be using the narrow road. Both sides had this configuration so passengers with reduced mobility had to choose between steep and possibly slippery metal stairs or a 500 metre detour using a road which sees limited but non-negligible amounts of traffic including large farmland machinery. This was a large barrier to use the bus service as noted by several passengers in section 3.3. Most passengers arrived on foot but the bicycle storage facility next to the stop was well used although this could also be by residents not using the bus stop.

3.2.3. Schipluiden

Figure 3.13: Schipluiden Southbound bus stop. Own work

The surveyed bus stop in Schipluiden was of poor quality. There was a shelter with a bench, lighting and a garbage bin on both travel directions. The curb was raised as to facilitate level boarding by means of a ramp installed on the bus. The stop did not have a modern feel and did not include any realtime departure displays. It included a map with a timetable but only on the Delft-bound direction. There was space for bicycles with two bicycles parked at the time of surveying.

To reach the stop on the opposite side of the road one has to cross the busy road on a non-priority pedestrian intersection with a wide refuge island. The stop did not feel pleasant to wait at due to the high traffic volumes and numerous large industrial and agricultural vehicles moving at high speed past the waiting passengers. A constant heavy wind was present due to the stop being situated next to a wide open field without any barriers to stop it.

3.3. Talking to passengers

The general sentiment of the passengers was positive. Most passengers were on their way to work or school and enjoyed the frequency of the service. As the day went on more people arrived who were using the bus to do errands, go shopping or visit family. These passengers enjoyed the comfort of the service but did have some remarks on the location of the bus stop.

In this section some of the remarks made by passengers are highlighted. As these were said by single passengers no strong conclusions can be drawn from them as no research was done to see if this was the sentiment amongst other passengers. However some of the remarks can help understand some of the other results by giving them underlying reasoning.

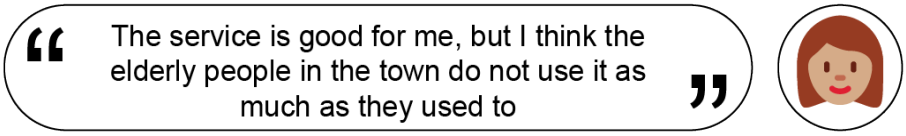


Figure 3.14: Quote of younger woman travelling to work in Stompwijk

A younger passenger on her way to work was very satisfied with the service herself, but she noticed that less elderly town people used the bus as before. She thought this was due to the longer walking distance.

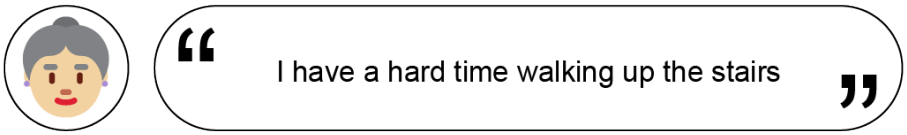


Figure 3.15: Quote of two elderly women in Stompwijk and Zoeterwoude

Two elderly passengers remarked that the main problem they had with the new location was the steps they had to walk up. There are seventeen steps up to the southbound platform in Stompwijk. There is an inclined path that runs alongside the bicycle path, however it is not signed well. The northbound platform has full ramp access. The inclusion of stairs combined with the longer walk could pose a barrier to accessibility of the bus stop for elderly and less mobile passengers.

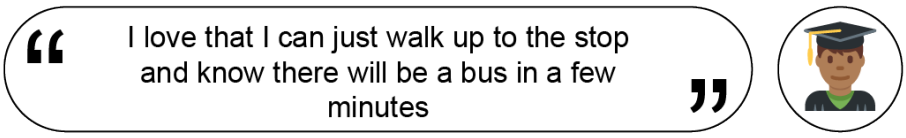


Figure 3.16: Quote of male student travelling to his school

This passenger was very happy with the frequency at the bus stop. They brought up the previous service which lacked frequency and meant that the passenger had to check the timetable before leaving to make sure they would not have to wait 30 minutes for the next bus. The maximum waiting time on week days is now ten minutes and six minutes during peak hours.

