Train travellers as station manager?

Trade-offs in the distribution of space for access & egress facilities - A case study at station Nijmegen

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by

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TU Delft

Preface

Writing this thesis is the final step in graduating from the Transport, Infrastructure and Logistics master's program, which brings my student life to an end. For my thesis, I wanted to do research that focuses on the human aspect within mobility. I am convinced that when we make policies and plans for the mobility of people, the human is the most important element.

I would like to thank NS Stations for their enthusiasm, collaboration and attitude towards my specific ideas for my thesis topic. Getting from a self-conceived topic to a solid final thesis was a challenge. I would like to thank Danique for her support in shaping my research and the very pleasant weekly meetings. Also for the moral and process-related support that was very much needed at some points. Jeroen, thanks for facilitating the necessities for the research and the internship. I would like to thank my supervisors at TU Delft, Niel and Jan Anne, for their enthusiasm and trust in my specific ideas for the topic and methods in my research. Their supervision and support during the challenging graduation process was very helpful. I would like to thank Niek for fulfilling the role of chair and for his enthusiasm about my topic.

Finally, I am grateful to my family, friends, girlfriend, roommates and fellow students for all their continuous support, distractions and fun times throughout my study years.

Enjoy reading and think about the question: "what would you do if you are the manager of a train station?"

Olaf de Waal
Utrecht, June 2023

Executive Summary

Context & Research Question

In the Netherlands, space is becoming increasingly scarce and with it comes increasing competition for space. At the same time, we are in a mobility transition which involves switching to more sustainable means of transportation. At the same time, the Dutch Railways (NS) is changing from a railroad company to a full mobility provider, offering door-to-door transportation. These issues make the choices for access and egress transportation facilities in the station environment more relevant than ever. These facilities are needed to transfer from the first-mile (access) means of transport to the train at the departure station and from the train to the last-mile (egress) means of transportation at the arrival station.

The objective of this study is to find out to what extent consulting train travellers from the station developer's perspective contributes to making trade-offs in train station development and thus should be utilized more often. We investigate how train travellers make a trade-off from the perspective of the station developer in comparison to professional station developers. During the consultation, the respondent is asked to make a trade-off from the hypothetical situation of being in charge of the station. To avoid ambiguity about the station developer role, the respondent is asked to pretend to be "station manager" or in the Dutch survey "stations baas". The following research question is formulated:

To what extent does train traveller consultation from a 'station developer' perspective provide new insights in trade-offs regarding access/egress facilities at a train station in a situation where space is restricted?

This research contributes to better-informed choices when distributing space and thus a more optimal use of scarce space. This study focuses on the trade-offs between access/egress facilities at train stations based on space use. This is societally relevant because it improves the access/egress transport capacity and thus better utilizes the capacity of the rail connection. When making choices, multiple stakeholders' interests come into play, which can be taken into account with this method so that the decisions made are the best solution for all parties. The scientific contribution is formed by, on one hand, a theoretical contribution through the development of a method to approach this study and, on the other hand, an empirical contribution through the application of the established method. This study's innovative character is combining elements of three methods: the philosophy of Participatory Value Evaluation (PVE), the depth of interviews and qualitative surveys, and the short participation time of quantitative surveys. To the best of our knowledge, there are no applications of citizen consultation methods that study exactly the same choices by the policymaker in addition to citizens' choices. This study not only looks at how a citizen (in this case, a rail traveller) makes trade-offs in a policy issue from the policymaker's perspective (in this case, a railroad company), but also compares it to how the policymaker makes those same trade-offs. In addition, to the best of our knowledge, consulting train travellers through the eyes of the rail company has not been done before in a scientific context.

Methodology

Several methods are applied in this study. The literature review identifies the current situation including which access/egress facilities belong to a station environment and how decisions are made in the current situation. To investigate how train travellers and station developers make a trade-off between access/egress facilities based on space utilization, we conduct a literature review on which method is most suitable for consulting train travellers from the perspective of the station developer. A Multi Criteria Analysis (MCA) assesses the different methods' suitability for this study. In addition to the literature review, interviews are conducted with experts to complement the literature review about the decision-making process.

The literature review on consultation methods and the subsequent MCA show that a combination of a quantitative and qualitative survey is most suitable for this study. A survey is designed that gathers data on how train travellers and station developers trade off access/egress facilities based on space utilization. The survey combination is implemented respectively by a choice task in which 100 points must be distributed among 8 access/egress facilities and open-ended questions about the trade-offs made when distributing the points.

The established consultation method is applied to a case study train station. This evaluates the drafted method on the one hand and obtains empirical data on the other. Both contribute to answering the research question. By focusing on one train station, the survey can be better tailored and the question becomes more concrete and clear. It is expected that better quality data will be obtained if the experiment (i.e. the survey) is tailored to a station known to the respondent. Therefore, only travellers who know the station in the case study are asked to participate. Respondents for the train traveller sample are recruited through personal networks, LinkedIn and through flyers at the station. Respondents for the station developers sample are recruited within NS Stations. The case study is station Nijmegen. This station was selected because of its roughly equal number of home-end and activity-end users, almost no transfer travellers and because it is an average large station with an average of 48.330 travellers a day.

The data analysis consists of the analysis of the point distributions in the quantitative choice task for the two sample groups. We look at mean values, the range and the deviation from the starting values (which reflect the current situation). An additional T-test assesses the significance of the differences between train travellers and station developers. In the qualitative analysis, the open-ended responses are labelled with keywords that represent the essence of the answer. The keywords are then aggregated into a selection of categories. This identifies what factors come into play when trading off access/egress facilities based on space utilization.

Findings

Literature says that access/egress transport at stations should be distinguished between home-end stations and activity-end stations. Thereby, the following facilities are relevant to include in this study: bicycle storage, OV-bike renting, Park and Ride, Kiss and Ride, individual on demand rides (e.g. taxi), collective on demand rides (e.g. bus), shared mobility and traditional bus, tram and metro stops. Literature does not include walking explicitly. When it comes to prioritization, NS formulates three main priorities in the 'station environment rights of way': cleaner power, shared economy and space efficiency. While the 'station environment rights of way' is mentioned in literature as a prioritization tool, it

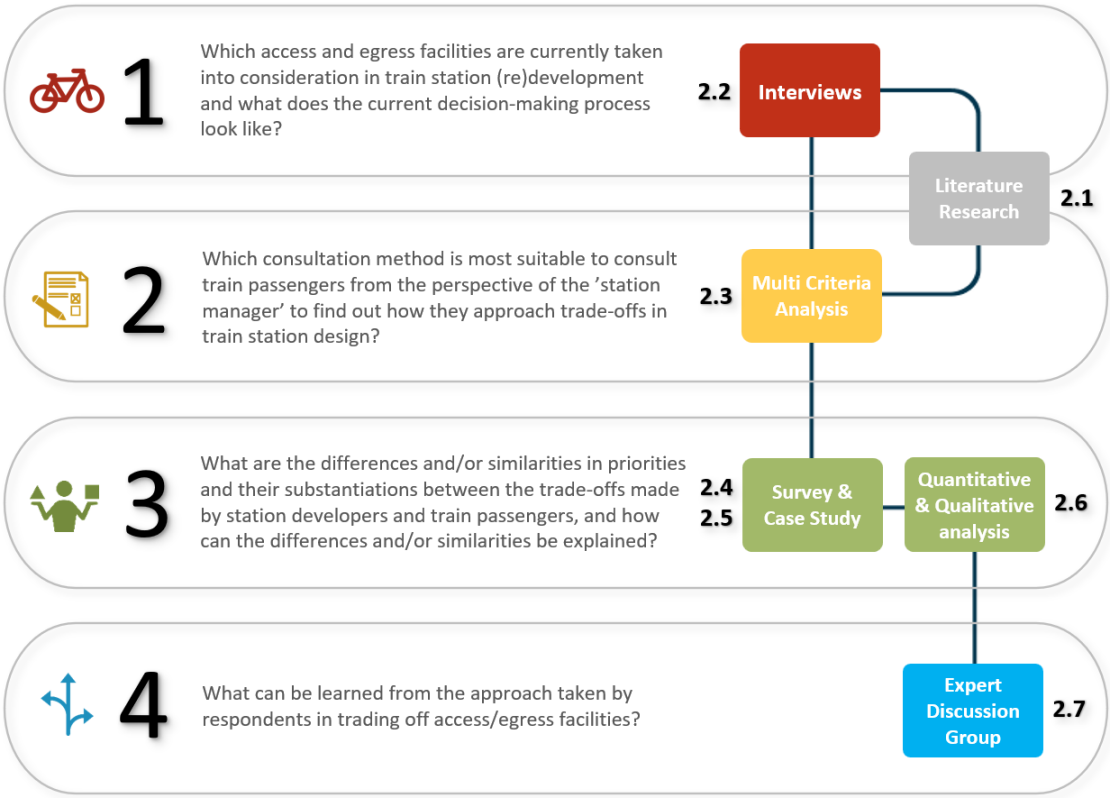

Figure 1: Research structure and methods

follows from the interviews that the station developers use the STOMP principle in practice. However, theoretical guidelines or descriptions on how to treat trade-offs between access/egress facilities and space are limited to these overarching prioritization tools.

There are a total of 110 valid responses to the survey, including 104 travellers and 6 station developers. Prior to designing and distributing the survey, preliminary expectations were formulated, which are used to structure the data-gathering process. The survey results in relation to the expectations are as follows:

1. As the entire sample group, travellers and station developers allocate space differently, with different justifications involved.
The results indicate the opposite: travellers and station developers do not allocate space differently, nor are there other justifications. The case study results show that on an aggregate scale, both groups distribute the points in the same way, see Figure 2. The way in which both travellers and station developers distribute points among facilities is in line with the hierarchy of the STOMP principle. That indicates that the outcome of the trade-off made by travellers and station developers have the same outcome. At the same time, station developers give arguments that travellers also mention. This indicates that station developers and travellers do not use opposing arguments. How strongly a category plays a role (i.e. the number of times it is mentioned in the answers), we cannot compare with travellers using this method, given the differences in population size of station developers.

Although the direction of the deviation from the starting values (i.e., more or less facility space) is the same for both groups, there are interesting differences in the extent to which the groups assign the increase and decrease. Station developers give a significantly greater increase in space to walking (+25% points) than train travellers (+10% points). At the same time, station developers give a signifi-

cantly greater decrease in space to bus (-18% points) versus train travellers (-8% points). See Figure 2.

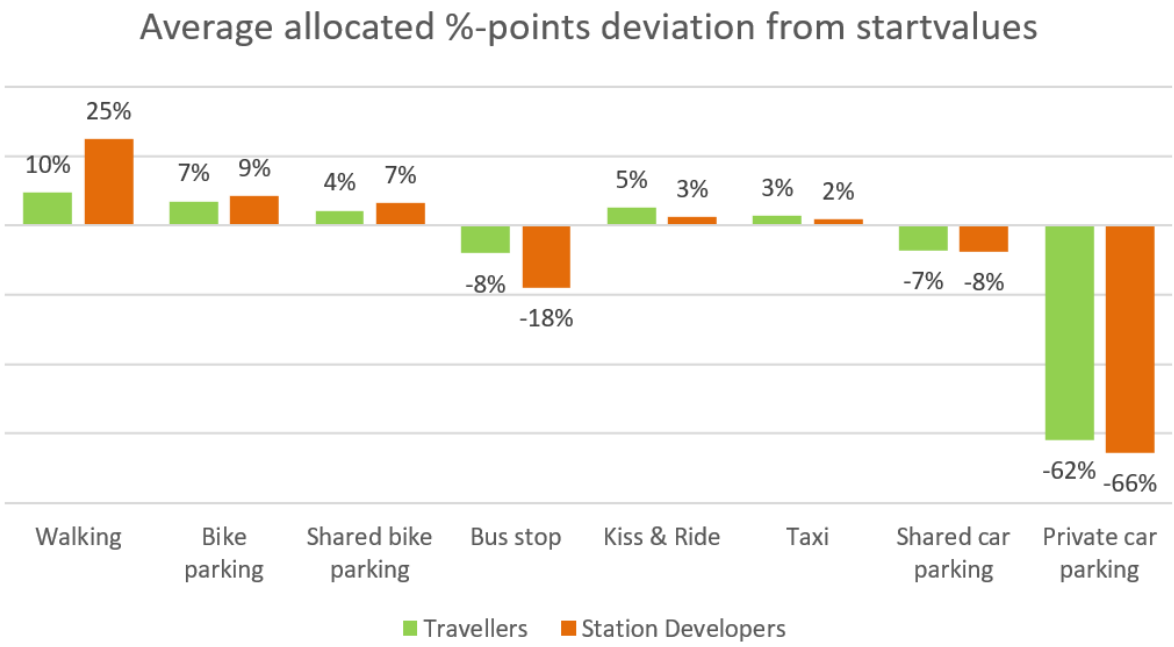

Figure 2: Average allocated %-points deviation from startvalues

2. Compared to travellers, station developers are more homogeneous in distributing space. Both travellers and station developers do not agree within their groups for every alternative. This can be seen through the differences in range for each alternative. For all alternatives, there is a smaller range among station developers than among rail travellers. This indicates that station developers are more homogeneous in making the trade-off compared to train travellers. However, the difference in N has to be considered here.

3. The distribution proposed by station developers follows the STOMP principle. The distributions made by both travellers and station developers are compliant with the hierarchy in the STOMP principle, see Figure 6.6. Since station developers are more homogeneous than travellers, they also automatically follow the STOMP principle more strictly. The STOMP principle is about prioritizing modes in relation to distance from the station. In the context of this study, station developers allocate space at the station according to the same prioritization: steps over stairs over public transport over MaaS over private transport.

4. The trade-offs made by travellers reflect their demographic characteristics (age, gender and education). There are slight differences between gender: men, relative to women, assign a larger increase for walking and a larger decrease for bus. For the six other facilities, there are no remarkable differences. Within age groups, we see a greater preference for walking among the 50-69 group and a greater preference for cycling among the 18-29 group. This indicates that train travellers' responses are affected by their demographic characteristics. However, we cannot measure the significance of this effect from this dataset.

5. The trade-offs made by travellers reflect their traveller characteristics (personally used access/egress transportation, travel frequency and travel purpose.
Although no notable differences were found between subgroups of travellers based on trip frequency and trip purpose, train travellers do tend to allocate relatively more space to the mode of transportation they personally use most often. This suggests that the traveller includes personal interest in making decisions. This is an important observation since in the instructions in the survey the respondent was explicitly asked to make a choice that is in everyone's interest. However, we cannot measure how strong the tendency is based on this observation.

The last questions of the survey are about what the respondent thinks of this consultation method. Respondents are asked to indicate whether they consider the traveller's responses more important, equally important, or less important than the station developer's responses. The results indicate that travellers and station developers have the same opinion: the responses are equally important or the responses of experts are more important. Remarkable is that no one from travellers and station developers indicates that experts' responses (i.e., station developers) is most important and that NS should adopt those responses. Regarding the difficulty of the survey, 65 out of 77 respondents indicated that they could understand the questions well, which is 91% of the respondents who answered this question.

The results of the case study can be interpreted from a theoretical perspective. First, in the open-ended questions, both groups of respondents do not explicitly distinguish between the activity-end and home-end functions of the train station, which indicates that the respondents make the trade-off integrally to both functions. Second, walking, which is often excluded in literature when studying access/egress facilities, is found to be highly important and received the largest increase in space allocation according to both groups of respondents. Walking is valued for its small footprint and sustainability, suggesting that it must be considered in planning access/egress facilities. Third, respondents often weigh facilities as overarching categories. For example, they group Kiss& Ride and Taxi under one category. Fourth, the survey results show that for Nijmegen station the following hierarchy applies: walking, bicycle, shared bicycle, Kiss & Ride, Taxi, shared car, bus, and private car. This is similar, except for the position of the bus, to the hierarchy in the STOMP principle, which indicates that STOMP can also be used for space distribution (see Figure 3). Last, the hierarchy resulting from the experiment aligns with NS' theoretical desired shifts toward cleaner power, shared economy, and space efficiency in the station environment. Respondents frequently justified their choices based on sustainable modes and space efficiency, while others emphasised the importance of shared mobility.

The practical interpretation is based on the Expert Discussion Group and evaluates how the results contribute to station development. First, these results provide insight into which modality the respondent considers most important to allocate space to. This does not need to be equal to the mode they use most. Hence, this complements the modal split. Second, in addition to finding out what the traveller thinks is the most important means of transportation, we also know what means of transportation they think is second most important, and third, and so on. This can be used in discussions about a modal shift and to predict the new choice of travellers when their preferred mode of transportation becomes less available. Third, by allocating points in this way including a question about why certain means of transport are allocated the least space, it can be found out why people do not use certain means of transport.

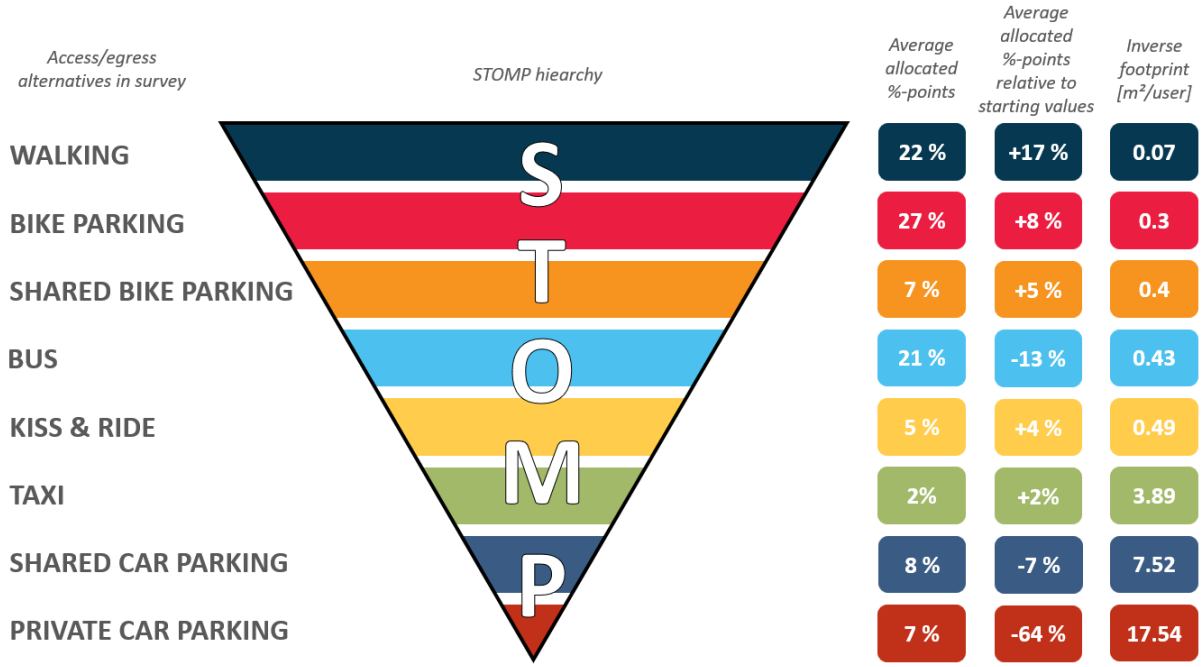

Figure 3: STOMP principle in relation to case study results

Conclusion

This study shows that consulting train travellers from the perspective of the station owner provide new insights when considering access/egress facilities at stations. These involve insights ranging from an aggregate methodological level to a higher level of detail within the case study. Figure 4 shows the four categories of new insights based on this study.

To answer the research question, we first have to gain **insight into the current decision-making process** in trading off access/egress facilities. The ”station environment rights of way” formulates three main priorities: cleaner power, shared economy and space efficiency. Also, the interviewed experts indicate that they themselves use STOMP for prioritization. The theoretical and practical approaches for making trade-offs are limited to these two principles. In the end, there are no clear guidelines on how to trade off access/egress facilities at railway stations based on available space. Also, access/egress facilities are often developed individually. Integral decision-making based on clear and objective criteria is lacking. In fact, in the current situation, it is a political process.

Next, **insight into a relevant consultation method and how it works** is required in order to be able to gather data. In this study, a consultation method is established which consists of a combination of a quantitative and qualitative survey. It applies the thinking of PVE in which the citizen takes the place of the policy maker. In addition, it maintains the depth and level of detail of interviews and qualitative surveys while at the same time maintaining a short participation time and low participation threshold. This creates a survey that allows a quantitative question to be presented in the first part. Here, the respondent has to trade off the alternatives. In the second, qualitative part, textual justifications are asked to motivate the choices made in the quantitative part. This method is suitable for consulting train travellers from the point of view of the station owner. At the same time, this method can also be used to present station developers with the same issue to objectively compare the outcomes.

The most remarkable **insight into the differences and similarities between travellers and station developers when trading off access/egress facilities**, is that travellers and station developers make roughly the same choice of whether to allocate more or less space to an access/egress facility. Relative to the current situation, both groups propose an increase or decrease in space that corresponds to the order of the facilities' footprints. That means the largest increase in space for walking, which has the smallest footprint, and the largest decrease in space for private car parking, which has the largest footprint. Additionally, station developers give arguments that travellers also mention. This indicates that station developers and travellers do not use opposing arguments. While the directions of the increases or decreases are identical, the magnitudes differ. Travellers and station developers give significantly different increases to walking and decreases to bus. Also, there are differences between the two groups in the ranges of the point distributions, which shows that station developers give more homogeneous answers than travellers. This may be due to the difference in sample size, but also due to indications that travellers are (unconsciously) influenced by their demographic (age, gender) and traveller characteristics (preferred modality).

This method ultimately provides **insight into how the respondent approaches the trade-off**. First, train travellers and station developers weigh access/egress facilities integrally without distinction between home-end and activity-end functions. Second, walking is considered the most prominent mode by both participant groups, while in literature walking is left out of consideration when determining space use. Third, respondents consider several modes at an aggregate level. They combine, for example, Kiss&Ride and Taxi. Fourth, the results largely support the generally formulated 'priorities in the station environment right of way', since the two most frequently mentioned arguments (i.e. sustainable mode and space efficiency) correspond to two of the three listed priorities. Last, the STOMP-principle, adapted to the specific situation at a station, can be used for prioritization. Another important 'content-related' insight coming from this study is which modalities the traveller considers most important, as second, as third, and so on. This is interesting because the modal split indicates which mode a traveller uses, but it does not have to equal the preferred mode. Which modality travellers have as their second or third preference is also a valuable new insight.

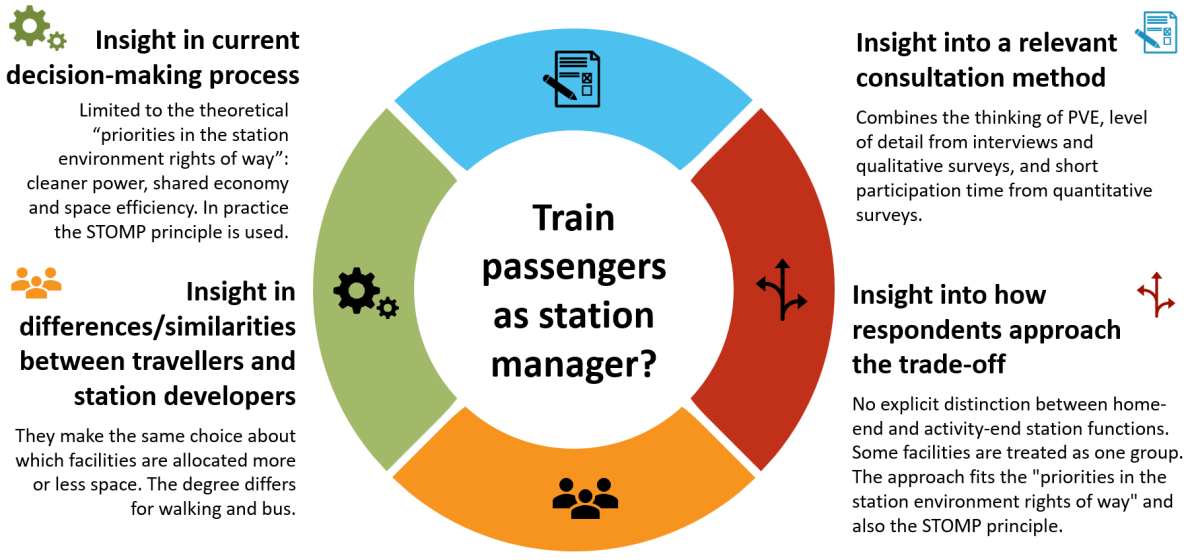

Figure 4: Insights in access/egress facilities trade-offs

Discussion

The **research methods** used have a certain sensitivity, which may influence the results. First, this study takes a qualitative and exploratory approach, involving expert views and insights. Since the experts are part of a sample, not all views may have been included and there may be different nuances in the results if a different sample is taken. Second, another station as a case study may yield different results given the population of travellers there is different. Nijmegen station is selected as it is an average station in terms of size, with the goal of being in the middle of a possible bandwidth of the results among all train stations. Third, based on the travellers' sample in the survey, it can be concluded that they understand the questions and can successfully complete the survey. However, there are respondents who did not complete the survey, so the possibility exists that there is a certain group that drops out because of the difficulty. Also, based on the result, it cannot be shown that travellers actually look through the eyes of the station developer and make trade-offs in the interest of all travellers. However, the results show that travellers make nuanced choices and consider other traveller groups, rather than just reasoning from their own interests. Finally, it has been experienced that without a (representative) panel or varied channels, it is challenging to obtain a representative sample or to reach and get all subgroups willing to participate at all.

The samples in this study have varying degrees of **representativeness**. The interviews and Expert Discussion Group samples encompass a large part of the population, so the differences will be small when a new sample is taken. Since the population of experts is small (about 20), the individual influence is large. The same goes for the sample of station developers for the survey. In contrast, the sample of train travellers in the survey (n=106) represents only 0.2% of the average daily number of travellers at Nijmegen (48.330 in 2019). A representative or heterogeneous sample is likely to generate different results. Also, missing subgroups such as youth, elderly, non-university educated people and car users will then be able to be studied, which are now missing in the sample. It is expected that fewer points will go to sustainable modes since the travellers in the sample group in the case study travels to and from the station by sustainable modes themselves. In the end, the case study results do not fully consider the situation at Nijmegen and the results cannot be generalized for other stations. The main conclusion that station developers and travellers largely make the same consideration applies only to this sample. Nevertheless, this observation can serve as a starting point for follow-up research and the hypothesis "station developers and travellers make the same trade-offs when allocating space among access/egress facilities" can be tested. This is a lot more specific than the research question this study started with.

A number of **choices and assumptions** are made in this study. First, access and egress and activity-end and home-end are treated as the same. As production (51%) and attraction (49%) are approximately equally distributed on Nijmegen, it is assumed that access and egress are equally important and that a random sample contains approximately equal numbers of home-end and activity-end users. However, we have not been able to verify whether this is the case in the sample. In addition, the respondents did not explicitly mention a distinction between access and egress in the open-ended questions, which suggests that they weigh it integrally or consider it from their own function (home-end or activity-end). Second, in the choice task in the survey, it is decided to use starting values that represent a future situation. Since respondents distribute points from these starting values, the distribution given may be different if other starting values are used (e.g., all to zero). Third, it is assumed that the footprints for access/egress facilities by Stam (2019) are representative for Nijmegen station. However, in the test phase of the survey, in the interviews and in the Expert Discussion Group, there were doubts about the footprint of the bus, which would be larger in reality. In addition, the 0m² for walking was not adopted

and together with experts it was roughly estimated to be 0.07 m² per pedestrian. In the results, walking gets the largest increase in space and the bus gets a significant decrease in space. The influence of the footprints is expected to have no significant impact if the order of space use remains the same, since the facilities in the survey are sorted by space use and the footprints are not directly visible.

The study has two **limitations** for future applications. First, in this study, we assumed that respondents are unable to weigh unfamiliar modes against each other and against known and existing modes. Since station (re)development has a long time horizon (10-15 years), it is a limitation if not all potential future facilities are included in the study, such as e-steps and self-driving cars. Second, the current situation in the case study is based on the 2019 modal split, since that is the last year without measures regarding the COVID-19 pandemic. This is a pre-COVID situation, and travel behavior and attitudes toward travel and working from home are different in the post-COVID situation. In addition, the footprints by Stam (2019) are based on traditional peak hours of the pre-COVID situation. Since Ton et al. (2022) expects changing peaks in train usage, occupancy rates may be different during the (new) peak hours. Therefore, footprints may need to be revised for the current situation.

The Expert Discussion Group discusses the applicability and usefulness of this consultation method in a **broader context**: application at different stations, different trade-offs and different stakeholders. First, station developers and travellers can collaboratively establish a hierarchy for access/egress transport for each station type. Second, it can be used for distributing functions at and around the station such as locations of stores and other services. This may involve trade-offs based on the use of space, locations or cost. Third, application with other stakeholders. For example, with participation and informing local residents or in a professional setting with municipalities and other stakeholders. For example, to clarify everyone's references, points of view or interests.

Recommendations

As a scientific recommendation, it is suggested to research to what extent respondents are influenced by the starting values in the choice task. Another recommendation is to analyze the quantitative and qualitative data integrally on an individual level. This can be used to examine whether the qualitative underpinnings match the proposed scoring in the choice task. Regarding methodology, it is recommended to have several stakeholders answering the same questions more often and on this basis improve the method. The method can be applied to issues outside the context of access/egress facilities at stations.

As a practical recommendation, it is suggested to adapt the choice task to the case study situation, using, for example, the modal split of a station as starting values. In addition, it is recommended to use a (representative) panel in order to recruit more respondents and a better distribution across different demographic and traveller characteristics. In the ultimate case, a representative sample is achieved. It is recommended to apply this method to other considerations made within the rail company. As an example when considering what type of facility to provide, such as secure/unsecured, paid/free, and covered/outdoor bicycle parking.

Contents

1

Introduction

This chapter describes the topic of this study starting from a broad social context and closing with specific research questions. It starts by placing this research in the broad social and mobility context. It then defines the focus of the study with the research objective and its corresponding scope. Further specifications are described by the societal and scientific relevance, which simultaneously describes why this research should be conducted. Nest, the research question is formulated including associating sub-questions. The presentation of the research structure concludes the chapter.

1.1. Topic and context

At the moment the Netherlands faces several major challenges. This includes climate change, the energy transition, the transition to a circular economy, accessibility, the housing crisis, and the nitrogen problem. The National Strategy on Spatial Planning and the Environment (Nationale Omgevingsvisie - NOVI) proposes an integral approach to address these challenges, in which the national government, provinces, water authorities, municipalities, companies, societal organizations, and citizens cooperate (Rijksoverheid, 2020). It describes the Dutch ambitions which have to fit in the limited 41.000 km² territory: ”Not everything will be possible, and certainly not everything will be possible everywhere. Shortages mean that choices will have to be made.” This also holds for Dutch train stations: a station must fit in its surrounding. As train stations are often located in built-up areas, choices and trade-offs have to be made about, for example, transfer facilities such as bicycle parking, car parking, bus stops as well as living space, shops, offices, residences, and more. Furthermore, NS recently calculated that the 47 biggest Dutch train stations require an additional 17 soccer fields to accommodate bicycle and car parking in 2040, based on the current modal split, passenger growth forecasts and in a situation nothing changes in the supply (Ton, 2023). The competition for space has already begun. Policymakers and politicians must start making even sharper choices regarding the spatial layout of the Netherlands: choices made now will still have an impact 50 to 100 years from now (Van de Hulsbeek, 2023). Therefore, the distribution of space plays an increasingly important role in political elections.

One of the ambitions described in the NOVI is that the Netherlands will have a fast, sustainable, and comfortable mobility and transportation system that connects cities and regions on the road to 2050. As part of the ’mobility transition’, CROW (n.d.) states that several agreements, deals, and agenda’s propose to focus on more public transport, walking, and cycling. The widely used ’trias mobilica’ is described: cleaner transportation, less transportation, and a modal shift to walking, cycling, and public transport. Complementary to this are the future goals of the Dutch National Railways (NS). NS aims to transform from a traditional train company to a door-to-door mobility provider. NS already includes first and last mile travel options in their trip planner. They also provide access and egress facilities,

such as bike parking, Park&Ride, bike rental (OV-Fiets), car rental (Greenwheels), taxis, and shared e-scooters (Check) to provide a more convenient and more attractive way of traveling.

Literature states that improvements in the transfer between access and egress modes and the train has more impact on the total journey from origin to destination compared to improvements of the train service itself (e.g. Halldórsdóttir et al. (2017); Brons et al. (2009); Krygsman et al. (2004)). From this, it can be concluded that NS should prioritize expenditures in railway station access and egress facilities above investments in their train service, as their train service is already at a proper level. In this regard, NS has already set targets in their *Journey to the future*: increase public transport capacity by 40%, become 100% energy neutral and sustainable, provide a highly attractive experience, and offer a seamless network that covers public, private, and shared transport (MaaS) (Bezema et al., 2019).

NS Stations develops the train stations of the Netherlands together with other stakeholders. They design the stations for the user: the train traveller. The station also includes the station environment where access/egress facilities are located. When designing the station environment choices have to be made about which facilities to provide, how many and where to place them. This involves dilemmas about the use of space. To substantiate the decisions made by NS, the advice of travellers can be asked, how they would make the choice. They are user experts and are ultimately the ones who use the station.

This research topic relates to the following four domains: mobility, geography, station development, and societal challenges. The core of this research focuses on the trade-offs between space and mobility, hence *geography* and *mobility* are the two key subject areas. The research is conducted in a broader context shaped by *societal challenges* and *station development*. Figure 1.1 below shows a schematic representation of the relationship between the four domains, including terms to sketch context.

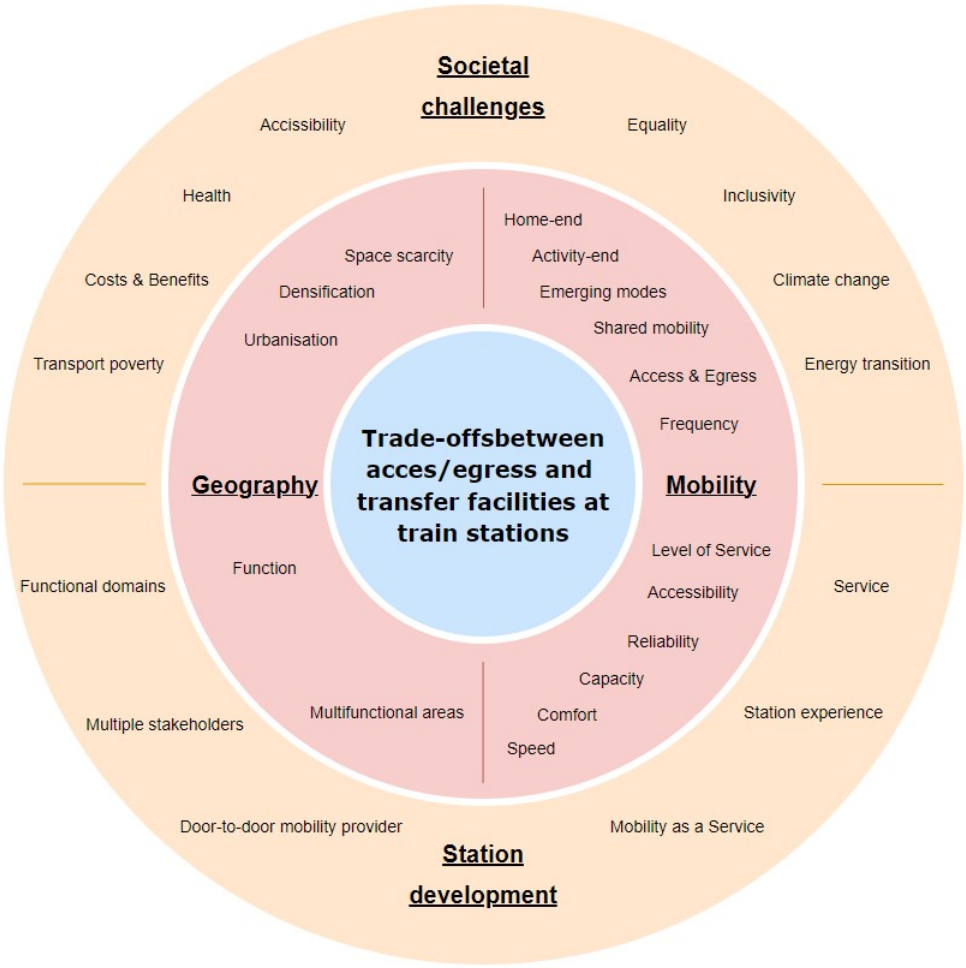

Figure 1.1: Relationship between the four domains

1.2. Objective and scope

The research goal is to contribute to better-informed trade-offs between access/egress facilities at train stations based on space use. This research proposes the participation of the train traveller in making trade-offs between transfer facilities at train stations and space usage, from the perspective of the station developer. This is relevant because, on the one hand, the travellers have to use the stations and, on the other hand, they are the user experts. The station developers design the stations for the users, so it is important to examine whether that aligns with how the users would do it if they were in charge of the station.

This study aims to establish a research method, test it on a specific case, and conclude from it whether consulting train travellers from the station developer's perspective contributes to making trade-offs in train station development. This is accomplished by examining the differences and/or similarities between NS's and the train traveller's decision-making from the viewpoint of the station developer. The context is provided by one specific choice in station development: a dilemma in which access/egress facilities are weighed on the basis of space use. We call this a trade-off of facilities based on footprint. During the consultation, in the form of a survey, the respondent is asked to make a trade-off from the hypothetical situation of being in charge of the station. To avoid ambiguity about the station developer role, the respondent is asked to pretend to be "station manager" or in the Dutch survey "stations baas".

Examining the perspectives of other stakeholders such as the infrastructure manager (in the Netherlands: ProRail), municipalities, the national government (in the Netherlands: Ministry of Infrastructure and Water Management) or local residents, is not considered in the main part of this study. However, in the end, we examine how the results obtained in the study of train traveller consultation could be extended to other stakeholders.

1.3. Societal and scientific relevance

Societal relevance

A rail connection has a certain capacity of travellers that it can carry. A train station has a certain transfer capacity where travellers can get on and off the train. All these travellers must also be able to reach the departure station and reach their destination from the arrival station. This is facilitated by access/egress transportation. Facilities are needed at the station where the traveller can transfer from the access or egress means of transportation to the train, for example, bicycle parking spaces or a bus platform. In practice, the rail connection and station capacity is more often discussed. Access/egress facilities capacity at stations should be equal or higher to optimally utilize rail connectivity. After all, there is often limited space at stations, and sufficient capacity must be available to access and egress the station. Here it is important that a variety of means of transportation is available that corresponds as much as possible to the travellers' preferred means of transportation. This can vary from station to station. In addition, travellers often have a preference for a mode of transport, or there are limitations and interests of municipalities and neighbours, among others. This study contributes to making better-informed choices for access/egress facilities at a train station. The potential similarities and differences between the choices made by NS and their travellers can substantiate or adjust the decision-making process at future station (re)development. This will result in better considerations and substantiations and in the end a more optimal usage of the transfer facilities and thus more optimal use of scarce space. In the current situation, the station developer makes choices when designing a station for the benefit of users. But would the train travellers themselves make the same choice?

In addition, in the current situation, there is no guidance on how access/egress facilities are weighed and the process is not clear and transparent. This study contributes to an understanding of the process and is a step towards a guideline that allows trade-offs to be made objectively.

Scientific relevance

To the best of our knowledge, there are no applications of citizen consultation methods that study exactly the same choices by the policymaker in addition to citizens' choices. This study not only investigates how a citizen (in this case, a train traveller) makes trade-offs in a policy issue from the policymaker's perspective (in this case, a railroad company), but also compares it to how the policymaker makes those same trade-offs. To study this, the exact same issue is presented to both the citizen and the decision-maker. In this way, not only the population of citizens are studied, but also the organization of the decision-maker. In this way, it is possible to examine how both groups approach the dilemma and to compare the two groups. This contributes to better-informed choices by the decision-maker by assessing the consistency within the organization as well as involving the input of the citizens.

The idea of allowing a citizen to experience a policymaker's dilemma is not completely new. This is the thinking of PVE, but even newspapers use this perspective to engage readers interactively (NOS, 2023). The innovative character of this study is the combination of these methods, combining the philosophy of PVE, the depth of interviews and the short participation time of surveys. This results in a method in which a specific and delineated issue can be investigated, where the level of detail is

maintained and the participation threshold is as low as possible.

To the best of our knowledge, consulting train travellers through the eyes of the rail company has not been done before in a scientific context. Questioning travellers with questionnaires is already done extensively at the Dutch Railways, however, this involves asking travellers about personal opinions and preferences. Asking train travellers to make a trade-off in a dilemma, while taking place on the seat of the rail company, is a new approach.

1.4. Research Questions

The preceding paragraphs lead to the research question, which formulates what exactly is being investigated in this study. The four sub-questions collectively form the answer to the research question and form the structure of the study.

Research question:
To what extent does train traveller consultation from a 'station developer' perspective provide new insights in trade-offs regarding access/egress facilities at a train station in a situation where space is restricted?

Sub research questions:

1. *Which access and egress facilities are currently taken into consideration in train station (re)development and what does the current decision-making process look like?*
2. *Which consultation method is most suitable to consult train travellers from the perspective of the 'station developer' to find out how they approach trade-offs in train station design?*
3. *What are the differences and/or similarities in priorities and their substantiations between the trade-offs made by station developers and train travellers, and how can the differences and/or similarities be explained?*
4. *What can be learned from the approach taken by respondents in trading off access/egress facilities?*

'Preliminary expectations' structure the study of sub-question 3. Based on the knowledge gained in Sections 3, 4 and 5 combined with our own understandings, the following preliminary expectations are established:

1. As the entire sample group, travellers and station developers allocate space differently, with different justifications involved.
2. Compared to travellers, station developers are more homogeneous in distributing space.
3. The distribution proposed by station developers follows the STOMP principle.
4. The trade-offs made by travellers reflect their demographic characteristics (age, gender and education).
5. The trade-offs made by travellers reflect their traveller characteristics (personally used access/egress transportation, travel frequency and travel purpose.

1.5. Reading guide

This study starts in Chapter 2 with an outline of all the different methods used in this study. This is followed by the preliminary research on the current situation in station development in Chapter 3. Next, Chapter 4 examines which method is most appropriate for consulting train travellers in the context described in the introduction. Chapter 5 thereafter deals with the construction and implementation of the survey and case study. The results are analyzed and discussed in Chapter 6. Chapter 7 examines the impact of the results of this study on the current way of making choices in station development and the scientific contribution. This is the content discussion of the survey and case study results. The discussion of the research methodology is part of Chapter 8. The report concludes with a conclusion, discussion and recommendations in Chapter 8. Figure 1.2 visualises the research structure.

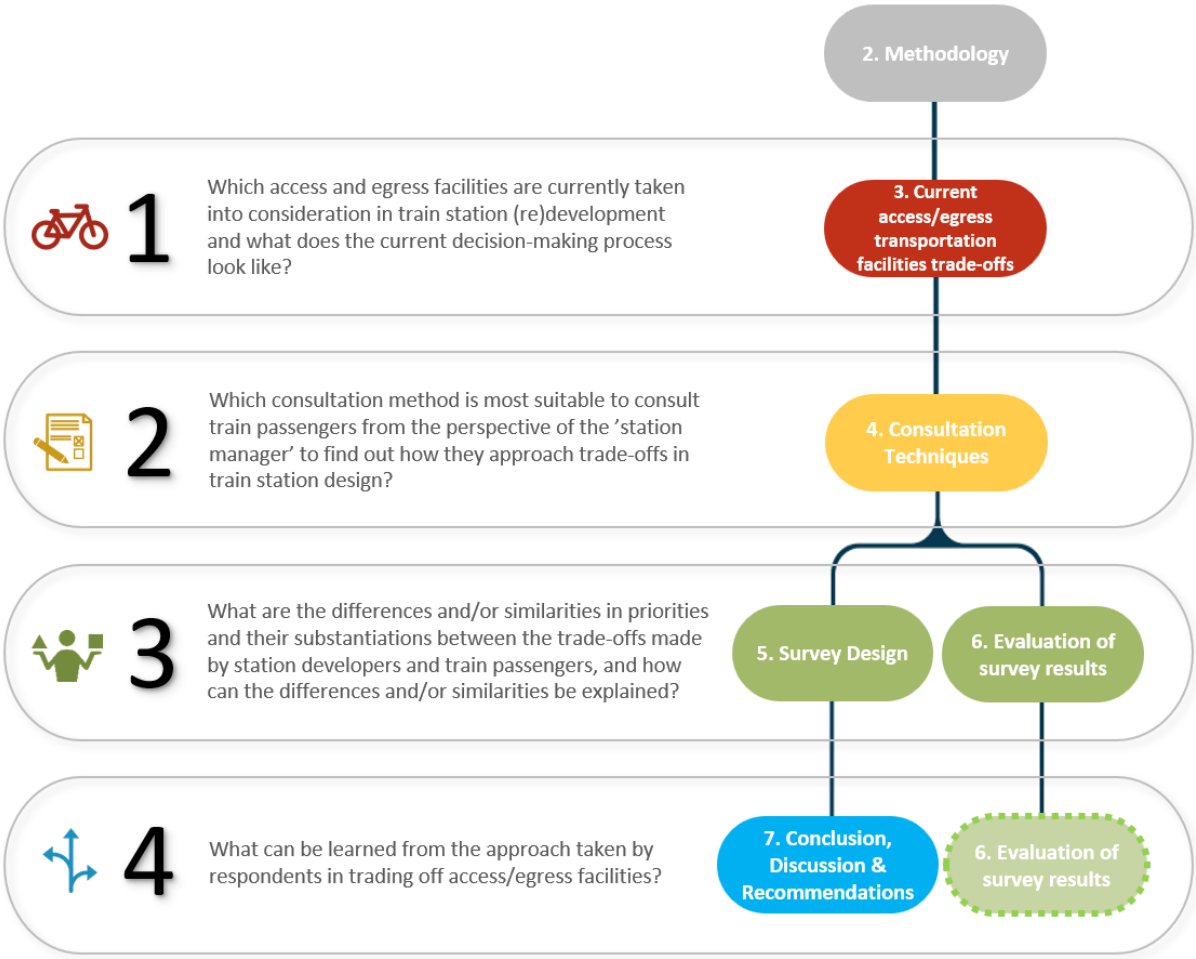

Figure 1.2: Research structure

2

Methodology

This chapter describes the approach taken in this study and the methods involved. Several methods are used to answer the four sub-questions. Figure 2.1 shows which methods are used for each sub-question. The sections in this chapter discuss and explain each method. These methods are applied at different stages throughout the study to obtain the desired knowledge and results.

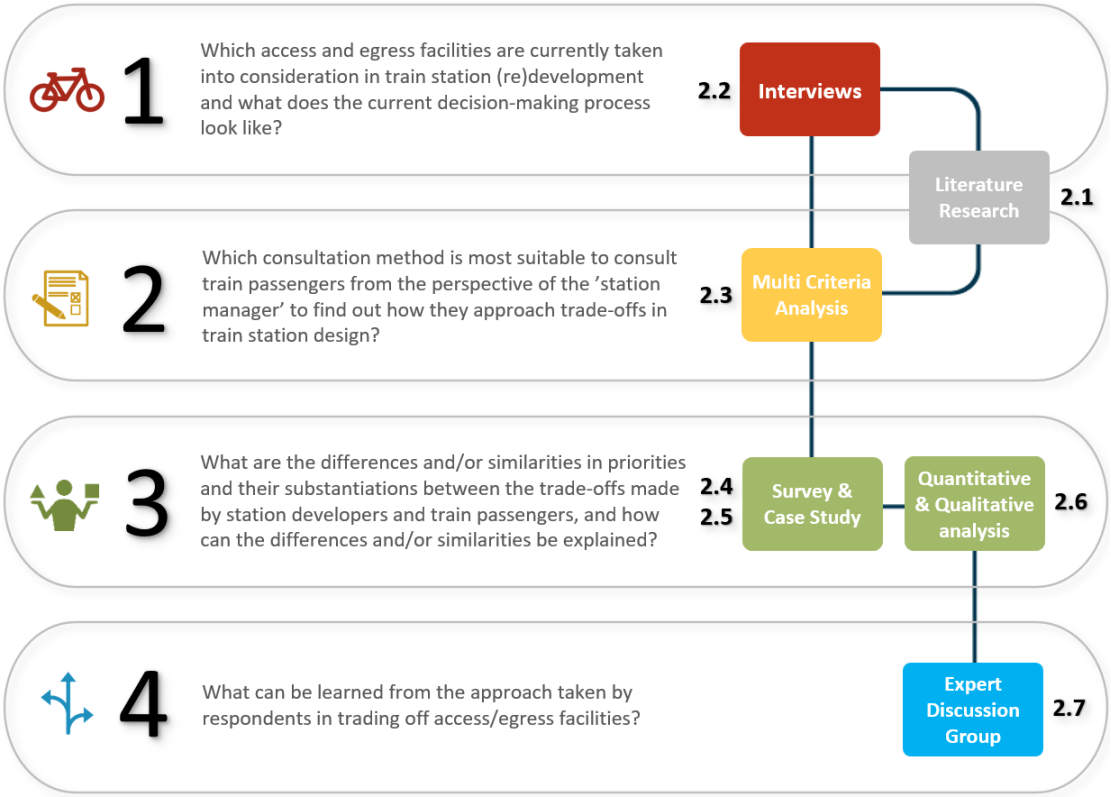

Figure 2.1: Research structure and methods

2.1. Literature research

The following elements of this research are studied through a literature review:

- To identify which access and egress facilities are common at stations. At the same time, it is explored whether the literature substantiates why certain modes of transportation should be provided based on space utilization.

- Mapping the current decision-making process when developing a station environment, focusing on choices for access and egress facilities. The objective is to determine whether there is an explicit trade-off between different access/egress facilities based on space usage. If so, the additional objective is to gain insight into the factors involved in making choices.
- Methods for consulting train travellers from the perspective of the station developer. The objective is to determine which method can best be used to study how train travellers and station developers make the identical trade-off and what factors are involved.

The search engine Google Scholar is used to search for relevant literature. It provides a good quick scan on a topic, which is useful when searching on multiple topics (Wageningen University & Research, n.d.). Access to the desired literature was obtained in combination with the TU Delft Library's Lean Library tool. Search terms are listed in the rest of this section. Further relevant literature was found through back-and-forward snowballing. Specific search terms for each topic are used to retrieve relevant literature. These search terms are listed in the next two paragraphs.