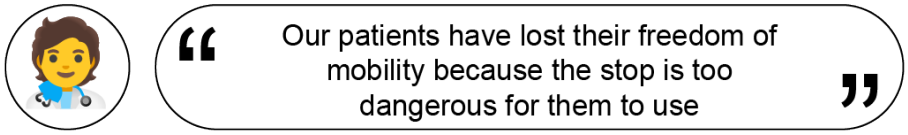


Figure 3.17: Quote of nurse at a mental health facility in Zoeterwoude

After having been notified by a passenger at the bus stop in Zoeterwoude that there is a mental health facility nearby and that the relocation has had a large impact on the patients, a conversation was had with one of the nurses at that facility. She confirmed that the patients had lost their freedom of mobility due to the relocation as the new bus stop is now situated on a busy road which is too dangerous for them to be waiting at. When the bus was still running through the village, around 80 of the 350 patients were allowed to make use of the bus by themselves, none of them have that freedom now.

4

Discussion

4.1. Summary of results and implications

The primary objective of this study was to find out if relocating a bus stop in a Dutch village has different effects on different demographic groups. A brief summary of the findings is as follows. The passengers surveyed at the bus stops have a different age distribution than the national average with a much higher percentage of passengers being between the ages of 18-24 and much fewer passengers between the ages of 25-65. A large majority of the passengers were travelling for work or education, and only a few for reasons such as visiting family, shopping or leisure. Correlating the ages of the passengers to their responses to questions 1 and 2, which were about their opinions on the service at and the location of the bus stop respectively, showed no correlation between age and the opinion on the service and a moderate correlation between age and opinion on the location. The correlation was negative which indicates that, as the passenger gets older they tend to have an increasingly negative opinion on the location of the bus stop. Drawing the walk and bikesheds of the passengers shows that the catchment area of the bus stop encompasses the entire village and most passengers if not all passengers who were cycling came from outside of the village boundaries which means that all passengers travelling to the bus stop from the village found the stop to be within walking distance.

Talking to passengers yielded insights into the background of the research. Elderly passengers remarked that the new stop is hard for them to reach due to the long distance between their destination and the bus stop in combination with the stairs they have to climb. Two women were unhappy with the social safety around the stops and said they felt unsafe during the dark hours, which can start as early as 16:30 in The Netherlands. A conversation with one passenger led to another conversation with a nurse at the local mental health facility who said that her patients were no longer allowed to use the bus due to safety concerns at the new stop. Passengers travelling to and from work during the peak were happy with the new service, especially the increased frequency and travel time was of great importance to them.

The implications of these results are aspects that bus operators and local governments can take into account when planning a service change of similar proportions. Having a new bus stop located next to a busy road speeds up the service but has severe negative effects on elderly passengers as they have to safely cross the road using stairs, it has negative effects on patients at mental health facilities and it affects women disproportionately as they can feel less safe in the new environment due to the lack of social safety. This could be counteracted by running a parallel service which could be a flexible transportation mode such as a dial-a-ride bus or a demand responsive bus service which requires a 30 minute notice before travelling. Passengers who use the bus daily to get to work would not use this service but that is not a large problem as they tend to be in favour of the service change regardless.

4.2. Limitations

The chosen method of research has its limitations. Taking a survey at the bus stop limits the respondents to only be passengers of the bus. Seeing as the research question includes all demographic

groups and the effects the relocation has om them, this is not a completely representative group of people to base the conclusion on. Therefore the question *"Who do you leave behind?"* has to be asked, a question to which this research does not have a conclusive answer. If more time had been given to this research this could have been studied but due to the limited eight weeks in which the research had to be done this was not a possibility.

Surveys also present other problems such as acquiescence bias which is when respondents tend to answer in a positive manner regardless of the question. This stems from the human tendency to agree more than disagree with statements in order to please others. A lack of information about the subject can also lead to respondents agreeing with the statement [18]. In this study an attempt to mitigate the effects of acquiescence was made by making the questions as simple as possible and by keeping the survey short. It was not taken into account during the analysis phase. This could be done in future research if the sample size is larger.

Whilst looking at the external factors some were left out as the scope was simply not large enough to include them. Cost is one of the factors that was not discussed and could possibly have implications for the conclusion. Another is the bus network as a whole which might have undergone large changes simultaneously which could have had an impact on the perception of service by the passengers. These are valuable aspects to be taken into account in future research.

5

Conclusion

The results that stem from the survey answers and the conversations with the passengers are sufficient to answer the main research question *"What are the different effects on demographic groups when relocating a bus stop from the centre to the periphery of a Dutch village"*.