Current situation decision-making process on access & egress facilities
The search query *access AND egress AND train* is entered into the Google Scholar search engine. The first ten papers are selected. Forward snowballing is applied to the paper by Halldórsdóttir et al. (2017), which is considered the most relevant because they study travellers' preferences for access and egress facilities at the station. These preferences may affect how a traveller makes trade-offs from a station owner's perspective. In parallel, the forward snowballing principle is applied to the the thesis by Hoskam (2021) because this thesis is carried out at the same railway company and in a similar mobility context. This search strategy results in a selection of literature. However, it does not cover all means of transportation which can be used as access and egress modes. Therefore, the following search queries are executed on Google Scholar to complement the literature: *park AND ride AND train*, *"OV fiets"*, *bus AND train*, *bus AND train AND network*, *"shared mobility AND train"*.

In addition to the scientific literature, grey literature is used as well. This is because this topic has a practical nature, and mainly publications from companies are available. This grey literature is found through search engine Google on the one hand and through internal sources at NS Stations on the other hand.

Consultation methods
First, we search for literature that provides an overview of relevant consultation methods. Based on this, a selection is made of which methods to study in more detail. The following search keywords are entered into the Google Scholar search engine: *"participation methods"*, *"consumer participation"*, *"participatory value evaluation"*, *"decision making AND participation"*, *"railway participation"*. Back- and forward snowballing is applied to relevant papers.

After selecting consultation methods, the following search terms are used to conduct a further literature review: *"survey method"*, *"survey methods"*, *"qualitative survey"*, *"qualitative survey strengths"*, *"quantitative survey"*, *"quantitative survey strengths"*, *"interview strengths AND weaknesses"*, *"interview strengths"*, *"interview AND data analysis"*, *PVE*, *"participatory value evaluation"* and *"participatie waarde evaluatie"*. Dutch and English keywords are used to find as much relevant literature as possible.

2.2. Interviews

In this study, we use interviews for two different purposes. First, the interview method is examined as

one of the potential consulting methods in Chapter 4. Second, interviews are used to examine how choices are made in station development in the current situation, as discussed in Chapter 3. The latter application is addressed in this section.

To give direction to exploring how travellers and station developers make trade-offs, we want to know how choices are made in the current situation. Who makes which choices at what time? Expert consulting, executed as interviews, is used to obtain information about the decision-making process in train station development. Three experts are consulted, who are all employees of NS Stations. Table 2.1 shows the interviewees' positions along with a description of their function. The interviewees themselves formulate these descriptions, see Appendix C.

Table 2.1: Interviewees' positions and expertises

Interviewee	Position / role	Description of expertise
1	Service Developer	A Service Developer focuses primarily on access and egress transportation. In particular, car parking, bicycle parking and public transport bike spatially fit well into the station environment. Also stakeholder management.
2	Station Developer	Working on station projects, usually from the beginning (feasibility phase, beginning of plan development) to the final design. In addition, developing vision and policies for stations. Also stakeholder management.
3	Format Manager	Format manager for bicycle: bicycle parking and "Bicycle&Service" facilities. Works on how NS Stations provides and operates bicycle parking.

The interviews have the following objectives:

- Gain insights into how, in general, the process of decision-making looks in train station development
- Investigate if choices are being made between access/egress facilities based on available space
- Find internal documents about decision-making for access/egress facilities and space. Or, confirmation of the conclusion from the literature review, i.e., the lack of guidelines and documentation.
- Testing and discussing the draft version of the survey with experts.

Since this research has an exploratory character and little has been documented about choices in the design of access/egress facilities at railway stations, it is important to give the interviewees sufficient freedom to tell their story and to be able to ask further questions about it. Therefore, the semi-structured interview method suits best. A set of questions is prepared in advance to guide the interview and ensure the abovementioned four points are addressed.

Two out of three interviews are conducted via video calling (Teams). The third interview is conducted in person. All interviews are audio recorded. This makes it possible to work out the interview afterward without loss of data. The relevant answers are paraphrased and worked out in summary, see appendix C. In this way, the core of the answers are extracted. At several points in the report, references are made to the interviews.

2.3. Multi Criteria Analysis

A Multi Criteria Analysis is used to assess the consulted literature about consultation techniques for applicability in this study. There are two categories of criteria: topic-related and process-related. Four criteria are defined for each category. The weighting factors are equal to 1, giving each criterion equal weight in the assessment, as no weighting can be determined based on the literature. For scoring, we use a 5-point scale with pluses and minuses: - -, -, +-, + and ++ which provides a relative comparison of the methods to each other. The score values are determined based on the pros and cons listed for each method in the literature review.

2.4. Survey

Gathering data ourselves is necessary as there is no literature available about consulting train travellers from a station developer's perspective. Data is gathered through an experiment: travellers are presented with a trade-off and are observed on how they approach it.

The experiment is conducted using a consultation method that consists of a combination of a qualitative and quantitative survey (Chapter 4 elaborates on the selection of this consultation method). In an online web tool, a survey is designed that first presents a dilemma to the respondent in which a trade-off must be made between access/egress facilities based on space usage. The respondent has to consider two constraints: minimum capacity and maximum amount of space. In the second, qualitative part, follow-up questions are asked about how the respondent made this trade-off. The objective is to explore the themes and factors involved in making this trade-off and to compare this between the two sample groups: train travellers and station developers.

This experiment requires respondents for the two sample groups. Due to this study's exploratory and qualitative nature, a representative sample is not necessary. Therefore, anyone familiar with the case study station (i.e. Nijmegen) can participate in the survey. Train travellers are recruited in three ways. First, through personal communication within own network. Second, by posting a message with a link to the survey on LinkedIn. The post gained 82 likes, 17 reposts, 22 comments and over 10,000 impressions. Third, flyers were personally distributed at Nijmegen train station. A total of 50 flyers are handed out. The final sample of the train travellers group includes 26 respondents through personal communication, 69 through LinkedIn, 3 through flyers at the station, and 4 'other'. The second sample group consists of station developers. Recruitment of respondents is done internally within NS Stations. All employees involved in the development of access/egress facilities at stations are invited to complete the survey. This includes station developers and service developers. Descriptions of these roles are given in Table 2.1.

2.5. Case Study

In this study, we apply the survey to a specific train station. A case study is conducted because of the following reasons:

- During interviews, station developers emphasized that each station is unique. Therefore, it is not easy to conduct a generalizing survey. By focusing on one train station, the survey can be better tailored and the question becomes more concrete and clear. It is expected that better quality data will be obtained if the experiment (i.e. the survey) is tailored to a station known to the respondent. Therefore, only travellers who know the station in the case study are asked to participate. They know the station environment and can imagine themselves in the environment when answering the questions. As an example, it may be that a respondent says: ”There should be more bicycle parking spaces because a lot of students live here.” This particular answer is specific to the station and its surroundings. When a ”general” or unspecified station is the focus of the survey, each respondent has a different perception of that station. This makes the results less comparable.
- Due to time limitations, it is not possible to study multiple stations. This would, however, allow for a more generalizable result. This is not part of the research question; given the exploratory nature of this study, it suffices to examine one station.
- The modal split differs per train station in the Netherlands. If one specific railway station is investigated, the current modal split can be a starting point. This makes the survey more realistic to the respondent.

The case study in this study is Nijmegen station. Section 5.1.1 elaborates on why this specific railway station is selected.

2.6. Data Analysis

The objective of the data analysis is to study the preliminary expectations (Section 1). The data analysis of the data gathered through the survey consists of six stages:

1. Data filtering and structuring
2. Analysis of survey execution characteristics
3. Analysis of the quantitative data
4. Analysis of qualitative data
5. Integral analysis of qualitative and quantitative data
6. Discussion of preliminary expectations

First, the data is filtered by removing invalid responses. With an addition per data point ”traveller” or ”station developer” the two sample groups can be distinguished. Then, the analyses are performed with the resulting dataset. The survey execution characteristics include the number of respondents, dropout rate, completion times, and quality of responses, which indicate how the survey is executed in relation to this set of respondents.

To analyze the quantitative data, respondents' distributions of the 100 points across the 8 alternatives are evaluated. The data is processed into a cross-tabulation, which plots the distribution of points across the eight alternatives against the different sample groups (i.e. travellers versus station developers) and subgroups of travellers (i.e. demographic and traveller characteristics). These cross tables are created for the mean values, the range and the deviation of the mean values from the starting value. Based on these tables, we will see if there are notable differences between the groups and subgroups. Based on this analysis, several preliminary expectations can be discussed.

The most essential analysis to answer the research question is the comparison of how travellers and station developers allocate the 100 points among the eight alternatives. To do so, we consider the deviation of the mean number of points from the starting value, for each sample group and for each of the eight alternatives. To support the observation, we perform an Independent-Samples T-test that calculates the significance of the mean of the two groups for each of the eight alternatives. As we consider the mean values of the entire sample group and compare two independent samples, other tests such as Chi-square are not useful because they test the relationship between attributes within a single sample group.

There are three assumptions to be made in the t-test. First, we assume that the sample groups are normally distributed. Second, we do not assume equal variances as we expect station developers to be more consistent than train travellers. Therefore, we observe the 'equal variances not assumed' values in the t-test output. Third, the two samples were taken independently. We observe the two-sided p-values because we do not know in what direction the averages of the two groups differ from each other. We want to know whether there is a significant difference, so we do not test whether it deviates in any particular direction.

The qualitative analysis aims to formulate a selection of justifications/arguments mentioned by respondents in response to why they assigned the most or least points to an alternative. This analysis has two steps. In the first step, individual responses are assigned "keywords" that cover the essence of the answer. Next, all keywords are sorted and the keywords are grouped. This results in a set of categories with the corresponding number of times it was mentioned. This process is run through individually for all four open-ended questions. The other way around is also possible, in which case categories are first formulated based on a small sample. Then each answer is assigned a category into which it fits. This approach was not used because during the process of assigning the answers to the categories, it may turn out that additional categories need to be included or that answers do not fit well in a category. By first attaching keywords to an answer, matching keywords can be merged into a category subsequently. In addition, it is possible to modify the categories after the data analysis. The keywords attached remain the same, however, merging keywords into one category can be adjusted later. This gives more flexibility. This will make the categories fit the dataset better.

This method uses the researcher's interpretation in assigning "keywords" and grouping of keywords. An experiment is conducted with seven professional researchers within the Dutch National Railways to validate this method. In this experiment, the seven participants are given the open-ended responses of five respondents. They are asked to capture the given answers in keywords. Further instructions are not given in order to observe how many keywords they assign and how detailed they do so. Before the experiment, the researcher also conducted the experiment. The data of the experiment are included in Appendix B. Based on this experiment, it can be concluded that this method is valid since the participants assigned the same or similar keywords to the data. The number of keywords per response ranged from one to five. Therefore, a maximum of five keywords are assigned to an individual response.

The data analysis is structured by the on forehand formulated 'preliminary expectations', which are based on the research question. Ultimately, the discussion of these expectations forms the answer to the research question. After the data analysis, the observations are evaluated against the predetermined expectations.

2.7. Expert Discussion Group

The 'Expert Discussion Group' discusses the impact of the survey method and case study results on the current way of making choices for access/egress transport facilities during train station (re)development. At the same time, we explore the broader application of this study: at other stations, other considerations, and other stakeholders.

In the current situation, stations are developed and designed by the station owner's 'station developers'. Since they have experience, they can imagine the effects of implementing the findings. Therefore, the results of the study are presented to them, and it is discussed what the impacts are for the current development process. The Expert Discussion Group consists of four experts involved in designing railway stations. Table 2.2 elaborates on the different types of experts and their functions.

The objective of the Expert Discussion Group is to determine the practical impact of the results from the experiment. For this purpose, two topics are discussed. First, the contribution of the case study related results. This determines the value of the results in the context in which they were studied. Second, the applicability and usefulness of this consultation method in a different context. This is discussed for other stations, other trade-offs and other stakeholders.

A summarized transcript of the discussion is attached in Appendix F.

Table 2.2: Positions and expertises of Expert Discussion Group members.

Number of participants	Position	Description of expertise
2	Station Developer	Working on station projects, usually from the beginning (feasibility phase, beginning of plan development) to the final design. In addition, developing views and policies for stations.
1	Service Developer	This position focuses primarily on access and egress transportation. In particular, car parking, bicycle parking, and public transport bike spatially fit well into the station environment.
1	Researcher	Studies, among other things, access, and egress facilities at train stations.

3

Current access & egress transportation facilities trade-offs

Since many stations are currently located in built-up areas, it is likely that trade-offs regarding space allocation are already being made when a station is being (re)developed. This chapter studies the current way of choosing between access and egress transportation facilities based on space.

To get a thorough understanding of the current situation, it is first examined which means of transportation are facilitated as access & egress transport in the current situation. The locations of these facilities in the station environment are examined as well. Because it focuses on the current situation, it does not consider emerging modalities such as self-driving cars and electric scooters. The goal is to understand which access/egress facilities should be considered, how much space they occupy and at which locations these facilities belong at the station.

The study then investigates whether explicit decisions are made in the existing method of station development regarding access/egress facilities. This is further studied to see if there are trade-offs between facilities based on space usage. As the literature does not provide all the desired information to answer the second research question, additional interviews with experts are performed. In the end, this section seeks to provide a theoretical representation of the spatial trade-offs between access/egress facilities.

3.1. Train station layout: access & egress transport facilities

3.1.1. Access & egress modalities

The first interesting observation is the difference between access and egress, or home-end and activity-end. Almost all papers distinguish between access and egress modalities (e.g.La Paix Puello & Geurs (2014); Arentze & Molin (2013); Givoni & Rietveld (2007); Krygsman et al. (2004)). For example, Keijer & Rietveld (2000) describe the unique high bicycle share at the home-end in the Netherlands. Furthermore, Keijer & Rietveld (2000) states that asymmetry applies between access and egress modes: private vehicles are more often available at the home-end than the activity-end. Additionally, Halldórsdóttir et al. (2017) hypothesizes that there are differences in home-end and activity-end preferences instead of differences between access and egress. This is because of unequal knowledge about parking, mode availability, road networks and station characteristics between home-end and activity-end train stations. Some research has been carried out on one side only, e.g. Brons et al. (2009) looks into the home-end and recommends analysing the activity end as well.

Second, multiple researchers underline the importance of **bicycle storage** facilities at train stations. Rietveld (2000) states that insufficient bike parking facilities and high theft risk may discourage travellers from using the bike as an access mode. Therefore, promoting bicycle usage as an access mode should focus on bicycle parking facilities. At the activity-end companies and municipalities should focus on renting, bike-in-train facilities and safe parking for second bikes. Martens (2007) shows that investments in promoting bike as access and egress mode generated positive results: increased user satisfaction, increased amount of parked bicycles, and an increase in bicycle use as access mode.

Third, Pluister (2022) underlines the relevance and importance of the **OV-Fiets** at the activity side of a train trip. Also, Martens (2007) mentions that the best results have been achieved by introducing the OV-Fiets to solve the egress problems at the activity side of train trips. The OV-Fiets replaced trips by traditional public transport, as a car passenger and caused some shifts from car to train.

Fourth, when the described literature search strategy is followed, the **Park&Ride facilities** (P&R) are less mentioned and represented in the found literature. The consulted literature that does include P&R facilities, focuses on the factors influencing station choice (e.g. Chen et al. (2015)) considering the car as fixed access mode. Vice versa, including P&R in mode choice studies at fixed stations has not been done in the reviewed papers. For example La Paix & Geurs (2016) explicitly excluded P&R in their access and egress preference study. Nevertheless, Van der Heijden & Molin (2002) underline the importance of P&R facilities in facilitating chain travelling. They mention the importance of alignment between chain travel behavior of the target groups and the (policy) decisions made regarding the P&R facility. Even more, Hou et al. (2020) state that investigating the need and required capacity of a P&R should be done before construction.

The fifth observation is the inclusion of **shared mobility** in the more recent literature. Recently, experts argued that emerging shared modalities such as shared e-bikes, shared e-steps, e-scooters, shared cars, and shared automated vehicles are crucial in providing a seamless multimodal trip (Torabi K et al., 2022). In fact, Torabi K et al. (2022) advise countries like the Netherlands to include shared bicycles at least as half of the capacity at small and medium multimodal hubs and also consider other emerging modes. Almost half of their consulted literature about access and egress modes included one or more shared mobility modes of transport.

Sixth, traditional public transport **bus, tram, and metro** (BTM) is hardly mentioned explicitly. This means that BTM is included in some literature focusing on access and egress modes as one of the included modes (Torabi K et al., 2022), but no research has been done about the train station-related characteristics of BTM, e.g. bus stop distance, capacity, availability, and findability.

Seventh, train station facilities regarding **walking** have not been found in the consulted literature. Again, walking is included as one of the observed access and egress mode in some literature. Still, specific facilities such as the availability of escalators, elevators, and convenient walking routes are not mentioned. Also, the required space for pedestrian flows at train stations has not been mentioned in the consulted literature.

Last, following the overview of literature discussing access and/or egress modes, presented by Torabi K et al. (2022), only one out of 39 reviewed references considered almost **all possible means of transportation** for access and egress: shared bicycle, shared e-scooter, shared car, bus, individual on-demand rides (e.g. taxi), collective on-demand rides (e.g. bus) and discusses also walking (Stam, 2019). This is an interesting observation because all means of transportation are discussed in the

literature, and thus could be considered relevant and interesting to investigate.

3.1.2. Layout and space usage of train stations and its surroundings

As this study investigates the trade-offs between access and egress facilities and space in and around train stations, the physical land use of access and egress facilities must be known. Stam (2019) addresses the incompleteness and lack of precision in the literature about these land use values. In his thesis, he provides values for the required area for all means of transportation. These values include storage area, design frequency, and occupancy rate. Figure 3.1 shows the components of the 'access/egress mode footprint' and Figure 3.2 presents the actual values for all means of access/egress transportation.

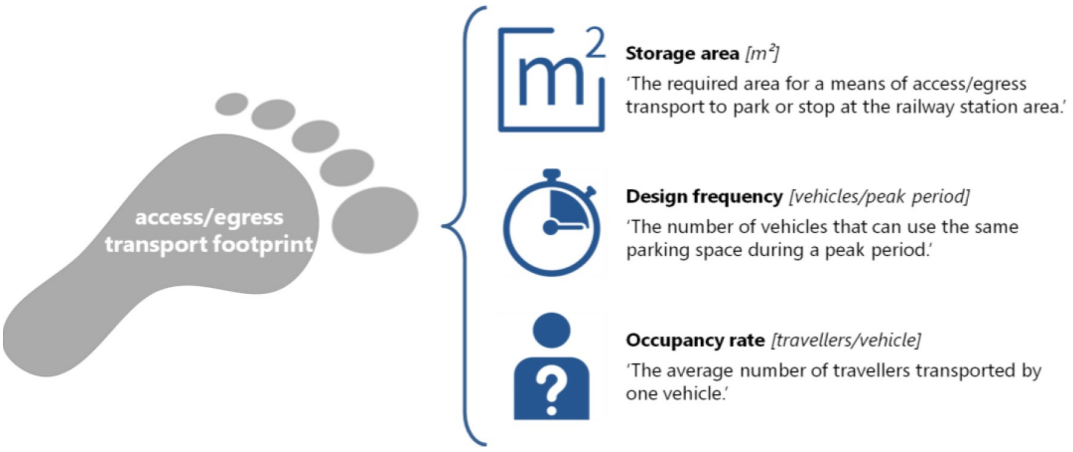

Figure 3.1: Access/egress transport footprint composition (Stam, 2019)

Access/egress modes	Storage area [m²]	Design frequency [vehicles/peak period]	Occupancy rate [travellers/vehicle]	Footprint [m²/traveller]
Walking	0	NA	NA	**0.00**
Private bicycle	0.6	2	1	**0.30**
Shared bicycle[1]	0.6	1.7	1	**0.40**
Private e-scooter	0.2	2	1	**0.10**
Shared e-scooter[1]	0.2	1.7	1	**0.13**
Private on-board vehicle	0	NA	1	**0.00**
Private car	21	1	1.2	**17.50**
Shared car[1]	14	1.7	1.2	**7.50**
Individual traditional ride service	28	6	1.2	**3.89**
Collective traditional ride service	260	24	25	**0.43**
Individual on-demand ride service	28	48	1.2	**0.49**
Collective on-demand ride service	130	48	8	**0.34**

[1] Average of the three vehicle sharing services: roundtrip, one-way and peer-to-peer.

Figure 3.2: Overview of the footprints and all three components (Stam, 2019)

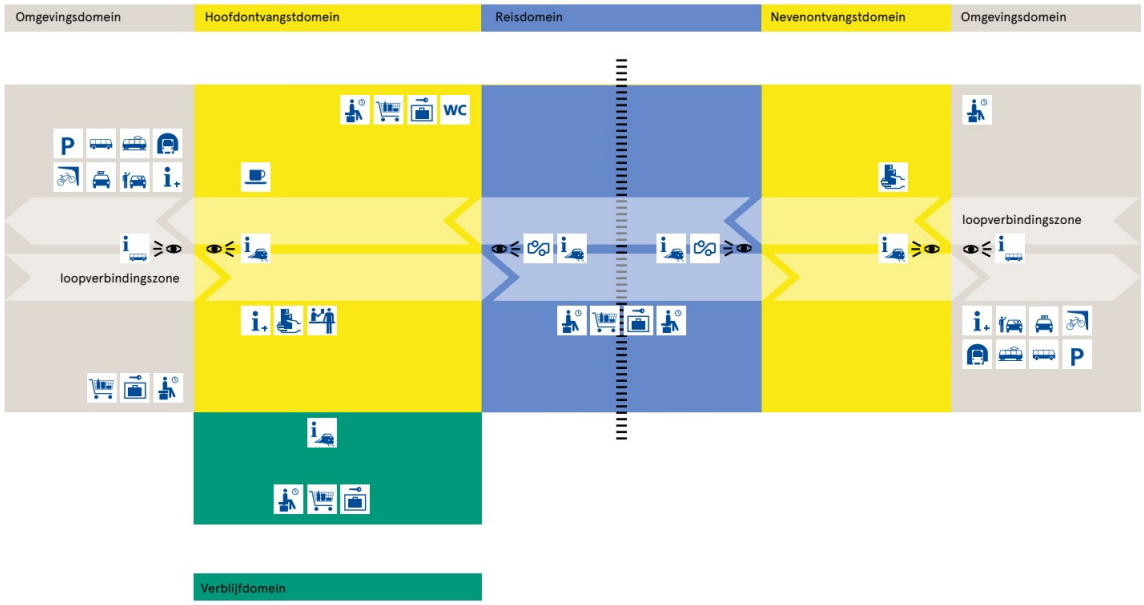

Figure 3.3: Functional domains of a train station (Spoorbeeld, 2010)

NS and ProRail developed policies for the (re)development of their stations. The published documents include guidelines about information provision and design. In these guidelines, a train station and its near surroundings are divided into four domains: station-environment domain, welcoming domain, travel domain, and the stay domain (see Figure 3.3). The documents Spoorbeeld (2010) and “Handboek Inrichting” (2014) discuss the station-environment domain in which access and egress facilities should be located. Remarkably, these facilities are limited to these modes: bike, bus/tram/metro, taxi, and car. At the same time, no specific space occupancy values are mentioned. In addition to these access and egress facilities, Spoorbeeld (2010) propose the consideration of ’urban public facilities’ such as libraries, hotels, museums, schools, and shops in the same station environment domain. This implies trade-offs between access and egress facilities and other functions, as space is often limited to incorporate everything.

The initial focus of the literature search was to find literature about the influence of access and egress facilities at a train station on the station environment. Interestingly, several studies did the other way around: they investigated the influence of the station environment on mode choice behavior (Stam, 2019).

3.2. Decision-making in train station development

Literature is primarily used first to study the current decision-making method in station development. Due to the very limited availability of literature, additional interviews with experts are conducted. The semi-structured interview questions and answers are included in Appendix C.

Although no specific decision-making guidelines are found related to access/egress modes in relation to space use, NS and ProRail are aware of the (future) spatial and mobility challenges. In their vision about future mobility (Bezema et al., 2019) they describe ’smart ways of using station environments’. They state: ”As increasing overall capacity of mobility is a significant challenge, ’density’ and the amount of m² used per person is a very important metric.” Comparisons are made between mode capacity and

space usage, for example 2000 m² for 135 persons in a car, 135m² for 150 persons using bus and 290m² for 150 persons on bikes.

When it comes to prioritization of mode facilities at train stations, three main priority shifts in the 'station environment rights of way' are presented:

- Cleaner power: from fossil fuels to electric & muscle powered
- Shared economy: from private transport to shared transport
- Space efficiency: from low density to high density

Additionally, NS Stations mentions the STOMP principle frequently. STOMP is a Dutch abbreviation which means walking, cycling, public transport, MaaS and private car. The first letter, which represents walking, gets the highest priority in spatial development projects, followed by bike, public transport, et cetera. As CROW (2020) describes, the STOMP principle can be used when integrating mobility in the spatial environment. CROW (2020) also shows that STOMP is based on sustainable mobility: healthy, clean and space efficient. This means that active modes (walking and cycling) are preferred on short distances to promote healthy means of transportation. Walking, cycling and electric (shared)mobility is promoted as clean transportation. Collective modes (public transport and shared mobility) that have high frequencies and high occupancy rates are promoted as traffic and spatial efficient modes.