The bus is used mainly by passengers travelling to and from work or school. In this group the age is low with a majority of passengers (55%) being under the age of 25. This is lower than the country average of 30%. The age groups between 35 and 64 were almost non-existent even though in the national average this group accounts for around 18% of the total public transportation users. The number of passengers above the age of 65 was higher than average which could be due to the demographic makeup of the area.

Most passengers see the relocation of the bus stop as being positive although it varies per bus stop. Zoeterwoude has less people who are positive about the change which can partially be attributed to the larger size of the village which means that more passengers have to travel a further distance to the new location. Passengers in Schipluiden were overall unsatisfied which was mainly due to the poor service provided at the bus stop.

All but 2% of the passengers travelled to the bus stop using active modes of transportation. Passengers within the confines of the village tended to travel by foot, passengers on the outskirts and just outside the village tended to travel by bike. Most passengers took 6 minutes to get to the bus stop which was both the median and the average travel time. It shows that the passengers who use the bus have adapted to the change well and it has not led to the use of cars to get to the bus stop.

In Schipluiden it was very evident that changing the routing can have a negative effect on the ridership if the corresponding bus service is not improved in other ways. In both Stompwijk and Zoeterwoude the increase in service and comfort meant that people still wanted to use the bus as it decreased the overall door-to-door travel time because passenger had to wait less and the buses ran quicker end-to-end. This was not the case in Schipluiden where service did not increase and therefore it saw a much lower ridership than Stompwijk and Zoeterwoude even though it had a higher population than both villages.

Besides the service improvements influencing the ridership and passenger experience, certain physical aspects around the bus stop also resulted in negative reactions from the passengers. Three main factors were identified. Firstly the accessibility of the stop decreased due to the inclusion of stairs or lengthy detours to use ramps. This is a barrier to use the stop for passengers with reduced mobility such as elderly and disabled passengers. Secondly is the social safety around the stop which was lower after the relocation because the new stop was now located outside of the area where people live. This leads to passengers feeling alone at the stop which affects female passengers more than male passengers especially at night. The last effect is the increased noise pollution from the passing cars as the new location of the bus stop has changed to being on the side of a busy road. This leads to a decreased passenger experience.

The overall conclusion to the research question *"What are the different effects on demographic groups when relocating a bus stop from the centre to the periphery of a Dutch village?"* is that the relocation has a net positive effect on younger, able-bodied passengers travelling for education or work if it is coupled with an increase in frequencies and a decrease in overall travel time. The relocation itself is seen as a negative aspect for older passengers due to the longer distance they have to traverse to get to the stop, however if the bus service is improved in combination with the relocation those older passengers have an overall positive opinion on the service provided. The demographic group of passengers between 35 and 65 was underrepresented in the study which can not be explained in this study. The relocation can have negative effects on residents of the villages that are no longer patrons of the bus service as the relocation has made the barrier to use the bus too large. Only two instances of this were found since the initial scope of the study did not involve this demographic group.

5.1. Future research

Future research should look more into who is not using the bus stop anymore since the relocation. As noted in the discussion, this research only focused on the passengers who were present at the bus stop and therefore were not deterred from using the bus due to the relocation. A starting point for this would be talking to locals in the villages at village centres, elder homes, schools and commercial areas. The conversations that were had for this research were some of the most valuable data points as they pointed to possible missed passengers who were difficult to reach due to the chosen research method. Another way of reaching those who are no longer using the bus is by conducting an exhaustive survey of the entire village population. This would give the most accurate and significant data but would require a lot of resources.

Ridership data was another data point that would have been extremely useful to analyse for this research but was not feasible due to the time allotted to the research. Working together with the bus operators could provide valuable data which could help understand and substantiate the data gathered from the surveys. Using population data from the municipalities and other governmental organisations and comparing it to the ridership levels could show an increase, decrease or stability of the ridership after the relocation.

If another survey will be conducted at similar bus stops, a larger time frame should be chosen which includes the afternoon as well as the morning. The time frame chosen for this research targeted mainly work and educational passengers and did not focus on the occasional traveller who often takes the bus in the afternoon to go shopping or visit friends.

In order give more substance to the external factors a ranking systems should be formulated which gives higher points to bus stops that have better service, higher comfort and faster travel times. One could give a point to every stop with a shelter, a departure display or a bench and deduct points for noise pollution, bad frequencies and poor reliability. This could give a scorecard to every stop which could be correlated to the opinions of the travellers and the ridership.

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A

Appendix A - Survey

The next two pages include the survey as taken for the village of Stompwijk. All surveys are the same bar the fourth question which is different for all research areas. Situation A is always the previous situation which runs through the centre. Situation B is always the current situation which runs along the village.

The surveys are own work and have been created using Adobe Illustrator. The TU Delft logo is copyright of the Delft University of Technology.

Onderzoeksenquête

TU Delft Delft University of Technology

Deze enquête wordt afgenomen voor een bachelorscriptie onderzoek aan de Technische Universiteit Delft. Met de gegevens wordt zorgvuldig omgegaan. Alle antwoorden zullen, na afronding van het onderzoek, vernietigd worden.

Hoe ervaart u de huidige busdienst vanaf deze halte?

☐ Zeer slecht ☐ Slecht ☐ Neutraal ☐ Goed ☐ Zeer goed

Hoe ervaart u de locatie van de bushalte?

☐ Zeer slecht ☐ Slecht ☐ Neutraal ☐ Goed ☐ Zeer goed

Maakte u gebruik van deze bus voor 2014?

☐ Ja ☐ Nee ☐ Weet ik niet

Welke situatie heeft uw voorkeur?

A Door Stompwijk

B Langs Stompwijk over de N206

☐ A ☐ B

Met welke reden reist u het vaakst met deze bus?

☐ Werk ☐ Winkelen
☐ School ☐ Familie / vrienden
☐ Plezier ☐ Anders: _____

Hoe vaak reist u met deze bus?

☐ 4+ dagen per week ☐ 1-3 dagen per maand
☐ 1-3 dagen per week ☐ Bijna nooit

Hoe bent u vandaag naar de halte gekomen?

☐ Lopend ☐ Fietsend
☐ Met de auto ☐ Anders: _____

Hoe lang was u onderweg naar de halte? (in minuten)

☐ 2 ☐ 4 ☐ 5 ☐ 6 ☐ 10 ☐ 12 ☐ 14 ☐ 16 ☐ 18 ☐ 20+

Wat is uw leeftijd?

☐ 0-17 ☐ 55-64
☐ 18-24 ☐ 65-74
☐ 25-34 ☐ 75-84
☐ 35-44 ☐ 85+
☐ 45-54 ☐ Zeg ik liever niet

Welke van de volgende categorieën omschrijft het beste uw situatie?

☐ Scholier ☐ Met pensioen
☐ Student ☐ Arbeidsongeschikt
☐ Werkend (fulltime) ☐ Anders: _____
☐ Werkend (parttime) ☐ Zeg ik liever niet

Als u nog iets kwijt wilt over uw ervaring of over de enquête dan kunt u dit hier schrijven

Research survey

TU Delft Delft University of Technology

This survey is conducted for an undergraduate thesis research at Delft University of Technology. The data will be handled with care. All answers will be disposed of after completion of the research.

How do you experience the current bus service at this bus stop?

☐ Very bad ☐ Bad ☐ Neutral ☐ Good ☐ Very good

How satisfied are you with the location of the bus stop?

☐ Very bad ☐ Bad ☐ Neutral ☐ Good ☐ Very good

Did you use this bus before 2014?

☐ Yes ☐ No ☐ Unsure

Which situation do you prefer?

A Through Stompwijk

B Past Stompwijk over the N206

☐ A ☐ B

For what reason do you travel on this bus most often?

☐ Work ☐ Shopping
☐ School ☐ Family / Friends
☐ Leisure ☐ Other: _____

How often do you travel on this bus?

☐ 4+ days per week ☐ 1-3 days per month
☐ 1-3 days per week ☐ Almost never

How did you travel to the bus stop today?

☐ On foot ☐ By bike
☐ By car ☐ Other: _____

How long did it take you to get here today? (in minutes)

☐ 2 ☐ 4 ☐ 5 ☐ 6 ☐ 10 ☐ 12 ☐ 14 ☐ 16 ☐ 18 ☐ 20+

What is your age?

☐ 0-17 ☐ 55-64
☐ 18-24 ☐ 65-74
☐ 25-34 ☐ 75-84
☐ 35-44 ☐ 85+
☐ 45-54 ☐ I'd rather not say

Which category most accurately describes your current situation?