Decision-making process in the current practise
The interviewees were asked if they know what the decision-making process looks like when choices have to be made related to the *station-environment domain*. The interviewees homogeneously stated that the process starts with the initiative of one of the stakeholders. Most of the time it is a municipality that has a need or ambition that it wants to be realised in the station area. When it comes to bicycle parking facilities, ProRail could be the initiator as well because they are in some cases the owner of the facility. Based on capacity requirements from the Ministry of I&W (Infrastructure and Water Management) ProRail could foresee a future need coming from their forecast models. ProRail and the local municipality together finance the construction and maintenance of bicycle parking facilities, and therefore have the largest influence on the decision-making. When it comes to a bus station in the station area, the province will join the process.

As the interviewees mainly mentioned choices related to bicycle parking facilities, the following stages in the decision-making process are described on the basis of bicycle parking. When the municipality and ProRail agreed on the development or reconstruction of a facility, they select an engineering or designing company. NS is the operator of the facilities in many cases and thus they are invited to the preparation of the program of requirements. Next, the engineering company processes the requirements and proposes one or more design alternatives. The municipality, ProRail and NS then discusses the technical drawings in which all stakeholders make sure they realize their desired elements. In the end, a contractor will (re)build the facility. In parallel to this process, NS negotiates with the municipality and/or ProRail about an operating contract in which NS provides the daily service.

It becomes clear that every stakeholder, ranging from municipality and province to ProRail and NS, pursue their own interests in the first place. As the node is part of a city, the municipality has often the greatest influence, regardless of the initiator. However, the ultimate goal is providing a well-functioning public transport node and thus all (public) stakeholders aim for the optimal option.

Trade-offs between access/egress facilities and space

The respondents were asked if they know how, in the current situation, the available space is allocated to access/egress facilities. One of the interviewees provided an additional context of the definition of 'space' for access/egress facilities. Which is: each facility has a strict minimum area requirement in order to provide safety and a basic comfort level. Each facility demands additional area to provide a higher quality level. The minimum area requirements are strict, which means that it cannot be traded off against other facilities. The extra space for higher quality can be renegotiated with other facilities. The remainder of this section takes the minimum required space into consideration, since it is assumed in the scope of this research that space is limited. In other words, access/egress facilities are traded off based on capacity reflected by the minimum space requirement per unit capacity (e.g. per parking spot).

First, trade-offs between access/egress facilities and space depend on the owner of the lot and the preferences of the stakeholders. In the case of a P&R facility located on a lot owned by the municipality, and NS would like to maintain the parking facility to serve travellers further away from the station while the municipality wants to decrease car usage, it is difficult to keep the P&R. When the lot is owned by NS Vastgoed, it becomes easier. As municipalities often have preferences in line with their policies that benefit the municipality, they often opt for spatial quality. This could be for example car-free squares and streets, enlarging pedestrian areas and increasing bicycle parking. On the other hand, when facilities are at NS Vastgoed or ProRail lots, they would prefer facilities which benefit the travellers in the first place. However, NS and ProRail do not have opposite preferences compared to municipalities. These stakeholders also prefer sustainable and shared modes. The nuance can be found in the slogan that represents the mission of NS: "the Netherlands sustainably accessible, for everyone". This means that it is not a choice between modes, but all modes should be included in order to serve everyone. Then the question is how to divide all the modes over the available space. Factors that play a role in this division are **sustainability**, **flexibility** and **spatial quality**.

Second, it becomes clear that car parking facilities are the first that will be reduced. Currently, municipalities face the challenges of the housing shortage. One of the solutions is densification within the city boundaries. This means that modalities with a high spatial footprint must be reduced. At train stations, it is possible to reduce parking facilities and stimulate travellers to reach the station by other means of transportation. Facilities such as bike parking or shared mobility could replace trips by car. This prioritization fits into the STOMP principle. This principle can be used to substantiate the choices made, for example when P&R facilities are reduced. If parking spaces are reduced, additional parking spaces can be negotiated at other stations to still entice people from further away to use the train instead of making the entire trip by car. However, the STOMP principle is not binding. For example, Rotterdam Centraal provides international train connections which attract international travellers. It could be argued that those travellers have heavy luggage and prefer accessing and/or egressing the international train station by car. Or, it could be that most business people use international connections and would like to pay for car parking. It is a balancing act to reduce car parking on one hand and on the other hand, making the internal train attractive compared to flights, as at the airport parking facilities are available.

3.3. Conclusion

First, which access/egress facility elements are relevant in railway station environment design? The literature states that the relevance of facilities depends on the function of the train station: activity-end or home-end station. It is expected that a different trade-off emerges when the home-end and activity-end facilities are studied separately. It is likely that different modes are needed at a home-end train station compared to an activity-end train station. The final train station design must provide access/egress

facilities as a home-end station as well as an activity-end station. A train station functions as a mobility hub and intents to provide all means of access and egress transportation desired by train travellers (stated by interviewees, see Appendix C). Therefore, all types of access/egress facilities are relevant to take into consideration when developing a railway station environment. This corresponds to the selection of access/egress facilities by Stam (2019):

- Bicycle storage (all types)
- OV-Fiets renting locations
- Park and Ride (P&R)
- Kiss and Ride (K&R)
- Individual on demand rides (e.g. taxi)
- Collective on demand rides (e.g. bus)
- Shared mobility (including (e-)bikes, e-steps, e-scooters and (e-)cars)
- Bus, tram and metro stops

Walking is left out of the selection because the literature does not discuss walking facilities explicitly. Also, Stam (2019) allocates 0 m² to the mode 'walking' in his space occupation calculations for access and egress modalities.

Second, what does the current decision-making process look like? In literature, it is found that NS Stations and ProRail are in theory aware of the space usage of the distinct access and egress modalities, which are located in the 'station-environment domain'. When it comes to prioritization, NS formulates three main priorities in the 'station environment rights of way': cleaner power, shared economy and space efficiency. While the 'station environment rights of way' is mentioned in literature as a prioritization tool, it follows from the interviews that the STOMP principle is used in practice. Theoretical guidelines or descriptions on how to treat trade-offs between access/egress facilities and space are limited to these overarching prioritization tools.

Regarding the decision-making process when an actual trade-off between types of access/egress facilities based on land use has to be made, the interviewees state that it depends on the stakeholders involved and their influence. When the landowner wants a certain facility on their lot, then that facility will most likely be chosen since the others have less power. There may be negotiations in which a balanced option is chosen. Sometimes this involves looking at the bigger picture which includes other train stations. In the end, every stakeholder tries to maintain their own interests in the first place. However, an optimal middle ground is ultimately sought because the ultimate goal for everyone is to provide a good mobility system. The interviewees mentioned 'sustainability', 'flexibility' and 'spatial quality' as factors that could play a role.

The final conclusion is that there are no clear guidelines on how to trade off access/egress facilities at railway stations based on available space. Also, access/egress facilities are often developed individually. Thus, integral decision-making based on clear and objective criteria is lacking. In the current situation, it is a political process. This underlines the relevance of this research: choices will be studied in a more transparent and more neutral manner and the trade-offs between facilities are studied in an integral approach. At the same time, this study investigates which factors play a role in decision-making, which is not explicitly clear in the current situation.

4

Consultation Techniques

This section discusses the literature research about consultation methods. First, relevant methods are selected that are suitable to consult train travellers: interviews, (quantitative and qualitative) surveys and PVE. The selected methods are further examined and the pros and cons are listed with respect to the research objective. In the end, the methods are compared using a set of criteria. A Multi Criteria Analysis (MCA) is used to compare methods in a systematic way and find the most suitable method.

4.1. Selection of relevant methods

Methods selected for further analysis in this chapter meets the following requirements. A suitable method must be able to...

- ... 'consult' a train traveller from the perspective of the 'station owner'
- ... 'consult' experts in the field
- ... provide insights into the meanings, arguments and substantiations (i.e. the 'why' and 'how') related to how the respondent makes trade-offs,
- ... contribute to the goal of finding a list of aspects or factors which play a role in the studied trade-off

This study concentrates on the *consultation* of train travellers and not *participation*. The goal of this research is to request advice on how the respondent would make a certain choice, including substantiations. Therefore, the method will not be used to let the respondents participate in the decision-making process and thus methods focused on collaboration between stakeholders fall out of scope (e.g. focus groups). In the end, the goal is to find a selection of arguments and/or factors that play a role in the trade-off, preferably sorted by importance. These factors are unknown and thus this study has an exploratory approach. Choice experiments are considered as non-suitable as those methods require predefined attributes. That is contradictory to the exploratory nature of this research, which explores factors that play a role in making the trade-off.

4.1.1. Qualitative & quantitative methods

At the aggregate level, there are differences in the application of qualitative and quantitative methods. According to Queirós et al. (2017), qualitative methods aim for an in-depth understanding of a problem that cannot be quantified. They explain that its focus is on the understanding and explanation of meanings, motives, aspirations, beliefs, values and attitudes. In contrast, quantitative methods are focused

on a numerical representation of data, which can help identify correlations between given variables and outcomes (Pasco & Choy, 2014).
Pasco & Choy (2014) compared qualitative and quantitative research on a general level. They formulated strengths and weaknesses, which are presented in Figure 4.1. In addition, Queirós et al. (2017) explain that in qualitative research theoretical frameworks and hypotheses are less structured compared to quantitative research. However, flexibility and exploratory analysis are considered higher in qualitative research compared to quantitative research (Queirós et al., 2017).

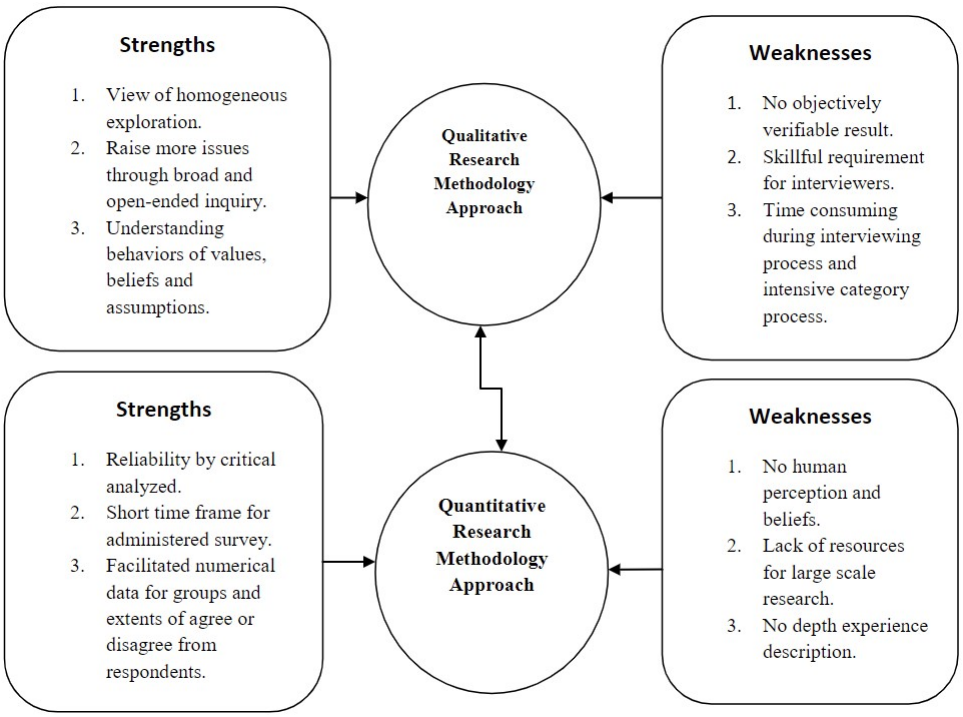

Figure 4.1: Strengths and weaknesses of qualitative and quantitative methods (Pasco & Choy, 2014)

Kleih (2000) discusses the combination of qualitative and quantitative methods which could complement each other. He states that the trustworthiness of the information gathered will be greater when methods are combined. Besides that, he mentions the relevance of 'participatory activities within a research or development context', which matches this study. Pasco & Choy (2014) discusses cases in which a complementary approach between qualitative and quantitative methods could result in better solutions. A comparison between separate methods and a combination shows a potential reduction of limitations and biases of each method when combined.

Kleih (2000) provides a guideline in how to choose a suitable combination of qualitative and quantitative methods. Research objectives must be identified followed by constraints. Objectives could be 'what characteristics', 'for whom is the data collected', 'degree of participation' and 'training objectives'. Constraints could be 'time', 'cost' and 'expertise'. The first combination option is **merging**, which combines elements from both approaches into one method. For example, coding responses to open-ended questions which results in frequency tables. The second option is **sequencing**, which is another way of combining, in which quantitative and qualitative methods are used separately in a particular order. For example, using a participatory method to formulate hypotheses, followed by a deeper hypothesis testing in a survey. The third option is **concurrent use** (or: "mixed suite") of qualitative and quantitative methods. For example, simultaneous use of a survey and a participatory enquiry for attitudes,

beliefs and perceptions. Kleih (2000) concludes that besides the improvement of trustworthiness also time, costs, expertise and other factors related to data collection and analysis influence the choice of a particular combination of methods.

4.2. Surveys

Pasco & Choy (2014) and Queirós et al. (2017) consider a survey as a quantitative method. Respondents have to provide their answers in a standardized way: e.g. a number or score. Using a set of questions that reflect the opinions, perceptions, and behaviors of the population, the researcher is able to derive information about a given phenomenon directly from a respondent Queirós et al. (2017).

However, Braun et al. (2021) propose *qualitative surveys* as a sound alternative to interviews in qualitative research. A qualitative survey looks like a structured interview: open-ended questions are presented in the same structured way to every respondent. It is typically used when the researcher aims for a deeper understanding rather than statistical representativeness. They conclude that qualitative surveys may be suitable when a wide range of perspectives or positionings is sought. Although individual responses may lack detail, the overall dataset could provide an in-depth understanding comparable to interview results. Data gathered in a qualitative survey have a plain text format. Table 4.1 lists the pros and cons associated with the survey method.

Table 4.1: Pros and cons of surveys (Queirós et al., 2017; Braun et al., 2021)

Pros	**Cons**
Low development time	Reliability depends on answer quality
Cost-effective	Reliability depends on survey design
Easy data collection and statistical analysis	Rigidity of the structure
Can reach high audiences	Don't captures emotions and behavior
High representativeness	Responses on individual level lack detail
Not affected by the subjectivity of the researcher	Excludes illiterates and low digitally skilleds
Openness and flexibiliy for wide range of questions	
Observing different perspectives	
Participation not time and location bounded	
No participation time pressure	
Feeling anonymous and thus expressing views	

4.3. Interviews

Interviews can be used when exploring views, experiences, beliefs and motivations of individuals on a specific topic. Different forms and types of interview techniques exist. Wilson (2014) and Adhabi & Anozie (2017) describe three main types of interviews: structured, semi-structured, and unstructured interviews. They further subdivide interviews into 'formal' and 'informal' and explain that formal interviews are more used professionally and are more structured and have higher standards. They also state that structured interviews provide less flexibility to the respondent, that analysts do not favor it in qualitative studies, and that semi-structured interviews are the ideal method for data collection in qualitative studies. Therefore, semi-structured interviews are considered as a most suitable type of interview in this study context.

A semi-structured interview combines the structure of a structured interview by incorporating predefined questions on one hand, and allowing the exploration of unknown and emerging topics or issues (as in an unstructured interview) on the other hand Wilson (2014). This combination can be formulated as the overall aim of a semi-structured interview: systematic data gathering while leaving room for the exploration of unexpected issues and topics.

Wilson (2014) describes situations in which a semi-structured interview could be applied. Besides the gathering of facts, attitudes and opinions, it can be used to let respondents address new issues on a topic where the interviewer already identified the relevant issues. It can also be used when the aim is to understand user goals.

The interviewer uses an interview guideline consisting of predefined questions and a time schedule. Based on these questions and time planning semi-structured interviews can vary in duration. Wilson (2014) mentions interview lengths ranging from several minutes to several hours. However, it suggests to arrange interviews between half an hour and two hours. In a situation where people have limited time, it is suggested to combine closed and open questions that are easy to answer. As this type of interview can consist of both open and closed questions, the output can be quantitative as well as qualitative. In the case of open-ended questions, the data gathered is in plain text format.

Semi-structured interviews can be used in the Delphi method. This method aims at consensus among the respondents, by showing a respondent the interview results of other participants in multiple interview rounds, until consensus is achieved (Slangewal, 2022). As consensus is not part of the research objective, the Delphi method is not used to seek consensus. The idea of presenting interview results to other respondents could be used to identify the implications of the current situation.

From the description above pros and cons are identified related to the application of semi-structured interviews in the context of this study (as described in Chapter 1). Additionally, the pros and cons mentioned in the literature are listed below as well.

Table 4.2: Pros and cons of semi-structured interviews (Wilson, 2014; Kakilla, 2021; Adhabi & Anozie, 2017)

Pros	**Cons**
Redirecting when out of topic	Reduced detail due to 'interviewer effect'
Flexibility for interviewers	Training needed to prevent directing
Broad comparisons across results	Multiple interviewers affect consistency
Low training time, compared to unstructured	Quantitative and qualitative data time-consuming
In-depth conversations	Hard to generalize due to different sub-questions
Non-verbal communication	Data loss if non-verbal signals are missed
Could find unknown issues	Costly and time consuming
Predefined topics + additional input	Limited geographical coverage
Duration adjustable to audience	Interviewer could be biased
'Accredited' for statistics and science	

4.4. Participatory Value Evaluation

PVE is a relatively new method. TU Delft (2022a) describes PVE as a policy evaluation method on one

hand and as a citizen participation method on the other hand. In this study we focus on the evaluation application of this method. Using citizen participation, PVE seeks to extract social welfare effects of public policies, based on the allocation of public budget by citizens (Mouter, Koster, & Dekker, 2021). This method can be used to let citizens 'advise' the government on public projects. In a choice task, participants are asked to make a selection out of a provided list of options. The impacts of each option are presented. As it is not possible to select all options, trade-offs have to be made. Subsequently, respondents are asked to provide arguments and substantiations about their proposed selection of alternatives. In the end, patterns can be identified among several groups of respondents. The essence of this method is to let respondents take place on the seat of the policymaker (Mouter et al., 2022). The output data of this method consist of both quantitative data and qualitative data in the form of plain text. Earlier applications of PVE include studies of corona measures, climate measures, energy transition and flood protection policies (Mouter et al., 2022).

This method was initially developed to overcome the limitations of Cost-Benefit Analysis (CBA) (TU Delft, 2022c). CBA uses private after-tax income preferences of citizens to valuate governmental policy impacts. This is based on the assumption that societal welfare effects of governmental policies can be calculated based on how citizens would spend their private income (TU Delft, 2022c). This is researched by Mouter et al. (2017) in the context of safety and travel time aspects of roads. In this specific case, it is found that consumers would spend private budgets rather on travel time improvements, while they would spend public money on safety improvements. In a CBA it is assumed that private budget and public budget can be considered as the same: 'complete fungibility'. To overcome this problem, the "The willingness to allocate public budget (WTAPB) valuation paradigm" has been developed. This WTAPB derives social welfare impacts of policies on how citizens prefer spending of public budget, instead of on how they would spend their private budget. PVE is based on this WTAPB approach, however, in PVE a respondent is able to opt for no allocation of public budget and shift the remaining budget to next year 55(Mouter et al., 2019).

Mouter, Hernandez, & Itten (2021) state that multiple options can be chosen in a PVE. This allows the participant to properly weigh the alternatives in relation to each other. In addition, not only preferences are expressed for certain alternatives, but also the allocation of public resources to those alternatives. Participants are faced with a (public) budget and a set of alternatives (e.g. public policies). The units of the budget can vary. For instance, the budget in prior PVE research included both financial resources and healthcare capacities (Mouter et al., 2022).

Information is provided for each alternative. This outlines the impact of the alternative, including its advantages and disadvantages. The participant is then asked to choose from the available options. A visual indicator shows the impact of the chosen set of alternatives. According to Mouter et al. (2022), the respondent is actually asked to make a continuous decision regarding how much they want to spend public budget (such as money, space, or healthcare), as well as a discrete decision regarding which alternatives they would like to include or exclude from their selection. In the end, the social costs and benefits per policy option can be derived from the choices made by the respondent (TU Delft, 2022c).

TU Delft (2022d) lists five characteristics of PVE. First, it is based on a strong theory: welfare theory. Second, all citizens have one vote. Third, it is non-paternalistic, which means that respondents are not instructed to answer the questions from an individual or collective perspective. Fourth, it is based on a pluralistic democracy model, which means that consensus among respondents is not aimed for. Fifth, PVE lowers the participation threshold because it is online, in a private setting, and takes approximately 20-30min to participate. Previous PVE studies showed a well-balanced representation of relevant population segments (TU Delft, 2022b). The lower participation threshold results in more and balanced participants which provides insights that reflect the preferences of the population more widely.

Table 4.3: Pros and cons of PVE

Pros	Cons
Respondent on seat of decision-maker	20-30 minutes participation
Lower participation threshold compared to offline	Budget allocation limited to predetermined options
Possible to allocate budget partly	Non-paternalistic
Multiple alternatives can be choosen	
Studies preferences of allocating public resources	
Quantitative data for statistical analysis	
Qualitative data for further substantiation	

Several pros and cons are identified related to the application of PVE in the context of this study and presented in Table 4.3.
Non-paternalistic means that respondents are not instructed to answer the questions from an individual or collective perspective. In order to compare the decision-making with the current decision-maker (s), it might be better to focus on one perspective explicitly.

In addition to the pros and cons in Table 4.3, there is an element that is both a pro and a con. To the best of the authors' knowledge, this method has not been applied before in a commercial context in which the citizen becomes a 'customer'. This also holds for semi-governmental applications, such as railway stations which have both a commercial and societal contribution. This is a pro because it highlights this research's knowledge gap and relevance. At the same time, this is a con because there is no knowledge available about application in this context.

4.5. Multi Criteria Analysis

In order to make sure a method is chosen that fits the research objective best, a Multi Criteria Analysis is performed. A set of criteria is formulated based on the research objective. The scores in the performance matrix represent the method's performance on all the individual criteria. These performances are estimated with respect to the research objective and relative to each other. The set criteria consist of four topic-related criteria (1-4) and four process and data analysis related criteria (5-8).

1. **Possible to "place the respondent on the seat of the decision maker.** The research's main objective is to compare the decision-making processes used by travellers and the present station developers of NS Stations.
2. **Provides full freedom of answers.** Due to the research's exploratory and qualitative approach, this is essential. The objective is to obtain an understanding of the factors that the traveller considers relevant while making a decision. This requires substantiation of the choices they make in the question.
3. **Ease of making it representative for a larger population.** This is not required due to the exploratory nature of the study, but it is very valuable if the findings can be used at many stations. Furthermore, because each station in the Netherlands is unique, fully generalized conclusions are not possible at the level of detail this study pursues.
4. **Applicable to both 'laymen' and 'professionals'.** This means that both travellers and current station developers are able to answer the questions. The questions should not be too challenging

for travellers who are unfamiliar with the specific subject, but they also should not be too simple so that experts feel restricted.

5. **Maximum participation duration between 5-10 minutes**. In order to maintain the optimal attractiveness of the survey, it should not take longer than 10 minutes. This way we make sure to obtain enough respondents.

6. **Low (execution) costs**. Since this is a student thesis project, (implementation) costs should be taken into account. Using commercial panels and software packages can be expensive.

7. **Many respondents can participate (+- 50)**. The more respondents, the more patterns can be discovered between different subgroups. Additionally, if certain factors are mentioned more frequently than others, for example, it may be possible to determine their strength.

8. **Respondents can participate whenever and wherever they want**. It is plausible that participating in research is more attractive as soon as it can be done when the respondent wants it and where.

Table 4.4 shows that some criteria scores close to each other (e.g. 'possible to place the respondent on the seat of the decision maker' while the four alternatives score differently on other criteria (e.g. 'participation duration between 5-10 min'). In the end, it is clear that the alternatives *quantitative survey* and *qualitative survey* have the highest scores. The other two alternatives score significantly less, making the survey alternatives the best fit for this research objective.

As discussed, the *qualitative survey* and *quantitative survey* methods scored best. In order to further enhance the performance, the two methods could be combined. In that case, the two methods can compensate limitations of each other. More specifically, the low score of quantitative surveys on 'gives full freedom in responses' can be compensated by the qualitative survey. However, some criteria with a lower score can disadvantage the combination. For example, the criterion *participation duration between 5-10min* scores less for a qualitative survey and this score becomes dominant in a combination of the two survey types. Because of the dominance of certain criteria, an additional alternative called 'survey combination' is added to estimate the scores of a combination on all the criteria. From this, it becomes clear that in the end, the two methods enhance each other, as the resulting score of the combination is higher than the individual scores of the two survey types. This is in line with the statements by Kleih (2000) and Pasco & Choy (2014) that qualitative and quantitative methods can reinforce each other.

Table 4.4: Multi Criteria Analysis consultation methods

Criteria	Quantitative survey	Qualitative survey	Interviews	PVE	Combination
Topic-related					
'Respondent on the seat of the decision maker'	+	-	+	++	++
Provides full freedom of answers (i.e. qualitative data)	- -	+	++	+	+
Ease of making it representative for a larger population	++	+	- -	+	-
Applicable to both 'laymans' and 'professionals'	+/-	+	-	-	++
Process and performance related					
Maximum participation duration between 5-10 min	++	+	- -	-	+
Low (execution) costs	+	+	+/-	-	+/-
Many respondents can participate (>50)	++	++	- -	++	++
Can participate whenever and wherever desired	++	++	- -	+	++
Total score	8	8	-6	4	10

4.6. Survey combination

According to the MCA, the combination of a qualitative and quantitative survey is most suitable for this study. With regard to this study's topic, this combination can be described as follows. First, it is possible to put the respondent "in the shoes of the decision-maker" by asking the respondent in the introduction to imagine that he/she is the one in charge of the station. Second, it is possible to give the respondent complete freedom in answering the questions. This is because of the qualitative part. Third, with this combination method, it is challenging to obtain a representative sample. It is a new method and therefore potential respondents are expected to drop out in advance because they are not familiar with this consultation method. There is a possibility that persons interested in the topic and the new method may be over-represented in the sample. Fourth, the combination survey is suitable for both laypersons and professionals. Both laymen and professionals can express their views in the qualitative section. This means that professionals do not feel limited by the closed questions in a quantitative survey.