☐ In school ☐ Retired
☐ Student ☐ Unable to work / disabled
☐ Working fulltime ☐ Other: _____
☐ Working parttime ☐ I'd rather not say

If you would like to say anything else about your experience or about the survey please write here

B

Appendix B

This is the bus diagram for the region around The Hague, Rotterdam, Zoetermeer and Delft from 2009. It includes all three locations and shows the previous routings of the bus. In Stompwijk and Zoeterwoude this previous route is coloured purple, in Schipluiden it is blue. The new route through Stompwijk and Zoeterwoude is also present and is depicted in green.

Lijnennetkaart 2009

Geldig vanaf 14 december 2008

Haaglanden

20

Detailkaarten

- Den Haag + HTM buslijnen

Wij helpen u graag verder

Reisadvies

- Persoonlijk reisadvies van deur tot deur.
- Per bus, tram, metro en trein in heel Nederland.
- Via connexxion.nl of 0900 9292 (€ 0,70 p/min.).

Mijn Connexxion

- Altijd de meest actuele informatie van uw buslijnen bij de hand.
- Maak gratis uw eigen persoonlijke busboekje op maat met alle lijnen die u nodig heeft.
- Gratis e-mailservice met berichten over wijzigingen, omleidingen en stremmingen in de dienstregeling van uw buslijnen.
- Meld u aan via Mijn Connexxion op connexxion.nl.

Klantenservice

- Vragen, klachten of suggesties?
- Iets in de bus laten liggen?
- Ga naar connexxion.nl/klantenservice.
- Of u belt 0900 - 266 63 99 (lokaal tarief), maandag t/m vrijdag 8:00-19:00 uur.
- Schrijven kan ook: Antwoordnummer 1860, 2000 WC Haarlem.

Alles voor de reiziger. connexxion

Wijzigingen en typefouten voorbehouden.
Aan deze informatie kunt u geen rechten ontlenen.

Legenda

- reguliere lijn (met halte uit dienstregeling,lijnnr. en éénrichtingspijl)
- RandstadRail
- Interliner (met lijnnummer)
- buurtbus
- Streekvervoerlijnen Sneldienst
- bundel van meer dan drie lijnen (met halte en éénrichtingspijl)
- Overstaphalte voor aansluitende bussen
- eindhalte
- spoorlijn met station(snaam)
- metrolijn RET met halte
- Tram- of buslijn Stadsvervoer
- veerpont
- zone met zonenummer
- kerk, kasteel, molen, watertoren
- ziekenhuis, politiebureau, VVV-kantoor, camping
- bebouwing, binnenstad, toekomst. beb., bijz. gebouw
- industrie, sportpark, begraafplaats
- bos / park, groot watervlak, kanaal

halte knooppunten

Den Haag

Centraal Station

(begin/eind-)halte voor de volgende lijnen:

2 6 9 10 15 16 17 18 22 23 30 39 42 43 45 53 88 89 90 91 95 380 381 382 383 491

RandstadRail: 3 4 E

Leiden

Centraal Station

(begin/eind-)halte voor de volgende lijnen:

36 37 38 40 43 50 51 54 55 56 57 65 169 182 186 187 206 249 232 256

doorgaande lijnen

11 12 13 28 32 39 45 48

halte knooppunten

Zoetermeer

Centrum West

(begin/eind-)halte voor de volgende lijnen:

32 50 54 70 71 72 74 77 121 165 170 173 177 204 206

RandstadRail: 3 4

Delft

Station NS

(begin/eind-)halte voor de volgende lijnen:

1 37 38 40 60 62 69 80 81 82 121 128 130

halte knooppunten

Schiedam

Centrum

(begin/eind-)halte voor de volgende lijnen:

21 23 bind augustus 2008 38 42 51 52 53 54 55 86 137

Naaldwijk

Verdilaan

(begin/eind-)halte voor de volgende lijnen:

30 31 34 86 128

Deze kaart is een uitgave van Connexxion. De kaart is met de meeste zorg samengesteld. Aan deze kaart kunnen geen rechten worden ontleend.

halte knooppunten

Rijswijk

Station NS

(begin/eind-)halte voor de volgende lijnen:

17 18 23 30 33 50 52 130

Rotterdam

Centrum NS

(begin/eind-)halte voor de volgende lijnen:

4 7 8 20 21 23 25 33 38 44 48 49 86 170 171 173 204

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