The combination also works well when it comes to processes and analysis. First, a survey can usually be easily tailored to fit a maximum time limit of 10 minutes. It is expected that the combination will take a little longer than a quantitative survey conducted solely since it includes a qualitative component. Second, compared to PVE and interviews, surveys are less expensive to implement. The survey can be processed using a (free) online web tool before being distributed online. Third, processing a significant number of respondents is feasible, especially when compared to interviews. The survey combination is also available to respondents whenever and wherever they choose. This is because of the online format and short participation length.

In conclusion, a combined survey consists of quantitative closed-ended questions and qualitative open-ended questions. The first part contains the 'choice task' in which the respondent is asked to make a trade-off between two or more variables in a specific context. The output data will be formatted as numbers. The second part consists of open-ended questions which are related to the choice task in the first part. It asks what was involved in the choices. These qualitative substantiations will be labelled

in order to identify which aspects played a role more often.

An online web tool can be used to create the survey, making it accessible to all respondents online. Depending on the target audience and desired representativeness, the survey can be distributed through various channels. Panels, newsletters and personal communications can be considered. For closed/quantitative questions, the output data consists of values, and for open/qualitative questions, it consists of plain text.

4.7. Conclusion

The consultation methods qualitative survey, quantitative survey, interviews and PVE are discussed in this chapter. Scores for a Multi Criteria Analysis (MCA) are estimated based on their pros and cons. The *qualitative survey* and *quantitative survey* methods scored best. Subsequently, a combination of these two methods is compiled and added to the MCA. This shows that the combination of the two types of surveys reinforces each other and scores even better than the methods individually. This is due to the dominant elements in each method. It turns out that these dominant elements advantage the combination rather than disadvantage.

This combination can be categorised as a combination type 'merging' as well as 'mixed suite'. The concurrent use of first closed-ended questions and subsequently open-ended questions can be categorised as 'mixed suite'. The coding strategy of the responses to the open-ended questions suits the 'merging' category.

A data gathering setup could be as follows. The quantitative component includes a dilemma or trade-off, in which a choice must be made between different alternatives. The qualitative part involves opinions, justifications and trade-offs. This serves as a deepening of the choice made in the quantitative part. Both the quantitative choices and the qualitative justifications can be compared between groups of respondents and also between subgroups.

5

Survey Design

This chapter discusses the survey and the case study. The first section discusses the case study, to which the survey is tailored. Next, the objectives of the survey are listed, which form the basis of the development process. The third section defines what specific data is needed. Next, the practical details of the survey are formulated in the fourth section. Among other things, this explains the choices and assumptions in the design and formulation of the questions. The last section elaborates on the design process: which choices and assumptions are made and how the survey is tested. The survey is built in an online platform to enable the respondent to participate online. Appendix D contains the survey as distributed to respondents.

5.1. Case Study

The case study is essentially an application of the survey. Nijmegen Station is chosen as the case location. A case study is used to ensure that the respondents have the same station with the same environmental characteristics in mind when answering the questions. It does not matter if the case study differs from the actual situation, as long as the trade-offs made by travellers and station developers can be studied.

5.1.1. Selection of Nijmegen station

Nijmegen Station is opted for as case study. This station is chosen for the following reasons:

- It is an average-sized train station, as it processes 48.330 travellers a day on average in 2019, pre-COVID (NS, 2023). This means that it is not a small local train station in an outlying area on one hand and on the other hand it is not a cathedral (a large station in a big city).
- This train station has mainly entry and exit travellers and only a few transfer travellers: approximately 47.500 accessing/egressing travellers and 800 transferring travellers (NS, 2023). This has the advantage that the majority of the travellers have to travel to or from the station, and thus have an interest in access/egress facilities.
- The distribution of travellers who have Nijmegen as home-end station (production station) or activity-end (attraction station) is approximately the same: 51% and 49% respectively in 2010. It is likely that, in general, in general, the modal split is different between a production and attraction station. For example, travellers are most likely not to have a second car ready at their activity station. Thus, the needs for access and egress transport facilities depend on whether a traveller uses the station as a home-end or activity-end station. This must be taken into account when

designing the access and egress transport facilities at a station. Since this station has an equal distribution, both functions are equally important and thus all access/egress facilities are. This means that there is no need to attach weights to the facilities. As a result, this difference is not considered in this study. This has the advantage that at the end the results are easier to generalize.

5.1.2. Content and scope

Nijmegen has five train stations: Nijmegen, Nijmegen Heyendaal, Nijmegen Goffert, Nijmegen Lent and Nijmegen Dukenburg. Nijmegen station is the largest of the five and is the only one with Intercity connections in addition to Sprinters. Nijmegen station is located in built-up urban area, close to the city center. The station is served by NS and Arriva.

This study considers the 'station surroundings' as marked in Figure 5.1. Using the measurement functionality in Google Maps, the total area of the station surroundings is roughly estimated to be 19.000 m². This includes bicycle parking spaces, Park and Ride (operated by NS Stations), bus stops, taxi stands, the 'station square', Kiss and Ride, and 'loading and unloading'.

The case study includes a selection of access/egress facilities. First, only the facilities for which Stam (2019) has developed a footprint are included (Section 3.1.2). Second, transportation modes that are currently not facilitated at the station are not included. It is not certain that every respondent can estimate the spatial impact of a future means of transportation, such as standing e-scooters, tram and metro. There is one exception to the two mentioned criteria:Stam (2019) provides a value for 'collective on-demand ride service vehicles'. Examples are 'ride-splitting' and 'Demand Responsive Transit (DRT)'. The latter is called in Dutch 'buurtbus' or 'belbus'. However, it is opted for to exclude this form of access/egress transportation as it is assumed that this mode can use Kiss and Ride facilities. Also, from the interviews it follows that this form of mobility is likely unknown to many respondents and thus causes confusion. As a result, Table 5.1.2 lists the selection of facilities that are considered in the case study.

Table 5.1: Characteristics of access/egress facilities at Nijmegen

Access/egress facility	Footprint by Stam (2019) [m²/user]	Footprtints used in survey [users/m²]	Modal share 2019
Walking	0	15,00	25%
Bike parking	0,3	3,33	30%
Shared bike parking	0,4	2,50	2%
Bus stop	0,43	2,33	39%
Kiss & Ride	0,49	2,04	1%
Taxi stand	3,89	0,26	0%
Shared car parking	7,5	0,13	1%
Private car parking	17,5	0,06	2%

The ratio of access and egress is approximately equal, hence equal priority is given to access and egress. One modal split is determined for practical convenience. Based on the 2019 modal split for both access and egress, a new modal split is estimated that also includes shared bikes, Kiss & Ride and shared cars. The breakdown of "bicycle" into private bicycle and shared bicycle was made because the two have different footprints. The same applies to cars. For example: if people come to the station

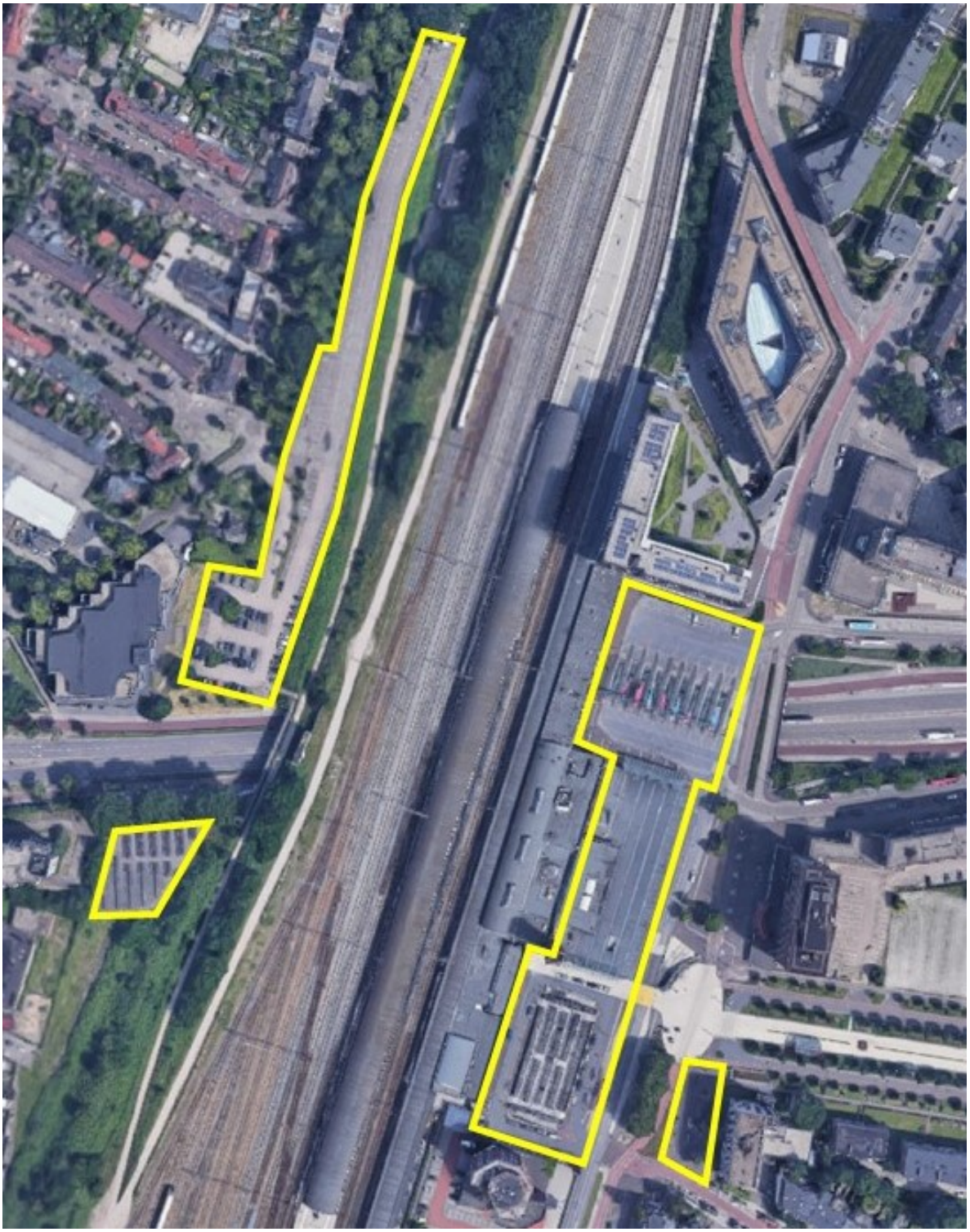

Figure 5.1: Access/egress facilities (parking facilities and stops) locations at railway station Nijmegen (edited) (Google Maps, 2023)

by car but do not park there (Kiss & Ride), considerably less space is required. The resulting modal split is shown in Table 5.1.2.

Additional clarification is required for the walking modality. Walking is the only mode of transportation

in the selection that does not require a physical facility to transfer from the access mode to become a pedestrian to then reach the train by foot. Or to transfer from the train to an egress mode. Strictly speaking, walking therefore does not fit into the list of access egress facilities that require space at the station to transfer from access/egress mode to the train. Stam (2019) therefore made the assumption in his study that walking requires 0 m² of space at the station. This study examines the relative trade-off between access/egress facilities based on space use (i.e. footprint). Therefore, it is necessary to assign a value to walking. It is assumed that pedestrian walkways can handle 10 people per m² during peak hours. This value is many times higher in reality. However, this value was chosen in order not to let walking be the most obvious choice in the trade-off in the survey. This value is close to the next most space efficient mode (i.e. bicycle parking). In general, for the selection of access/egress facilities, this study is about examining how train travellers make trade-offs from the perspective as 'station boss'. It is expected that the selection of means of transportation does not significantly affect the results of this study.

It is assumed that in the current situation (2019) at Nijmegen station, all travellers can travel to and from the station using their preferred mode of access/egress transportation. This means that the modal split consists of voluntary choices and does not include forced choices because there is a shortage of certain access/egress facilities. If a respondent assigns the most points to bicycle parking but chooses to take the bus instead, is is assumed that this is not because they prefer to travel by bicycle and refrain from doing so because there is not enough bicycle parking.

5.1.3. Scenario: limited available space

Based on the average number of daily travellers at Nijmegen station in 2019, the corresponding modal split and the footprints of access/egress facilities, the amount of space needed in the current situation to provide all travellers with access/egress transportation to and from the station was calculated. This shows that there is no shortage of space in the current situation. The same calculation was made based on forecasts for 2040 and 2050 both in the "high scenario. For both years, assuming a modal split as in 2019 and equal available space, there appears to be no deficit of space in the future.

To still present the respondent with a dilemma, a scenario is created in which the number of m² available in the future is only 25% of the space available in the current situation. In this case, together with an increase in traveller numbers (forecast of 2040 in a high scenario), less available space (25% of the current situation) and a modal split as in 2019, there is indeed a shortage of space to provide all travellers with their preferred access/egress transportation mode. As a result, only $0.25 * 19.000 = 4750m^2$ is available. In the choice task in Part 1 of the survey (see 5.4), one percent-point equals $47,5m^2$. As can be seen in table X below, the m² required equals $6955m^2$. From this, it follows that $6955/47,5 = 147$ percentage-points are required. A maximum of 100 percent points can be allocated to access/egress facilities, and that is less than the 147 points required. This results in a dilemma which is presented to the respondent in the survey.

As described at the beginning of this section, it does not matter whether the numbers are realistic. This is because it is about a trade-off of access/egress facilities **relative** to each other based on footprints. For the same reason, the survey does not say whether there is a space deficit in the current situation or in the future. It is mentioned that with redevelopment in the future, there may be less space available and then there will be a lack of space. At the same time, this contributes to the requirement to present as little irrelevant information as possible in the survey.

5.2. Survey objectives

The data objectives to be collected with the survey are:

- The distribution of space proposed by **train travellers**.
- The substantiations **train travellers** provide for the proposed distribution of space. Including the main themes and arguments involved.
- The distribution of space proposed by **station developers**.
- The substantiations **station developers** provide for the proposed distribution. Including the main themes and arguments involved.
- The distribution of space proposed by **subgroups of train travellers**, based on demographics (i.e. gender, age, and education level) and traveller characteristics (i.e. most frequently used access/egress mode, travel frequency, and travel purpose).
- The substantiations **subgroups of train travellers** provide for the proposed distributions. Including the main themes and arguments involved.
- What **train travellers** and **station developers** think about asking travellers for advice from the perspective of the station boss.

5.3. Program of Requirements

The program of requirements serves as a starting point for the development of the survey. It describes the data needed and the design and implementation requirements.

The **required data** sets are formulated based on the survey objectives. Table 5.2 shows the requirement of a distribution of space with an associated substantiation of the proposed distribution, from the two sample groups. Furthermore, the demographic and transportation-related characteristics of each individual respondent are questioned. With this data, complementary analyses can be done to identify differences and/or similarities within the target group or between the two sample groups. These data are required for discussion of the preliminary expectations (listed in Chapter 1).

To obtain the required data, the survey is subject to the following **design requirements**. The design requirements are formulated and validated in collaboration with NS Stations research experts.

- The survey consists of at least two sections or questions, one section collecting quantitative data and the other qualitative data.
- The target audience includes everyone as long as they are familiar with the train station of the case study. That means that the survey should be understandable to all types of people, regardless of age or education. Specifically, this means that the texts meet the B1 language level.
- It is important that respondents interpret the questions in the same way. Therefore, the questions need to be formulated unambiguously.
- The questions are the same for both target groups to be able to compare results.

Table 5.2: Overview of data gathered with survey

Sample Group	Element	Format
Travellers	Prioritization of access/egress facilities	Scores between 0-100 for each alternative
	Substantiation of distribution of points	Plain text
	Demographic characteristics	Gender Age Level of education
	Traveller characteristics	Most frequently used access/egress transport mode Travel by train frequency Main trip purpose
Station Developers	Prioritization of access/egress facilities	Scores between 0-100 for each alternative
	Substantiation of distribution of points	Plain text

- The survey presents a dilemma in which the respondent is forced to make a trade-off. The data is not usable if no trade-off is made.

In addition to the design requirements, **implementation requirements** are formulated:

- The duration of the survey should not exceed 10 minutes. A survey longer than 10 minutes without compensation increases the probability of respondents dropping out. Revilla & Ochoa (2017) state that the optimal length has a median of 10 minutes and a maximum of 20 minutes. Experience within NS shows that the probability increases of panellists dropping out if the survey takes more than 10 minutes to complete. In addition, the panel administrator wants to prevent people from not wanting to participate in surveys in the future.
- Experience within NS shows that respondents go through surveys quickly and do not read everything in detail. This underlines the importance of making the questions quick and easy to understand to ensure that all respondents interpret the questions correctly and in the same way. More specifically, this means as little text as possible and self-explanatory questions.

5.4. Survey choice task

The respondent is presented with a dilemma through a 'choice task' which simulates the trade-off of access/egress facilities based on space usage. Figure 5.2 shows the choice task presented to the respondent. The choice task consists of eight access/egress facilities. Using the corresponding sliders, the respondent is able to assign the number of desired percentage points to each alternative. The initial value, as presented in the figure, represents the current situation in which too much space is being used. To the upper right are two gauges representing the two constraints: the minimum total capacity (minimum 9,999 travellers) and the maximum available space (maximum 100 points). If the two constraints are met, the respondent is allowed proceed to the next part of the survey.

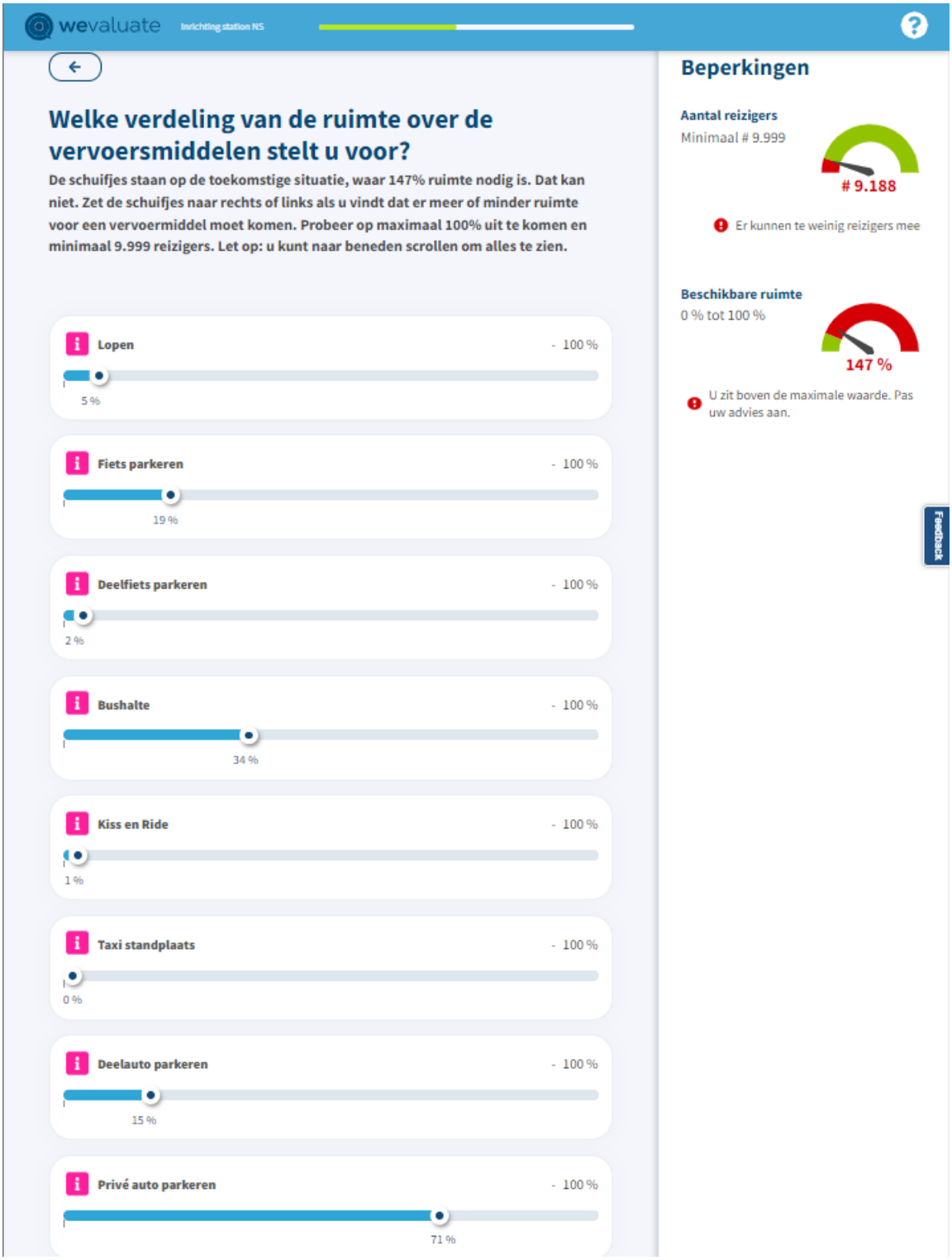

Figure 5.2: Survey Choice Task

5.4.1. Design

A selection of access/egress facilities is presented in order of space utilization per user (i.e. footprint). It is very important that the respondent is aware of the variations in how much space the access/egress

facilities take up per person, e.g. the footprints of the facilities. It is decided to not show the footprints per access/egress facility to the respondent. The numbers are specific, and it is expected that many respondents have no sense of them. Showing these numbers makes the task more difficult and increases the time it takes to understand the task. To still make it clear that the modes of transportation have different footprints, it was decided to sort them in the choice task from smallest footprint to largest. However, the footprints are included but not directly visible, they can be accessed by pressing the information button on one of the alternatives.

The respondent is asked to allocate 100 points among these facilities. A maximum of 100 percent was chosen instead of a strict requirement that exactly 100 percent must be allocated. This was chosen primarily for user friendliness. In the testing phase, it was found that respondents drop out once they have awarded 99 points and cannot move on to the next question. However, textual explanations do specifically state that the objective is to distribute all 100 percent. This prevents people from assigning fewer points because they think the space should be used for something else. This is in line with the reason why there is no ”other” category.

One point represents a certain amount of space in m², which is 1/100 of the available space at the train station under study. It is decided to use percentage-points instead of the real squared meters. We expect respondents to have a better and more consistent understanding of allocating 100 points or percent instead of squared meters. In the future situation (i.e. the start situation in the choice task) the use of space exceeds 100%. It is intuitive that this is not possible. The instructions explain that 100% of the space is reserved for access/egress facilities and that 100% of that can be used.

In addition to the space constraint of 100 points, there is a minimum number of travellers who can use the access/egress facilities. The train station handles a certain amount of travellers. All these travellers should be able to reach and leave the station with access/egress transportation. All facilities combined must serve at least the number of train travellers. For example, with 100% car parking, there is insufficient capacity to allow all travellers to reach and leave the station. Hence, the distribution of space points among facilities must generate sufficient capacity. A maximum number was considered to ensure that it is not possible to allocate all points to one of the efficient means of transport. However, in order to maintain maximum freedom, it was chosen not to set a maximum. If the respondent allocate all points to one or more efficient means of transport (e.g. walking), a justification is requested in the open questions after the choice task.

The two trade-off constraints in the choice task are presented visually to the respondent. Two gauges indicate the range in which the choice made satisfies the two constraints. The first shows the number of space points used and the second shows the total number of travellers served by the proposed distribution.

To maintain the current modal split combined with the future number of travellers (growth) and/or less available space, the allowed 100 points will be exceeded. As there are only 100 points to allocate, the respondent must make choices. The sliders in the choice task are given an initial value. This initial value corresponds to the current modal split, extrapolated to the future number of travellers and available space. From this initial value, the respondent has the choice of assigning more or fewer points than necessary to allow everyone in the future to use the mode of transportation they would like (derived from the current modal split). With the use of sliders, it is visible to the respondent what the relative distribution of points is. It is opted for to include starting values in the choice task, rather than setting the starting values at zero for all modes. This has the advantage of giving the respondent a perception of a realistic distribution of space in relation to the modal split. From the initial values, it is

easy to assign more or less points, instead of having to come up with a value themselves. In addition, it is expected that this will prevent the respondent from giving the majority of the points to one or more space-efficient modalities and thus quickly satisfy the constraints and quickly complete the survey.

No ”other” category was added to the list of alternatives. It is expected that if this category is added, the respondents may trade off access/egress facilities as a whole against other functions such as shopping or housing. Therefore, an ’other’ category was not added to ensure that the alternatives shown are weighed against each other and not against something else. However, to still promote full freedom in answering the questions, the following question is added: ”You had to distribute 100 points. If you would have preferred to use less than 100 points, could you explain that?”

5.4.2. Input data

Data are needed to create a realistic choice task. First, key numbers about access/egress facility space usage (footprints in m²/user) are required to calculate the actual space usage for each individual facility. Table 5.1.2 presents the modes considered, including the footprints. Second, the current modal split provides insight into how travellers currently get to and from the station. This modal split is shown to the respondent to get a feeling for a realistic distribution and to show that in the future situation the current modal split cannot be maintained. Third, it is necessary to know the current space use of access/egress facilities at the station being studied. This serves as a starting point in the choice task. Or, if in the future more or less space is available for access/egress facilities, the future available space can be used as starting point. The available space is set equal to 100 points.

5.4.3. Calculations

It is assumed that in the current situation exactly enough space is used for all travellers to use the mode of their choice. In other words, the current modal split and daily boarding and alighting train travellers correspond exactly to the space used for access/egress facilities in the current situation. This space use is equated to 100 ”space points” or 100%.

When the respondent changes the distribution of points among the facilities, space usage and capacity are instantly calculated in the background. The numbers are not shown to the respondent, it only says whether the requirement of total minimum number of travellers is met or not (i.e. the sum of all facilities). This avoids influencing the respondent (e.g. encouraging maximization of the number of travellers). Calculations are made using the following steps. The calculation is mathematically represented by the function 5.1.

1. The key numbers of space usage per access / exit facility are given in space per user [m²/user]. This number is first converted to the number of users per square meter [#users/m²]. This step results in values for y_i. All values are listed in Table 5.1.2.
2. The percentage assigned x_i by the respondent is multiplied by the corresponding footprint y_i. See equation 5.1.
3. The first two steps result in the number of travellers per access/egress facility, proposed by the respondent. In the end the sum is calculated to see if the minimum traveller threshold is met.

$$N_i = x_i * \frac{1}{A} * y_i \tag{5.1}$$

where:

N_i = traveller capacity of access/egress facility i [-]
x_i = Allocated percentages at access/egress facility i [%]
y_i = Footprint access/egress facility i [users/m²]
A = Total area available for access/egress facilities [m²]

Equation 5.2 provides an example calculation in a synthetic case study study (see Section 5.1) where 35% is allocated to bicycle parking.

$$N_{bikeparking} = 35 * \frac{1}{4750} * 3,33 = 5536 \tag{5.2}$$

5.5. Survey questions

To further understand the trade-off process which is simulated in the choice task, additional questions are asked. These questions aim to gain insight into what is involved in making the trade-off. Using open questions, the respondent is provided complete freedom to describe what played a role in making the trade-off.

To gain insight into why one facility gets more priority than another, respondents are asked which facility gets the most space and which gets the least space. These are the extreme values, and it is expected that this is where it becomes most clear why one is more desirable than another. Because of time constraints to complete the survey, only the extremes are asked for. The following questions are formulated:

1. This question is about the mode of transportation you gave the highest percentages to. Can you explain why you gave the most percentages to this one?
2. This question is about the mode of transportation you gave the least percent to. Can you explain why you gave the least percent to this one?

Next, the respondent is asked if there are any other things that he/she would like to mention about the allocation of points to access/egress facilities. This question was added in order to not lose potential interesting elements, such as out of the box ideas, sentiment that comes into play or certain important elements not asked in the previous questions. The question is formulated as follows:

3. Which other things played a role into the distribution of points (e.g., what trade-offs did you make and what themes played a role)?

The respondent is asked to allocate 100 percentage points. No hard constraints are built in to maintain a good user experience. Due to the exploratory nature of this study and the desire to maximize the freedom of the respondents, respondents are asked if they would rather have distributed fewer points. There may be an interesting rationale behind this that plays into the consideration of access/egress facilities. The question reads:

4. When you would have preferred to use less than 100 points, could you explain your preferences?

Traveller and demographic characteristics are used in the data analysis to find differences between clusters of respondents. The selection of these characteristics is based on the preliminary expectations (as listed in Chapter 1). The **traveller characteristic** about their most used access/egress

transportation is specific to the case study, as the available access/egress facilities differs per station. Since this research and survey are applied to Dutch train stations, the question about education includes diplomas available in the Netherlands. To complete the picture, respondents are asked what they think of this method of consultation. All the questions are listed in Appendix D.

5.6. Survey pilots

The survey is reviewed at different stages in the process. It is discussed with people from both sample groups: train travellers and station developers. It is also discussed with researchers who have experience consulting travellers and with researchers who have experience consulting citizens from the policymaker's perspective. In addition, two pilots are conducted with both experts and travellers. In the end, knowledge is gained from these pilots and discussions in terms of design, content/topic, level of difficulty and user experience.

The main findings of this test phase are:

- Significantly lowering the level of detail. It is necessary to avoid overloading a respondent with too much information. Furthermore, this is an exploratory study, so a high level of detail is not necessary. In a follow-up study, certain issues can be explored in greater detail. Examples of information that was excluded: details about access/egress facilities such as ”double layer bike racks that can be used on both sides,” which moment in the future (year, traveller numbers) and what peak load is involved (rush hour).
- Limiting the number of options in the choice task. Giving priority to means of transport that people are familiar with. This means excluding less well-known, emerging, or not yet implemented means of transportation. For example, shared electric scooters and scooters and self-driving cars are not included. Nor is the ”bell bus” specifically mentioned. The number of options is also limited by lowering the level of detail since no breakdown is made for example for 'free float shared bikes' and 'station based shared bikes (OV-Fiets).
- It appears to create confusion among the respondents if walking is excluded. However, walking should be excluded from a theoretical point of view since walking as an access/egress transportation does not require physical facilities to switch from the access/egress transportation mode to the train. Walking is included in the options to make the choice task more realistic and avoid confusion.
- The option of being able to allocate space to functions other than access/egress transportation appears to create confusion and reduce focus on the dilemma being addressed.
- It is found that the language level should be lowered significantly. As an indication, the language level Dutch B1 was used. The length of the texts and the number of questions also appeared to need to be reduced.
- All the above points were applied in further iterations to reduce the total duration of the survey to a maximum of 10 minutes. In the testing phase, length proved to be the main challenge.

6

Evaluation of Survey Results

This chapter discusses the data analysis of the responses collected from the survey. The first section describes the survey execution in terms of number of respondents and the validity of their responses. The second section analyzes the quantitative data and discusses it in relation to the qualitative data. Next, based on these analyses, the 'preliminary expectations' are evaluated in the last section and form the answer to sub-question 3. The last section interprets the survey results and therefore contributes to answering sub-question 4.

6.1. Survey Descriptives

Invalid responses are filtered out of the dataset. First, out of the 168 responses are 5 'screenouts', which means that the respondent is out of the target group (i.e. respondent does not use Nijmegen at least once a year). The respondent is then immediately directed to the end of the survey and cannot complete the questions. Second, 43 respondents did not complete the survey. This results in 110 valid responses, of which 104 are travellers and 6 are station developers. Table 6.1 provides an overview of these data set characteristics after the filtering process.

Table 6.1: Raw dataset characteristics filtering characteristics

Characteristic	**Value**
Total responses	168
Screenouts	5
Incomplete responses	43
Dropout-rate	26%
Net valid responses	110
… of which are Station Developers	6
… of which are Travellers	104

The sample size of station developers is considerably smaller than the sample size of travellers. However, the population of station developers and service developers combined equals 13, which means that with 6 respondents 46% of the population participated in the survey. Based on this, it can be concluded that it is a meaningful sample. This makes it acceptable to study the sample groups of travellers and station developers relative to each other.

The distribution of respondents among subgroups influences the data analysis as there are big differences in group size. Comparing subgroups with small sample sizes makes the analysis less reliable.

Therefore, in the data analysis, the subgroups' size is considered to make valid analyses. The distribution by demographic and traveller characteristics is attached in Table 6.2.

Table 6.2: Distribution of respondent characteristics

Category	Description	Amount
Group	Traveller	104
	Station Developer	6
Most used access/egress transport mode	Walking	36
	Bike	40
	Shared bike	6
	Bus	20
	Kiss & Ride	3
	Taxi stand	0
	Shared car	0
	Private car	0
Gender	Woman	42
	Man	67
Age	17 years or younger	0
	18 – 29 years	47
	30 – 49 years	46
	50 – 69 years	16
	70 years or older	0
Trip frequency	Less than once a year	0
	On average once a month	31
	More than once a week	79
Trip purpose	Family, shopping, hobby	50
	School or study	17
	Work, business trip	74
Education	Elementary school	0
	High school	6
	MBO	2
	HBO	15
	WO	86

Based on the time it takes respondents to complete the survey, it can be assessed whether the survey meets the design criterion: "the survey duration should not exceed 10 minutes." When looking at the completion times, it can be noticed that there are outliers. It is likely that these respondents paused during the survey. These outliers can be seen in the total completion times, in the sub completions times of the choices task and in the open-ended questions. Following from the survey test phase it is expected that a completion time of 1 or 2 minutes will not provide valid data. In addition, it is expected that respondents with completion times exceeding 30 minutes paused in between since no respondent

in the test phase took longer than 30 minutes. To minimize the influence of these outliers on the average completion time, the median of the sorted values of all responses is calculated. This value then gives an indication of how long a respondent takes to complete the survey with serious answers and without pauses. Figures E.1, E.2, E.3 in Appendix E provide a graphical representation of the sorted values for the total completion times, choice task completion times and open questions completion times. These graphs show that there are some outliers and that most of the completion times are near each other, so the median gives a better indication of the time it takes an average respondent. As a result, the median for total completion time is 8.2 minutes, for the choice task it is 6.3 minutes, and for the open-ended questions it is 35 seconds (see Table 6.3). Overall, 65% of respondents completed the survey within 10 minutes.

The survey included a quantitative choice task and qualitative open-ended questions. Within the filtered dataset, all 110 respondents give valid responses to the choice task. Out of the 110 respondents, 83 give a valid answer to the first open-ended question, 70 to the second question, 59 to the third question, and 46 to the fourth open-ended question (see Table 6.3). Empty fields and answers that are not related to the question are considered invalid answers as these responses cannot be used in the data analysis.

Table 6.3: Characteristics of filtered dataset

Characteristic	Value
Median total survey completion time [min]	8,2
Median choice task completion time [min]	6,3
Median open question completion time [sec]	35
Valid answers Choice Task	110
Valid answers Q1	83
Valid answers Q2	70
Valid answers Q3	59
Valid answers Q4	46

6.2. Analysis

6.2.1. Quantitative analysis

Each respondent divides 100 points among eight alternatives, resulting in one value per alternative. From these values, the mean, range and deviation of the mean from the initial value are calculated, for all subgroups. The subgroups are based on travel characteristics (access/egress transportation, travel frequency, and travel motive) and demographic characteristics (gender, age, education). This results in three tables. Appendix E contains the tables presenting the mean values, range values, and the deviation of mean values from the initial values.

Mean values

The mean values provide an insight into the ranking of how much space all access/egress facilities are allocated relative to each other. From this, it is immediately clear that there are both differences and similarities between travellers and station developers, which can be seen in Figure 6.1. The most outstanding variations are in alternatives. First, travellers give only 15%-points to walking whereas

station developers give 30%-points. Second, travellers give 26%-points to bus stop whereas station developers give only 16%-points. To all other facilities, the two groups give similar values. These values clearly reflect how much space the modes of transportation should get relative to each other according to the respondents. Figure 6.2 shows the average point distributions of train travellers and station developers relative to the current distribution of space. In it, the increase in space for walking and cycling and the decrease in space for car parking can clearly be seen.

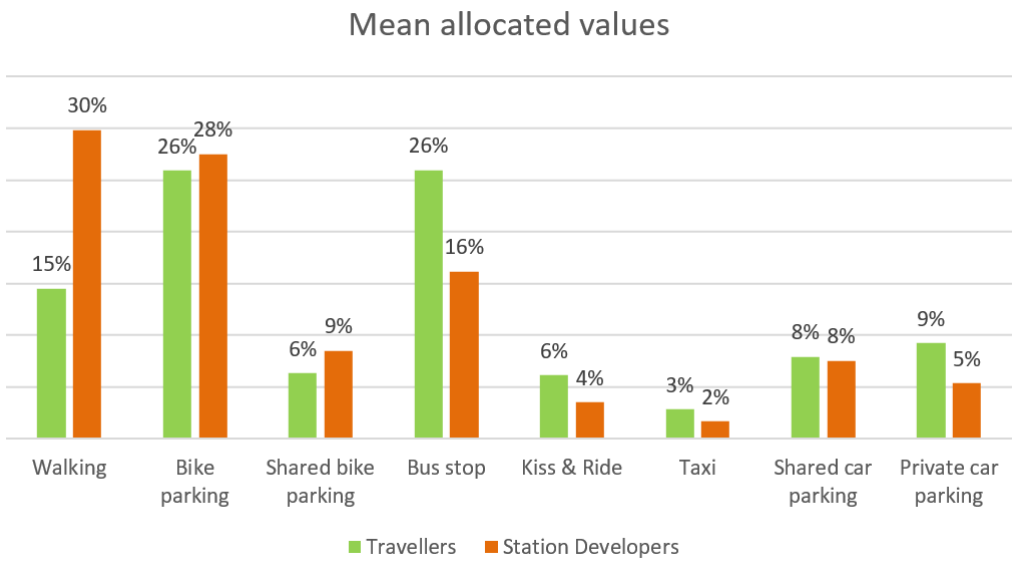

Figure 6.1: Mean allocated %-points

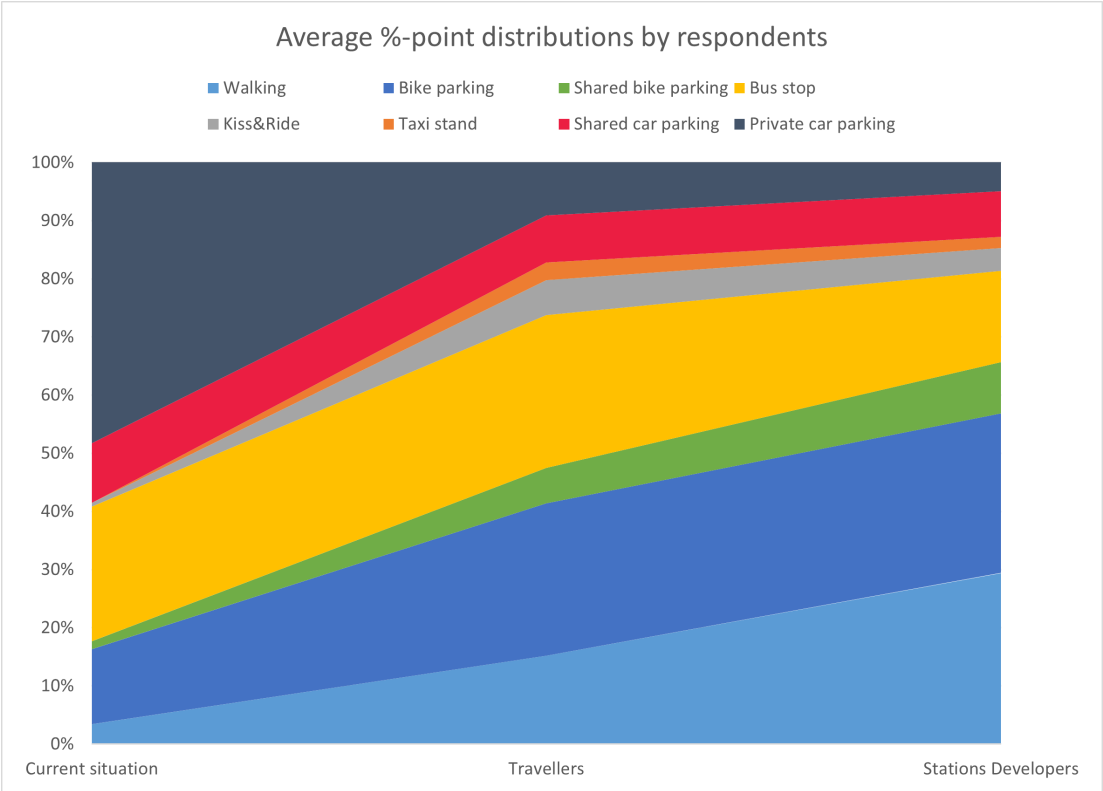

Figure 6.2: Average total %-point distributions in relation to current situation

Range values

The range indicates the homogeneity of respondents within their group. It gives the difference between the minimum and maximum values given within that group, for each of the eight access/egress options. The range is calculated for each group and all eight access/egress facilities.

Figure 6.3 shows that among both the group of travellers and station developers, the range is greatest for walking, bike parking and bus stop. The smallest range is observed in both groups at taxi-station. For all access/egress facilities, the group of station developers shows a smaller range compared to travellers. However, the large difference in N must be taken into account in this case.

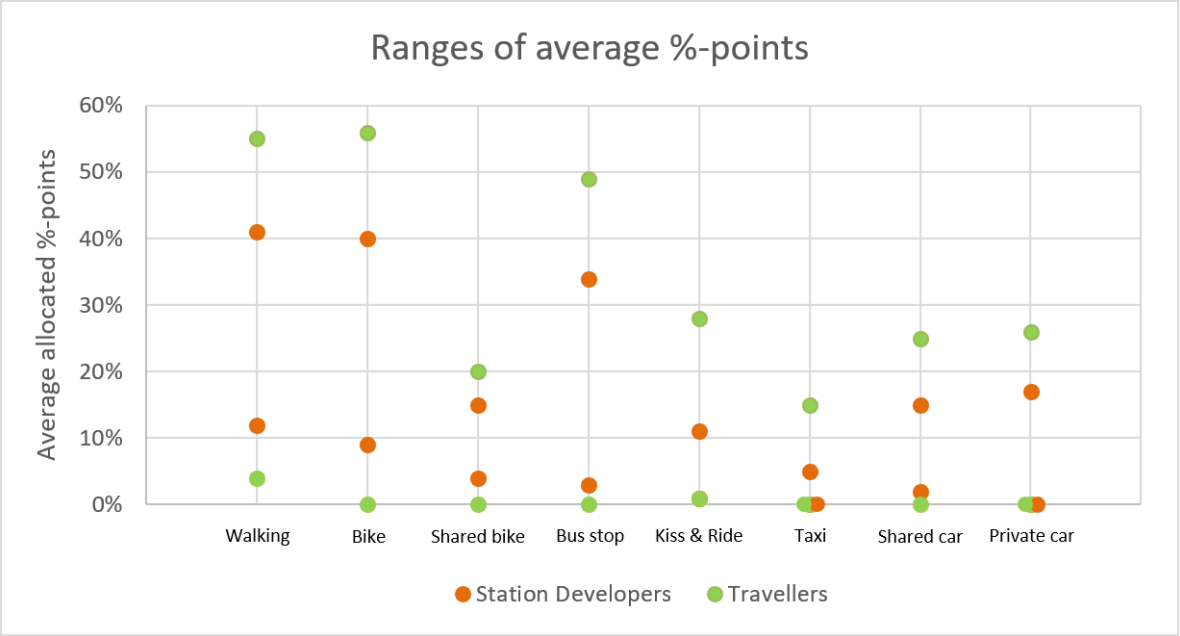

Figure 6.3: Ranges of average %-points

Deviation of mean values in relation to start values

The choice task includes starting values. The respondent divides the 100 points with respect to these starting values, resulting in a relative increase or decrease of the starting value. The mean value indicates the average number of points given to an alternative and thus does not look at the deviation from the starting value. This provides insight into whether the respondent considers that an access/egress facility should be given more or less space compared to the current situation. This determines which access/egress facility the respondent considers relatively more important compared to the others. Figure 6.5 shows the cross table in which the mean values for each subgroup are corrected to the initial values, in other words, the deviation of the mean value from the starting value. Figure 6.4 represents the values graphically.

The choice task lists the access/egress facilities in order of space use per traveller (i.e. footprint). The deviation of the average number of points compared to the starting value follows the order of the footprints: the largest increase in points for the option with the smallest footprint and the largest decrease in points for the option with the largest footprint. The only exception in this trend is the bus stop. Looking at the values in the table, one thing immediately stands out. Walking is assigned the largest increase in space among all (sub)groups (+17%-points on average) while car parking is assigned the largest decrease in space (-64%-points on average).

As with the mean values, the largest differences can be seen between travellers and station developers at walking and bus stop. Travellers assign walking +10%-points more space while station developers assign +25%-points. At the bus stop facility, travellers allocate -8%-points less space and station developers -18%-points space compared to the initial values. At all other facilities, both groups propose a similar increase or decrease in space.

In terms of an increase or decrease in space from the starting value, both groups are equal. They both allocate more space to walking, bicycle parking, share bike parking, Kiss&Ride, and taxi-station. A decrease in space is assigned to bus stop, shared car parking, and private car parking.

Three differences between subgroups of travellers are observed. First, the largest increase in space allocated to a certain facility is given by people who frequently use the associated means of transportation. For example, travellers walking to/from the station assign the largest increase in points to walking (relative to the starting value) in their distribution of points. The same is true for cyclists, who assign the largest increase to bicycle parking in their distribution of points. Share bike users assign the largest increase in space to walking and share bike parking in their distribution of points. Among bus users, no similarity is observed between used access/egress transportation and the largest deviation from the starting value. They assign the largest increase in points to walking. Second, among the gender-based subgroups, it is observed that men (+11%-points) allocate more space to walking than women (+8%-points). Men (-10%-points) also assign a greater decrease in space to bus than women (-5%-points). To the other facilities, men and women assign almost the same average values. Third, the 50-69 year age group (+14%-points) propose a greater increase in space for walking compared to the 18-29 year age group (+8%-points) and the 30-49 year age group (+10%-points). For bicycle parking, the opposite is observed: the 18-29 age group (+8%-points) suggest the greatest increase in space compared to the 39-49 age group (+6%-points) and the 50-69 age group (+3%-points). Between subgroups based on travel frequency and travel purpose, no notable differences are observed.

An Independent-Samples T-Test compares the mean values of two independent samples. The T-test evaluates whether the differences in mean (relative to the starting values) for each access/egress facility between the two groups are significant. The null hypothesis is: the average number of points, relative to the starting value, that train travellers and station developers assign to an alternative do not differ from each other. Figure E.6 shows the T-test results, including the two-sided p-values for 'equal variances not assumed'. Walking has a p-value of p=0.020 and bus stop has a p-value of p=0.091. According to Fernandez (2023), these p-values can be interpreted as follows: there is 'evidence' is that the null hypothesis can be rejected for walking and there is 'strong evidence' that the null hypothesis can be rejected for bus stop. As a result, it can be concluded that travellers and station developers assign significantly different points to walking and bus, and that there are no indications that they assign points differently to the other facilities. This t-test substantiates the observation in the previous section, in which it is found that walking and bus have a noticeable deviation between the two sample groups and that the other alternatives have no noticeable deviation.

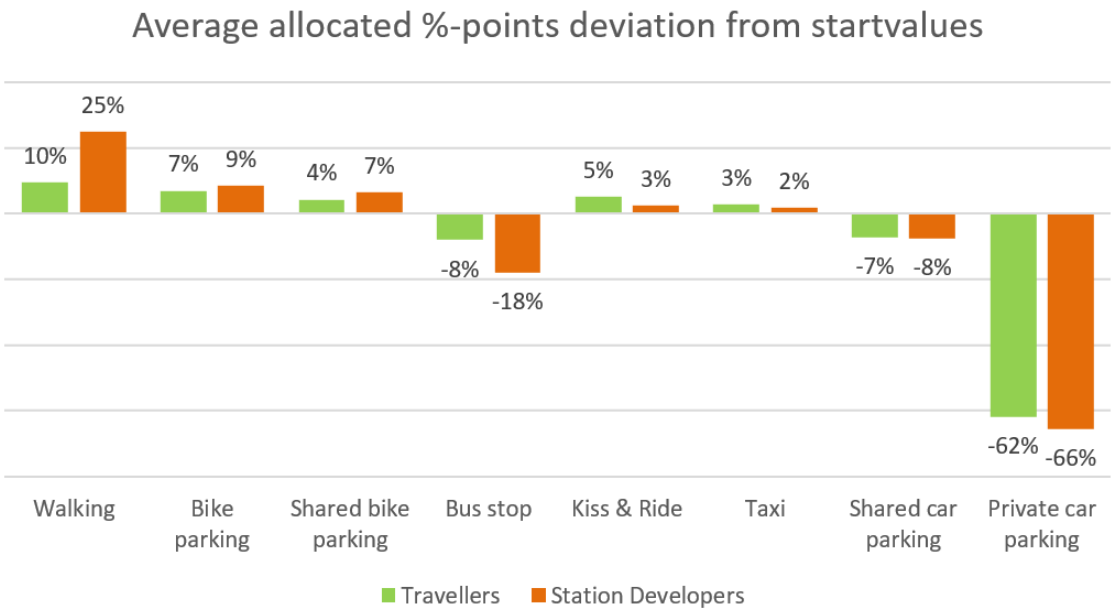

Figure 6.4: Average allocated %-points deviation from startvalues

		Sample size	Walking	Bike parking	Shared bike parking	Bus stop	Kiss & Ride	Taxi	Shared car parking	Private car parking
Sample group	Traveller	104	10%	7%	4%	-8%	5%	3%	-7%	-62%
	NS	6	25%	9%	7%	-18%	3%	2%	-8%	-66%
						Subgroups Travellers				
Access/egress	Walking	34	11%	4%	5%	-8%	6%	3%	-7%	-63%
	Bike	38	7%	11%	3%	-7%	4%	2%	-7%	-62%
	Shared bike	6	14%	4%	13%	-15%	5%	5%	-7%	-66%
	Bus	20	11%	6%	4%	-8%	6%	3%	-8%	-61%
	Kiss & Ride	2	2%	4%	0%	1%	4%	1%	0%	-59%
	Taxi	-	-	-	-	-	-	-	-	-
	Shared car	-	-	-	-	-	-	-	-	-
	Private car	-	-	-	-	-	-	-	-	-
Gender	Woman	37	8%	6%	4%	-5%	5%	2%	-7%	-62%
	Man	66	11%	7%	4%	-10%	5%	3%	-7%	-62%
Age group	17 years or younger	-	-	-	-	-	-	-	-	-
	18 – 29 years	47	8%	8%	3%	-6%	4%	2%	-6%	-60%
	30 – 49 years	43	10%	6%	6%	-9%	7%	4%	-8%	-64%
	50 – 69 years	13	14%	3%	6%	-10%	4%	4%	-8%	-64%
	70 years or older	-	-	-	-	-	-	-	-	-
Trip frequency	Less than once a year	-	-	-	-	-	-	-	-	-
	Approx. once a month	31	9%	5%	6%	-6%	6%	3%	-8%	-62%
	More than once a month	73	10%	8%	4%	-9%	5%	3%	-7%	-62%
Trip purpose	Family, leisure	49	7%	7%	5%	-6%	5%	3%	-8%	-61%
	Study, school	17	10%	9%	4%	-7%	4%	1%	-8%	-61%
	Work, business	68	11%	6%	5%	-9%	5%	3%	-7%	-63%
Education	Basisonderwijs	-	-	-	-	-	-	-	-	-
	Middelbaaronderwijs	6	4%	6%	3%	-2%	2%	1%	-6%	-55%
	MBO	2	33%	-2%	5%	-16%	3%	5%	-8%	-66%
	HBO	14	8%	9%	5%	-9%	5%	3%	-6%	-62%
	WO	81	10%	7%	4%	-8%	6%	3%	-7%	-62%

Figure 6.5: Deviation of mean values from initial values, per traveller subgroup

6.2.2. Qualitative analysis

The qualitative analysis examines the answers given to the four open-ended questions in the survey. On this basis, insight is gained into what played a role in the distribution of points in the choice task. In line with the research question, the responses of train travellers are compared with those of station developers. Answers to the open-ended questions are labelled using keywords that capture the essence of the answer. All keywords are categorized into groups of corresponding keywords. Section 2.6 explains this method. The categories are broken down by sample group: the number of times each category is mentioned by travellers and the number of times mentioned by station developers. Table 6.4 presents the top 5 most mentioned categories in each question (for questions 1, 2, and 3) and the top 3 most mentioned categories for question 4. Appendix E presents the full tables for each open-ended question in, respectively, Table E.1, Table E.2, Table E.3, and Table E.4. Across these tables, it can be seen that the number of times an argument is mentioned in the responses decreases across the four questions. This can be explained by respondents giving an argument in the first question that also applies to the second and/or third question.

From all responses to the first open-ended question, 17 categories are extracted. The five most frequently mentioned are: sustainable modes (22x), space efficient (17x), impact on mobility system (16x), city type (11x) and most people use this (11x). Within the group of travellers all 17 categories are mentioned at least once. Within the group of station developers, 8 out of the 17 categories are mentioned. A total of 142 times an argument from these categories is mentioned in the answers to open question 1.

From all responses to the second open-ended question, 14 categories are extracted. The five most frequently mentioned are: does not belong to a railway system (15x), efficiency (15x), rarely used (15x), sufficient alternatives available (14x) and most people use this (11x). Within the group of travellers all 14 categories are mentioned at least once. Among station developers, 3 categories were mentioned. A total of 108 times an argument from these categories is mentioned in the answers to open question 2.

From all responses to the third open-ended question, 19 categories are extracted. The five most frequently mentioned were sustainable mode (24x), space efficient (11x), impact on mobility system (8x), safety and liveability (8x) and city type (8x). In the group of travellers all categories are mentioned at least once. Within the group of station developers, 7 out of 19 categories are mentioned. In total, an argument from these categories is mentioned 102 times in the answers to open question 3.

When analyzing the categories mentioned in the justifications of the first three questions, it is noticeable that the categories mentioned by both station developers and travellers are in the top 5 most mentioned categories of each question. In other words, if a category is often mentioned by travellers, then that category was usually also mentioned by station developers. It can also be clearly seen that for all three questions, there are no categories mentioned exclusively by station developers. The difference in sample size should be taken into account here, as we expect fewer different categories to be mentioned within a smaller sample size.

From all responses to the fourth open-ended question, six categories are extracted. By far the most frequently mentioned was ’no’. The answer ’more’ was mentioned seven times. This answer is surprising since the question is whether the respondent would have liked to use fewer points and if so, why. An argument was given eight times to explain why the respondent would like to allocate fewer points, covered in five categories. Only travellers answered this question with ’more’ or ’yes, because...’.

Table 6.4: Most frequently mentioned categories within answers to open questions 1, 2, 3, and 4

	Substantiation categories	Travellers	% Travellers	Station Developers	% Station Developers
Q1: This question is about the mode of transportation you gave the highest percentages to. Can you explain why you gave the most percentages to this one?					
1	Sustainable mode (environment, clean, efficient)	21	20%	1	17%
2	Space efficient	15	14%	2	33%
3	Impact/contribution to mobility system	15	14%	1	17%
4	City type (students, car free, green)	10	9%	1	17%
5	Most people use this	9	8%	2	33%
Q2: This question is about the mode of transportation you gave the least percent to. Can you explain why you gave the least percent to this one?					
1	Does not belong at a railway station	15	14%	0	0%
2	Efficiency (space, capacity)	15	14%	0	0%
3	Rarely used	15	14%	0	0%
4	Sufficient alternatives available	12	12%	2	33%
5	Can be located further away or on demand	9	9%	0	0%
Q3: Which other things played a role into the distribution of points (e.g., what trade-offs did you makeand what themes played a role)?					
1	Sustainable mode (environment, clean, efficient)	22	21%	2	33%
2	Space efficient	8	8%	3	50%
3	Impact/contribution to mobility system	7	7%	1	17%
4	(Traffic) safety and liveability	8	8%	0	0%
5	City type (students, car free, green)	8	8%	0	0%
Q4: When you would have preferred to use less than 100 points, could you explain your preferences?					
1	No	26	25%	4	67%
2	More	7	7%	0	0%
3	Yes, for greenery (parks, trees)	5	5%	0	0%

6.2.3. Integral analysis of quantitative data and qualitative data

This analysis integrally analyzes the combination of quantitative choice task and the qualitative open-ended questions in the survey. The quantitative analysis found a significant difference between travellers and station developers in assigning points to walking and to bus.

Station developers give a significantly greater increase in %-points to walking than travellers. In the qualitative substantiation, 3 station developers are considered who gave walking the highest number of %-points and at the same time in their distribution gave the most points to walking. In the qualitative substantiation of why they have given most points to walking, they indicate that walking is an excellent alternative given the young population in Nijmegen and the location of the station close to the city.

Travellers give a significantly smaller decrease in points for the bus than station developers. We consider the 20 travellers who give the highest number of points to bus and at the same time give the

highest number to bus in their distribution. In the qualitative substantiation, they mention inclusiveness / disabled people (5x) most often.

This analysis indicates that station developers are proposing a modal split for travellers. Travellers, on the other hand, actually think about the needs of fellow travellers and want to facilitate them.

6.2.4. Respondent experience

The last page of the survey contains questions about the design and purpose of the study. This provides insight into how the respondent experienced this method of surveying and what they think should be done with the results. Finally, there is room for other comments.

More than half of traveller respondents (54%) feel that traveller advice is as important as that of station developers (experts). The second largest group within the traveller group said the advice of experts is more important than that of travellers (38%). The other categories are mentioned by only less than 5% of travellers. Within the station developer group (i.e. the experts), 33% say the advice is equally important and 50% say the advice of experts is more important than that of travellers. The distribution of opinions is presented in Table 6.5. These results indicate that travellers and station developers have the same opinion: the advice is equally important or the advice of experts is more important.

Table 6.5: Question 1 about this study

1. In this survey, we asked advice from travellers, by letting you, the traveller, take a seat in the chair of the 'station boss'. We also ask advice from experts. Which advice do you think is most important?	Travellers #	Travellers %	Station Developers #	Station Developers %
NS should adopt travellers' advice	0	0%	0	0%
travellers' advice is more important than experts'	5	5%	0	0%
travellers' advice is as important as experts' advice	56	54%	2	33%
Experts' advice is more important than travellers'	40	38%	3	50%
NS should adopt the advice of experts	2	2%	0	0%
Don't know / Would rather not say	1	1%	1	17%

Out of a total of 77 responses to the question, 59 indicated a good understanding of the questions, which is 77% of the respondents who answered this question. Added to that, eleven respondents also found the questions easy to understand, but added a comment: 'may be difficult for other people', 'but the choice task was difficult', and 'but too much to do in limited time'. Altogether, 65 out of 77 respondents indicated that they could understand the questions well, which is 91% of the respondents who answered this question. Remaining, three respondents indicated medium understanding (4%) and four respondents found it too difficult (5%). The scores, broken down by sample group, are shown in Table 6.6.

Table 6.6: Question 2 about this study

2. Did you find the questions in this survey easy to understand?	Travellers	Station Developers	Total	% of responses
Yes	54	5	59	77%
Medium	3	0	3	4%
Difficult / complex	4	0	4	5%
Yes, but may be difficult for other people	4	0	4	5%
Yes, but the choice task was difficult	5	0	5	6%
Yes, but too much to do in limited time	2	0	2	3%
Total			77	100%

6.3. Evaluation of preliminary expectations

In this section, the *preliminary expectations* in relation to the survey results are discussed. First, the preliminary expectations in relation to the case study are evaluated and subsequently in relation to the methodology. The evaluation of these preliminary expectations forms the answer to sub-question 3.

1. As the entire sample group, travellers and station developers allocate space differently, with different justifications involved.

When considering the case study content, it can be seen that in both groups that the magnitude of the deviation from the starting value follows the ranking of the footprints. That means: largest increase in points for the option with the smallest footprint and the largest decrease in points for the option with the largest footprint. The only exception in this trend is the bus stop. Based on this, it is observed that the way in which both groups redistribute space fits the STOMP principle. In terms of an increase or decrease in space from the starting value, both groups are equal (i.e. the same direction). Both allocate more space to walking, bicycle parking, share bike parking, Kiss&Ride, and taxi-station. A decrease in space is assigned to bus stop, shared car parking, and private car parking. However, the magnitude is not the same for all alternatives. Station developers show relative to travellers a significantly larger increase in walking and a larger decrease in bus space.

Regarding the difference in qualitative substantiation, little can be said given the population size of station developers. Nevertheless, there are no arguments specifically mentioned by station developers. The arguments mentioned by station developers almost all fall into one of the five most frequently mentioned categories. In addition, one of the most frequently mentioned arguments ”sustainable mode” and ”space efficient” are mentioned by both groups and also fit the STOMP principle.

Concluding, there are indications that the way both travellers and station developers make trade-offs, have similarities with the priorities incorporated in the STOMP principle. Figure 6.6 links the case study findings to the STOMP principle. However, the focus of the two groups in making the trade-off seems to differ. From the integral analysis of the point distribution and the qualitative justification for the two significantly different values (walking and bus), there are indications that travellers are more focused on the inclusiveness of all travellers, while station developers focus more on the mobility system and propose a modal shift.

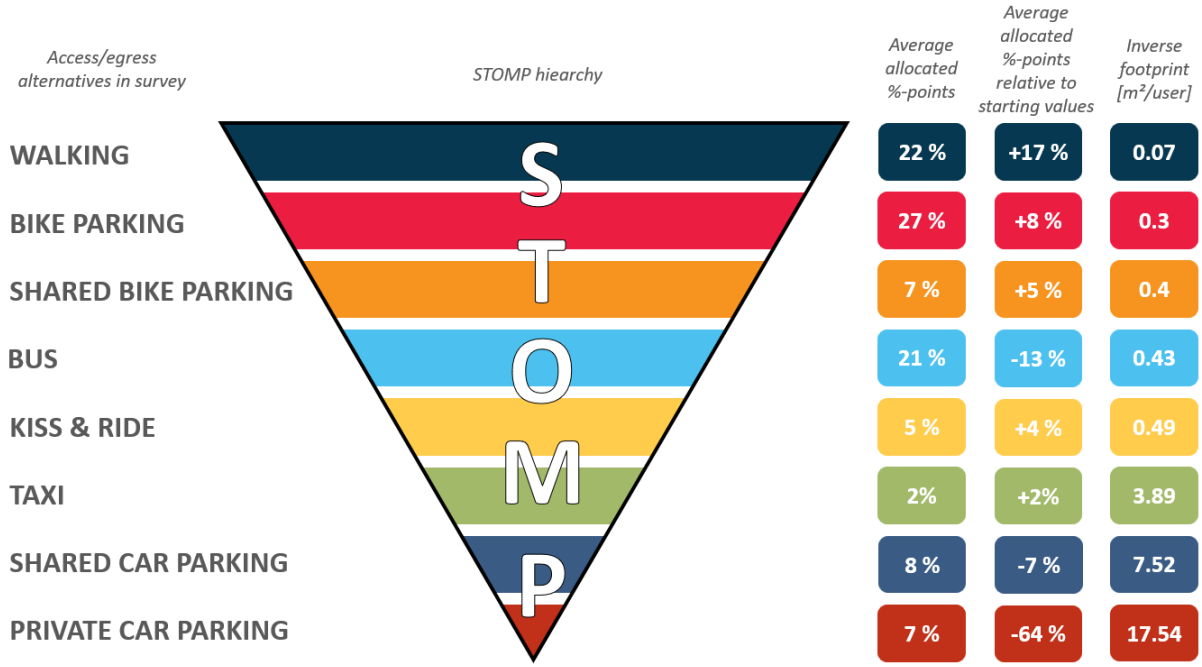

Figure 6.6: STOMP principle in relation to case study results

Regarding the methodology, this method shows that on an aggregate scale, both groups distribute the points in the same way. The way in which both travellers and station developers distribute points among facilities is consistent with the STOMP principle. This means that the outcome of the trade-off made by travellers and station developers seems to have the same outcome.

At the same time, station developers give arguments that are also mentioned by travellers. This indicates that station developers and travellers do not use opposing arguments. On the differences in priorities, and how strongly a category plays a role, we cannot compare with travellers using this method, given the differences in population size of station developers. The absence of major differences in justifications may be explained by the fact that the distributions given are also close to each other.

2. Compared to travellers, station developers are more homogeneous in distributing space.

When considering the case study content, it can be seen that for both groups the range of allocated points is largest for walking, bike parking and bus stop. The smallest range is observed in both groups at taxi-station. For all access/egress facilities, the group of station developers shows a smaller range compared to travellers.

Regarding the methodology, it can be seen that both travellers and station developers do not agree within their groups for every alternative. This is observed through the differences in range for each alternative. For all alternatives, a smaller range is observed among station developers compared to rail travellers. This indicates that station developers are more homogeneous in making the trade-off compared to train travellers. However, the difference in sample size has to be considered.

3. The distribution proposed by station developers follows the STOMP principle.

The distributions made by both travellers and station developers are compliant with the STOMP principle. Since station developers seem to be more consistent than travellers, they also automatically follow the STOMP principle more strictly. The STOMP principle is about prioritizing modes in relation to distance from the station. In the context of this study, station developers allocate space at the station according to the same prioritization: steps over stairs over public transport over MaaS over private transport.

4. The trade-offs made by travellers reflect their demographic characteristics (age, gender and education).

When considering the case study content, it can be seen that there are slight differences between genders: men, relative to women, assign a larger increase for walking and a larger decrease for bus. For the six other facilities, there are no remarkable differences. Within age groups, a greater preference for walking is observed among the 50-69 group and a greater preference for bicycling among the 18-29 group. In terms of education groups, nothing can be concluded due to very limited data.

Regarding the methodology, there are indications that the point distribution made by train travellers reflects their demographic characteristics. Their personal situation plays a role in making trade-offs. However, we cannot measure how strong the tendency is based on this observation because of the non-equally distributed sample and limited data for the subgroups of travellers. No explanation is found in the qualitative underpinnings since no respondent mentioned their own gender, age or education as an area of justification. This is an indication that the effect of demographic characteristics is unconscious.

5. The trade-offs made by travellers reflect their traveller characteristics (personally used access/egress transportation, travel frequency and travel purpose.

When considering the case study content, it can be seen that travellers walking to/from the station assign on average the largest increase in points to walking (relative to the starting value) in their distribution of points. The same is true for cyclists, who on average assign the largest increase to bicycle parking in their distribution of points. Share bike users assign the largest increase in space to walking as well as shared bike parking. However, this trend is not observed among bus users. Based on this, indications are found that in the majority of cases, the greatest increase in space relative to the initial values is given by people who frequently use the associated means of transport. As can be seen in Figure 6.7, the sample size for the different subgroups of travellers based on their most frequently used access/egress transportation is not evenly distributed and for the majority of the subgroups very little data is available. Walking and cycling have the most data available. When looking at the numbers in great detail, it can be seen that people who walk give in their distribution of points the largest increase in space to walking. The same is true for bike parking. However, for all other subgroups based on the most used access/egress mode, this effect cannot be seen. Also, with this dataset, it is not possible to statistically demonstrate whether the indications are true (and if so, how large the effect is) that respondents who walk give more space to walking and respondents who cycle give more space to bike parking. Looking at the point distributions of the subgroups at an aggregate level, a similar distribution of points can be seen for all subgroups, ranging from an increase in active modes (walking, biking) to a decrease in space for cars. See the even distribution of color codes in Figure 6.7. This provides the nuance that the ”preferred mode impact” is limited.

There are no notable differences observed between subgroups based on travel frequency and travel purpose.

			Alternatives in choice task							
		Sample size (travellers only)	Walking	Bike parking	Shared bike parking	Bus stop	Kiss & Ride	Taxi	Shared car parking	Private car parking
Most used access/egress mode	Walking	34	11%	4%	5%	-8%	6%	3%	-7%	-63%
	Bike	38	7%	11%	3%	-7%	4%	2%	-7%	-62%
	Shared bike	6	14%	4%	13%	-15%	5%	5%	-7%	-66%
	Bus	20	11%	6%	4%	-8%	6%	3%	-8%	-61%
	Kiss & Ride	2	2%	4%	0%	1%	4%	1%	0%	-59%
	Taxi	0	-	-	-	-	-	-	-	-
	Shared car	0	-	-	-	-	-	-	-	-
	Private car	0	-	-	-	-	-	-	-	-

Figure 6.7: Points distribution of travellers broken down by subgroups 'most used access/egress transportation'

Regarding the methodology, although, no notable differences are found between subgroups of travellers based on trip frequency and trip purpose, train travellers do tend to allocate relatively more space to the mode of transportation they personally use most often. This means that the traveller includes personal interest in making decisions. This is an important observation, since in the instructions in the survey the respondent was explicitly asked to make a choice that is in everyone's interest. However, based on this observation, we cannot measure how strong the tendency is.

6.4. Interpretation of case study results

The results of the case study can be interpreted from a theoretical and practical point of view. This evaluates what can be learned from the results and respondents' approaches to trading off access/egress facilities (sub-question 4). The theoretical interpretation involves considering the results in light of the literature review. The practical interpretation concerns translating the results into practical relevance and insights. This interpretation is the result of the development of the survey method and its application to a case study.

6.4.1. Theoretical interpretation

First, within this study and in the experiment, no distinction is made between activity-end and home-end functions of a train station in order to examine how respondents consider these functions. Both groups of respondents do not explicitly distinguish between these two functions in the open-ended responses. This indicates that travellers in the seat of the station boss as well as station developers, make the trade-off integral to both functions.

Second, in the literature, there is no consensus in the literature on whether and how walking should be included in studies of access/egress transportation facilities. For example, Stam (2019) assumed that walking has no footprint. The results of the case study show that walking is considered very important and is allocated the largest increase in space by both groups of respondents. Walking is weighed positively against other modes because of its small footprint and sustainable nature, among other reasons. Hence, walking should be included in considerations of access/egress facilities.

Third, a selection of access/egress facilities relevant to station development is listed based on the literature. The experiment shows that respondents include access/egress facilities at an aggregate detail

level. This means that they consider Kiss & Ride and Taxi as one category. The same applies to OV-bike and other shared bike concepts. Concluding: when making trade-offs, the included access/egress facilities can be aggregated into a smaller selection of overarching categories.

Fourth, we can contribute to the lack of literature on how station developers are expected to make the trade-off between access/egress facilities. The literature describes the STOMP principle, which indicates the hierarchy of facilities concerning the distance from the station (i.e. walking closest, private car farthest). In the experiment, both travellers and station developers show a clear hierarchy consistent with the STOMP principle. In this, only the bus is an exception. So, it can be concluded that for Nijmegen station the following hierarchy applies: walking, bicycle, shared bicycle, Kiss Ride, Taxi, shared car, bus, and private car. This indicates that STOMP can also be used for space distribution and not only for the distance to the station. Further research is needed to understand the bus exception.

As last, the hierarchy that follows from the experiment also supports the three main shifts in the ”station environment right of way”: cleaner power, shared economy, and space efficiency. Respondents most often cited ’sustainable mode’ and ’space efficiency’ as justifications for their choices. The importance of shared mobility is explicitly mentioned a couple of times.

6.4.2. Practical interpretation

The Expert Discussion Group discusses the Survey Results. This practical interpretation provides an understanding of the value of the results. The results show that this method can contribute to station design. The starting point of the station designers is the current modal split at a specific train station, on which they base which groups are most important. The results show that travellers tend to assign the greatest increase in space to the mode of transportation they use the most. This often corresponds to the modal split. This observation does not provide new information. However, the results provide a new insight, which is threefold.

First, travellers may often use a particular mode of transportation, but it may not be the one they prefer. Based on the case study results, it can be determined which means of transport they consider the most important. It is not shown that that is also the means of transportation they would prefer to use, but the point is that the modal split does not have to correspond to the means of transportation that travellers find most important to allocate space to at the station.

Second, in addition to finding out what the traveller thinks is the most important means of transportation, it is also known what means of transportation they think is second most important, and third, and so on. This gives station developers justification for the choices they make. If a choice is made to reduce a particular facility, it can be shown that those users can still use the means of transportation they have identified as the second most important. For example, the private car can be parked close to the platform at some stations. Based on the modal split, car users appear to be the most important group. The fact that there are many car users is partly because there are good facilities. If it turns out that car users find the bus the second most important, then it can be substantiated why the number of parking spaces is reduced while more space goes to the bus. At the same time, a modal shift from car to bus can be stimulated. Concluding, this method can serve as a tool in discussions about modal shift and can be used to predict the new choice of travellers when their preferred mode of transportation becomes less available.

Third, allocating points in this way with justification about why certain means of transport are allocated the least space, provides insights into why people do not use certain means of transport. For example,

possibly the access routes are not convenient, or the design of the station environment is unsafe.

7

Conclusion, Discussion & Recommendations

This chapter reflects on the research conducted. First, the answer to the research question forms the conclusion of the study. Next, the discussion section reviews the context in which the conclusion of the study should be considered. This includes a discussion of the research method, representativeness of the samples, choices and assumptions made, limitations of the study, and the applicability of the methodological-related findings in a different context. Finally, there are recommendations for follow-up research, for either similar applications of this research method or research for improvements of the method.

7.1. Conclusion

The conclusion formulates the answer to the research question: ***To what extent does train traveller consultation from a 'station developer' perspective provide new insights in trade-offs regarding access/egress facilities at a train station in a situation where space is restricted?***

Consulting travellers from the station developer's perspective as well as the actual station developers provides a transparent understanding of how trade-offs are made and how to optimally allocate space at stations according to station developers and according to travellers. This is important because The Netherlands faces several challenges now and in the future, including the increasing scarcity of space. The population is increasing and with it the travel demand. As a result, the value of land around train stations, which are often located in built-up areas, is increasing. There are different competing interests in distributing space at stations in the current situation. For example, real estate parties want to develop housing and stores there. At certain stations, the bus station is moved because of the amount of space it occupies. In addition, the Dutch National Railways (NS) wants to provide as many types of access/egress facilities as possible in order to make it as attractive as possible for travellers to use the train. So it is very important to make informed choices when distributing scarce and valuable space around train stations. This research provides a method by which access/egress facilities at stations can be weighed on the basis of space utilization. By examining how train travellers make this trade-off and comparing it to how station developers make the trade-off, an optimal distribution of space and an optimal supply of access/egress facilities can be achieved. As a result, a new method is provided to researchers in science and practice to study trade-offs in train station design in a structured and substantiated manner.

The research question is answered based on empirical research. This requires a suitable consultation

method that allows travellers to experience a trade-off ”from the perspective of the station owner”. To determine the extent of new insights, a specific trade-off made by travellers is compared to that of station developers in a case study. This study shows that consulting train travellers from the perspective of the station owner provide new insights when considering access/egress facilities at stations. These involve insights ranging from an aggregate methodological level to a higher level of detail within the case study. Figure 7.1 shows the four categories of new insights based on this study.

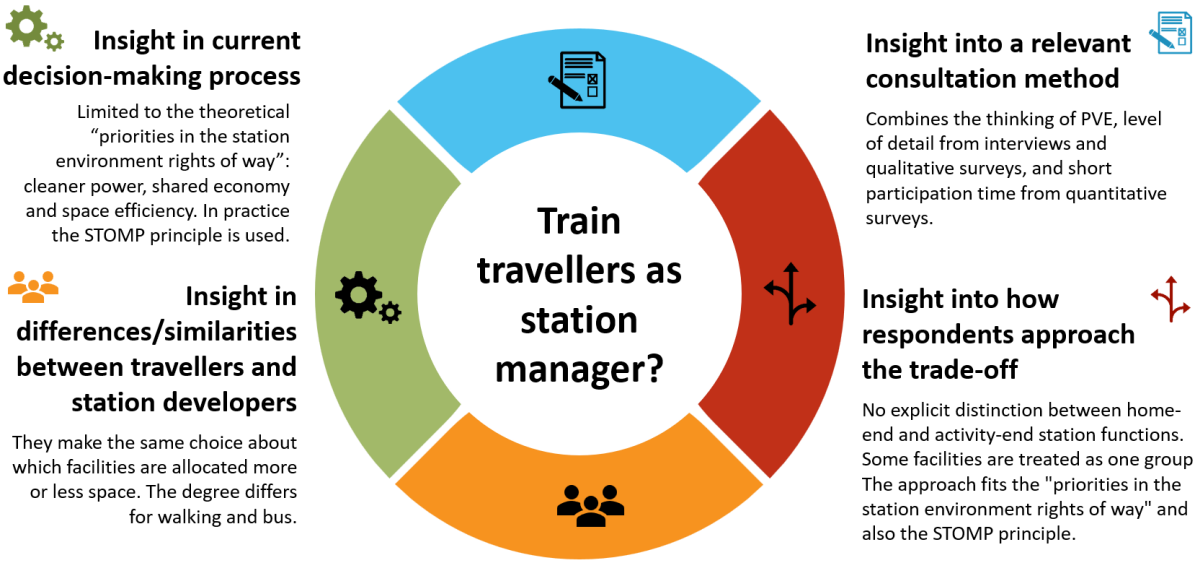

Figure 7.1: Insights in access/egress facilities trade-offs

Insight into the decision-making process in the current situation

To answer the main question, we first want to know how station developers make trade-offs between access/egress facilities in the current situation. The ”station environment rights of way” formulates three main priorities: cleaner power, shared economy and space efficiency. Also, the interviewed experts indicate that they themselves use STOMP for prioritization. The theoretical and practical approaches for making trade-offs are limited to these two principles. In the end, there are no clear guidelines on how to trade off access/egress facilities at railway stations based on available space. Also, access/egress facilities are often developed individually. Integral decision-making based on clear and objective criteria is lacking. In fact, in the current situation, it is a political process. This underlines the relevance of this research: decision-making is studied in a transparent and neutral manner and the trade-offs between facilities are studied in an integral approach. At the same time, this study investigates which factors play a role in decision-making, which is not explicitly clear in the current situation.

Insight into a relevant consultation method and how it works

In order to be able to gather data, it is needed to obtain insights into a relevant consultation method and how it works. This study provides a method that can be used when making choices in station development. This method is applied in a case study that provides insight into how it can be used and how it works. In this study, a consultation method is developed which consists of a combination of a quantitative and qualitative survey. It applies the thinking of PVE in which the citizen (in this case the traveller) takes the place of the policy maker (in this case the station developer). In addition, it maintains the depth and level of detail of interviews and qualitative surveys while at the same time maintaining a short participation time and low participation threshold. This creates a survey that allows a quantitative question to be presented in the first part. Here, the respondent has to trade off the alternatives. In the

second, qualitative part, textual justifications are asked to motivate the choices made in the quantitative part. This method is suitable for consulting train travellers from the point of view of the station owner. At the same time, this method can also be used to present station developers with the same issue to objectively compare the outcomes.

Insight into the differences and similarities between travellers and station developers when trading off access/egress facilities

The most remarkable insight is that travellers and station developers make roughly the same choice of whether to allocate more or less space to an access/egress facility. Using a case study at Nijmegen station, the trade-offs of access/egress facilities by both travellers and station developers are studied empirically. On the one hand this provides insights into the similarities and differences between travellers and station developers and on the other hand into the application of the developed consultation method. The similarity between the two groups can be observed by similar priorities in terms of relative importance of access/egress facilities. Relative to the current situation, both groups propose an increase or decrease in space that corresponds to the order of the facilities' footprints. That means the largest increase in space for walking, which has the smallest footprint, and the largest decrease in space for private car parking, which has the largest footprint. This indicates that the outcome of the trade-off made by travellers and station developers have the same outcome. This prioritization largely fits the priorities of the STOMP principle, with the exception of the position of the bus. While the directions of the increases or decreases are identical, the magnitudes differ slightly. Additionally, station developers give arguments that travellers also mention. This indicates that station developers and travellers do not use opposing arguments. This means that station developers make roughly the same choices as travellers when considering access/egress facilities. This is an indication that station developers are well aware of what the traveller would do or it is an indication that travellers and station developers consider all interests in the same way.

Differences between the two groups can be seen in how trade-offs are addressed. There we see that station developers are more homogeneous than travellers: their answers are closer together. Here the difference in group size possibly plays a role. Another indication for the cause of greater range within the group of travellers is the (unconscious) influence of demographic and traveller characteristics. There are indications that train travellers' responses represent their demographic characteristics. However, we cannot measure the magnitude of this effect based on this dataset. No explanation is found in the qualitative underpinnings since no respondent mentioned their own gender, age or education as an area of justification. This is an indication that the influence of demographic characteristics is unconscious. When we consider traveller characteristics, we found indications that train travellers tend to allocate relatively more space to the mode of transportation they personally use most often. This means that the traveller includes personal interest in making decisions. However, we cannot measure how strong the tendency is based on this observation because of the non-equally distributed sample and limited data for the subgroups of travellers.

Insight into how the respondent approaches the trade-off

This method provides insight into how different types of access and egress facilities, as discussed in the literature, should be considered in station development. There are a number of implications regarding the method content (i.e. access/egress facilities at train stations). First, train travellers and station developers weigh access/egress facilities integrally without distinction between home-end and activity-end functions. Second, walking is considered the most prominent mode by both participant groups, while in literature walking is left out of consideration when determining space use. Third, respondents consider several modes at an aggregate level. They combine, for example, Kiss&Ride and Taxi. Fourth, the results largely support the generally formulated 'priorities in the station environment

right of way', since the two most frequently mentioned arguments (i.e. sustainable mode and space efficiency) correspond to two of the three listed priorities. Last, the STOMP-principle, adapted to the specific situation at a station, can be used for prioritization.

Another important 'content-related' insight coming from this study is which modalities the traveller considers most important, as second, as third, and so on. This is interesting because the modal split indicates which mode a traveller uses, but it does not have to equal the preferred mode. Which modality travellers have as their second or third preference is also a valuable new insight. This gives station developers justification for the choices they make. If a decision is made to reduce a particular facility, it can be substantiated with that users can still use the means of transportation they have identified as the second most important. In addition, the qualitative data provide insight into why travellers do not use or infrequently use certain modes. This consultation method makes the preferences within a specific context concrete, making the (re)development process clearer and choices better substantiated.

7.2. Discussion

This section discusses the research methods applied, the assumptions and choices made, the representativeness of the different sample groups, the limitations of this study, and finally the applicability of this research method in a different context.

7.2.1. Research methods

This study has a **qualitative and exploratory** nature. The research question of this study has a broad scope and is therefore exploratory in nature because of time constraints. It has a qualitative nature because the insights and opinions of stakeholders are needed. Given the fact that it concerns the perspectives of a number of people who are part of larger populations, not all perspectives and opinions may have been included. This could imply that there are different results if different or larger samples are taken. Section 7.2.2 elaborates on the representativeness of the samples.

The application to a **case study** allows for goal-oriented data collection. Based on the case study, the research question is answered. However, when a different train station serves as a case study, different results may be obtained. We were not able to verify this because of the reason for just one case study: time constraints. To minimize possible differences, an average case study train station is chosen: it belongs neither to one of the exceptionally large stations nor to one of the smallest, it is located in a medium-sized city, has equal distribution access and egress, and facilitates almost all access/egress facilities that exist among all Dutch railway stations in the Netherlands in the current situation.

Section 4 studies literature related to different **consultation methods**. The Multi Criteria Analysis (MCA) then shows that a quantitative and qualitative survey best fit the research question. A combination of the two scores even better. This section evaluates whether the method used has performed as expected in the MCA.

The criterion *possible to place the respondent on the seat of the decision maker* is applied in the combination survey and performed as expected. We cannot prove whether the respondent actually completed the questions from that point of view. However, from the qualitative answers, it can be derived that people give nuanced answers and take into account the interests of other travellers, thus not making the trade-off from an individual point of view. The criterion *applicable to both laymen and professionals* performs as expected. However, a number of respondents did not complete the survey.

The sample group contains many highly educated people in the field of mobility, so we cannot show that laymen are actually able to understand the survey. From the test phase of the survey, laymen are expected to find participation in the 'point distribution part' of this method more difficult than professionals. To get enough laymen to successfully complete the survey, it should be specifically targeted in the future. Then it can also be examined whether they are equally capable of participating in this method.

The criterion *ease of making it representative for a larger population* performs worse than expected. Without a representative panel, it is difficult to reach certain target groups with techniques such as social media, flyers at the station and personal communication. Furthermore, not all panels are representative. Therefore, this method scores neutral (-) rather than very good (++). With that, it has a shortcoming compared to quantitative surveys because these are much shorter and easier to understand and thus a higher variety of respondents can be recruited, making it easier to create a representative sample.

We have shown that this method allows both station developers and travellers to participate. The results are useful for comparing the trade-offs made by travellers and station developers. This complements interviews and PVE. Relative to interviews, it is possible to obtain a larger number of respondents in the same available time. The same applies with regard to PVE: it is complementary given the limited time required, which is often limited among experts. With this, more professionals may be willing to participate (voluntarily). Applying a combination of a quantitative and qualitative survey, we developed a new consultation method. In this method, the mindset remained where the citizen (in this case, the traveller) takes the seat of the policy maker (in this case, the station boss). However, the topic is stricter scoped and focused. As a result, 65% of participants take a maximum of 10 minutes to participate and 84% of respondents take a maximum of 15 minutes. By comparison, in PVE, respondents 'typically' need 20-30 minutes (TU Delft, 2022b). Relative to interviews, the difference is even greater. An interview often takes at least 30 minutes. In addition to finding a middle ground between interviews and short surveys to minimize the participation threshold, we seek a middle ground between in-depth interviews and more general surveys to be able to present both laymen and professionals with the same question. As a result, comparing how citizens weigh in and how policymakers themselves do so is an innovative addition to existing consultation techniques.

7.2.2. Representativeness

A large proportion of the population of station developers are involved in the **interviews and Expert Discussion Group**. We do not expect different results if a different sample is taken within NS Stations for the expert interviews and the Expert Discussion Group. Because we already have about half the population in the sample and they are consistent in their responses. This means that the sample represents the population well. However, because the absolute number is low, the influence of each person is high in the results.

In this study, the **survey sample** of travellers using Nijmegen station includes 106 unique individuals. There are over 47,500 daily travellers arriving at and departing from Nijmegen in 2019 (NS, 2023). This means that we only consulted 0.2% of the daily travellers entering and exiting the station. The scope of the population includes everyone who is familiar with the station environment, specified through a minimal 1x per year travel to or from this station. The population familiar with the station environment based on this criterion is probably even larger than the 47.500 average daily in and out travellers. In addition, the sample group taken is also not representatively distributed, which is a limitation to the generalizability of the study. We do not expect different results if a different sample is taken within NS Stations for the sample group in the survey because we already have about half the population in the sample and they are homogeneous in their responses.

Due to circumstances, the survey could not be distributed to 1100 panel members of the NS Panel that uses Nijmegen station as a departure or arrival station. As a result, the survey was distributed through our own network, via LinkedIn and by handing out flyers at Nijmegen station. Handing out flyers at the station proved to be inefficient: only 3 of the 50 people who received a personal invitation including a flyer completed the survey. Distributing within the personal network performed better with 26 respondents. The highest number came via posting on Linkedin: 69 respondents. Four respondents indicated they entered the survey via 'elsewhere'.

Although representativeness is not a requirement (Chapter 1), it does affect the usefulness of the findings. In addition to not being representative, the sample is also unevenly distributed among the subgroups. As a result, for example, it represents almost only the highly educated, there are no respondents at some access/egress facilities, and there are no people under 18 and over 70 in the sample. In the statistics associated with the LinkedIn post, we can see that out of 10,000 impressions, only 694 are from the Arnhem-Nijmegen region and surroundings. In addition, we can see that a fairly homogeneous group was reached. The largest job groups are "project manager," "owner," "policy officer," "teacher" and "policy advisor". Categorized by company, the largest groups are employed by NS, universities and engineering companies. In short, spreading within one's own network and through LinkedIn results in a limited diversity of respondents. This results in a sample that often includes highly educated people and also often within the mobility and technical fields. Therefore, the results of this study should be presented in that context. A representative or heterogeneous sample is likely to generate different results. On the one hand, missing subgroups such as youth, elderly, non-university educated people and car users will then be able to be studied, which are now missing in the sample. In addition, we expect that fewer points will go to sustainable modes since the group described here travels to and from the station by sustainable modes themselves.

In the end, the case study results do not fully consider the situation at Nijmegen. In addition, the results cannot be generalized for other stations. The main conclusion that station developers and travellers largely make the same consideration applies only to this sample and therefore cannot be directly applied to other stations. However, this observation can serve as a starting point for follow-up research and the hypothesis "station developers and travellers make the same trade-offs when allocating space among access/egress facilities" can be tested. This is a lot more specific than the research question this study started with.

7.2.3. Choices and assumptions

Access and egress transport are not separated in the survey, case study and data analysis. The same applies to how the respondent uses the station: as a home-end (production) or activity-end (attraction) station. The choice is based on the distribution of production and attraction at the case study station Nijmegen, which is 51% and 49%, respectively. Based on this, we have assumed for this study that access and egress facilities belonging to activity-end and home-end use of the station are equally important. At the same time, we assumed that if we take a random sample, it includes approximately an equal distribution of home-end and activity-end users. This allows us to keep the survey as short and concise as possible, in order to get the response rate as high as possible and the dropout rate as low as possible (which are design requirements). However, we do not know whether the sample group indeed contains approximately equal numbers of home-end and activity-end users. Also, it is arguable that respondents have different preferences at Nijmegen station based on activity-end or home-end. This means that even if there is an unequal distribution of the two groups in the sample, this may affect the results. In the open-ended responses, no respondent explicitly mentioned the difference between access/egress or home-end/activity-end, so we do not know how the respondent considered the two

types in their trade-off. Follow-up research can examine the extent to which the respondent considers both home-end and activity-end users (as the station boss does) or, on the contrary, tends toward a distribution of points appropriate to their own type of station use. It can then be determined whether differentiation between home-end and activity-end is necessary.

In the design of the survey choice task, the choice of which starting values potentially influences the respondent. In this study, the starting values are based on the 2019 modal split. The respondent redistributes 100 points from those starting values. We chose this to show, on the one hand, that there is a spatial problem if the modal split is maintained in the future with an increase in travellers and/or less available space. On the other hand, the respondent gets a picture of a realistic modal split. We expect that there may be a different distribution of points given with different starting values used, or if all values are set to zero. Given the scope and time constraints of this study, we cannot investigate whether this indeed has a significant impact.

The choice task is based on the footprints defined by Stam (2019). We have assumed that these footprints are applicable in the case study on Nijmegen. In the test phase of the survey and in the Expert Discussion Group, it emerged that the footprint of a bus is questioned, as it would be larger than defined by Stam (2019). In addition, Stam (2019) proposes a footprint of 0 m² for walking. We estimated, based on consultation with experts, a footprint of 0.07 m² per pedestrian. This is a rough estimate. The walking facility receives the largest increase in points relative to the starting value. It is possible that this large increase in points is due to the fact that walking has by far the smallest footprint. To what extent the rough estimation of the footprint for walking influences the distribution of points, needs further investigation. In addition, the extent to which the footprints determined by Stam (2019) influence the distribution should be investigated. However, the influence of the values of the footprints is not expected to have a major impact if the order of space use remains the same since the facilities in the survey are sorted by space use and the footprints are not directly visible.

7.2.4. Limitations

This study is explicitly limited to access/egress facilities known to respondents in the current situation. Other studies deliberately examine emerging or future modalities, such as e-steps and self-driving cars. Since station (re)development has a long time horizon (10-15 years), it is a limitation if not all potential future facilities are included in the study. In this study, we assumed that respondents are unable to weigh unfamiliar modes against each other and against known and existing modes. Therefore, it should be investigated whether respondents are able to include facilities with which they are less familiar in the consideration they make.

The 2019 modal split serves as the basis for the starting values in the survey. The 2022 modal split is not available on the NS dashboard (NS, 2023). The modal split of 2020 and 2021 may have been influenced by the COVID-19 pandemic, therefore the last ”normal” modal split from before the pandemic is used. This means that the starting values in the choice task are based on pre-COVID values, while respondents fill in the survey in a post-COVID situation, which means no more restrictions due to the pandemic. It is possible that travel behavior pre and post-COVID is different, which is being studied by TU Delft and NS (Ton et al., 2022). They show that a large group of people (71% of the respondents in their survey) show a high willingness to work from home and thus will commute less. In addition, there is a possible spread of travel demand. This is also likely to impact the use of access/egress at the station. Due to the use of pre-COVID modal split values, the starting values in the choice task may be less representative of the current situation, for which the respondent distributes the points. Certain large deviations of points from the starting values might be explained by a changed attitude towards those

access/egress facilities before and after COVID. However, the method involved in this study can be used to further research the changes in travel behavior and attitude due to the COVID pandemic, in the field of space use at stations. For this purpose, the justification given for space allocation can explicitly ask about the influence of experiences and changed travel behavior due to the COVID pandemic.

In addition to the modal split, the footprints used are also based on pre-COVID travel behavior. Stam (2019) shows that the footprints are calculated at traditional design peak hours. Since Ton et al. (2022) expects changing peaks in train usage, occupancy rates may be different during the (new) peak hours. Therefore, footprints may need to be revised for the current situation.

7.2.5. Relevance in a broader context

The Expert Discussion Group discusses the applicability and usefulness of this consultation method in a different context: application at different stations, different trade-offs and different stakeholders. This evaluation serves on the one hand as a discussion of the method and at the same time as recommendations for NS Stations for future development and application of the method.

This method can be used at **other stations**. The hierarchy of transportation modes found in the case study, which largely fits the STOMP principle, may differ at other stations. For example, at stations where people live further away from the station. With this method, station developers and travellers can collaboratively establish a hierarchy for access/egress transport for each station type. This can be done, for example, for the six KIS types of stations.

Application of this method to the trade-off of access/egress facilities based on space, i.e., dividing 100 points among 8 alternatives, is very clear. For **other trade-offs**, it may be too complicated for respondents. However, there are possible applications that could be studied. First, classifying functions at the station. Trade-offs between which stores and/or locations of stores. Or if there is space left over, what functions should be located there. This may involve trade-offs based on space usage, locations or costs.

This method could be used with **other stakeholders**, such as residents close to the stations. An example application is resident participation or information meetings. Residents often come up with unrealistic and unfeasible ideas. This method gives the participants a concrete and delineated issue with which they can experience the limitations. In addition, using this method as a participation tool can help create understanding. Explaining spatial dilemmas to residents is often very difficult. In conclusion, this method can serve as an implementation of the participation law, which NS Stations must comply with, while obtaining useful input.

Applying this method with municipalities can be very useful. It turns out that within a municipality, not everyone is always single-minded. With this method, the preferences of each stakeholder can be made concrete. Accordingly, it can be applied as a discussion tool.

Besides municipalities, multiple stakeholders are often involved in developing stations and station environments. In many cases in station development, an 'action perspective' (in Dutch, 'Handelingsperspectief') is formulated in advance. The first step is mapping the current situation. The second step is to formulate the desired situation. In this step, this method can help identify the ambitions of each stakeholder. Even if no "action perspective" is formulated, this method can contribute to getting to know all stakeholders. The same applies to stakeholders who become involved in the project at a later stage. This clarifies how everyone makes the trade-off and what is involved for everyone. It is often in people's heads, and this method helps to make it concrete.

7.3. Recommendations

As a closing note, there are recommendations for follow-up research and future applications of the method from this study, categorized as scientific recommendations and practical recommendations. The scientific recommendations focus on the development of this method and its scientific contribution to research on trade-offs in transportation-related studies. The practical recommendations are aimed at the successful implementation of this method. For each of the two categories of recommendations, we focus on the methodology on the one hand and the content of the case study on the other.

7.3.1. Scientific recommendations

To better substantiate the validity of the survey design, the impact of different starting values can be investigated. Respondents may give different answers if there are no starting values in the choice task, since they will not be shown an example distribution associated with the modal split. In addition, it is recommended to conduct a sensitivity analysis on the footprints. It is possible that there is a relationship between the relative differences in footprints between the alternatives and the number of points they are assigned by respondents.

Integrating the qualitative and quantitative elements at an individual respondent level. This can be used to examine whether individuals are doing what they say or whether there give a politically or socially desirable response. As an example, it can be examined whether people who say a bus station takes up too much space at the station actually give less points to bus. In addition, it is possible to examine what people mean by a particular argument. For example, it can be studied which modes are included in ”sustainable modes”, according to travellers and according to station developers.

In this study we have seen the added value of including other stakeholders such as the policy maker in the same survey in addition to citizens in general. It is highly recommended to use this application more often, investigate and further improve the method. This will develop a valuable combination of the survey, interview and PVE method that can also greatly contribute to decision-making outside the context of access/egress transport at stations.

7.3.2. Practical recommendations

It is recommended to use starting values in the choice task that represent the current situation of the case study. The modal split at a large station in a city is most likely different compared to a smaller station in a less densely populated area. It has not yet been proven whether the respondent is influenced by the starting values. If they are, at least the responses are based on a situation that fits the case study. Both the scientific and practical recommendations are relevant to NS Stations.

It is recommended to use a panel to distribute the survey. This will improve the possibility of obtaining an even distribution of subgroups across the sample, or if desired, a representative sample. Once the sample is large enough and there is enough data for each subgroup, more detailed analyses can be done. For example, the extent to which respondents tend to allocate more space to an access/egress facility that they themselves use the most can be examined.

Regarding the sample for station developers (or other stakeholders with a relatively small population), it is recommended to try to take a sample as large as possible. This will reduce the individual influence of each station developer by giving them a smaller share of the sample. In addition, it is suggested to

examine how large that individual influence actually is in case of a low absolute number of people in the sample.

It is recommended that this method be applied to other choices to be made at a railroad company. For this purpose, the method can be adapted to the issue at hand. For example, the services at a station are a possible application. Here it is possible to examine within one type of access/egress facility what form and characteristics it should take. For example, the trade-off between open-air/covered, secured/unsecured, and free/paid bicycle parking.

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A

Scientific Paper

Train travellers as station manager? Trade-offs in the distribution of space for access & egress facilities - A case study at station Nijmegen

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Abstract

Train stations are developed by rail companies, for the benefit of travellers. Choices and trade-offs must be made. However, there are no guidelines on how to approach these trade-offs. This study aims to find out to what extent consulting train travellers from the station developer's perspective contributes to making trade-offs in the development of train stations. We investigate how train travellers make a trade-off from the perspective of the station developer in comparison to professional station developers. Therefore, a consultation method is established using a qualitative and quantitative survey. The first part involves a trade-off in which the respondents have to distribute 100 points, representing the total available space, over eight access/egress facilities. It appears that both train travellers and station developers assign an increase or decrease in space to the same facilities. At the same time, we gain insight into how respondents approach the trade-off. Also, insight has been gained into a possible consultation method by which the making of trade-offs by train travellers and station developers can be investigated. For follow-up research, it is recommended to explore this approach for other trade-offs and in other contexts.

Keywords: trade-offs, train stations, access egress, train traveller, station developer

1. Introduction

In the Netherlands space is becoming increasingly scarce and with it comes increasing competition for space. At the same time, we are in a mobility transition which involves switching to more sustainable means of transportation. At the same time, the Dutch Railways is changing from a railroad company to a full mobility provider, offering door-to-door transportation. These issues make the choices for access and egress transportation facilities in the station environment more relevant than ever. These facilities are needed to transfer from the first-mile (access) means of transport to the train at the departure station and from the train to the last-mile (egress) means of transportation at the arrival station.

The objective of this study is to find out to what extent consulting train travellers from the station developer's perspective contributes to making trade-offs in train station development. This consultative approach is explored by studying a specific trade-off: trade-offs between access/egress facilities at train stations based on space use. This paper primarily addresses the decision-making process in train station development and the development and application of the consultation method: investigate how train travellers make a trade-off from the perspective of the station developer in comparison to professional station developers. During the consultation, in the form of a survey, the respondent is asked to make a trade-off from the hypothetical situation of being in charge of the station. To avoid ambiguity about the station developer role, the respondent is asked to pretend to be "station developer" or "station boss".

The societal contribution of this research is formed by better-informed choices when distributing space, and thus a more optimal use of scarce space. Even more, it improves the access/egress transport capacity and thus better utilizes the capacity of the rail connection. When making choices, multiple stakeholders' interests come into play, which can be taken into account with this method so that the decisions made are the best solution for all parties. The scientific contribution is formed by, on one hand, a theoretical contribution through the development of a method to approach this study and, on the other hand, an empirical contribution through the application of the new method. This study's innovative character is combining three methods: the philosophy of Participatory Value Evaluation (PVE), the depth of interviews and the short participation time of surveys. To the best of our knowledge, there are no applications of citizen consultation methods that study exactly the same choices by the policymaker in addition to citizens' choices. This study not only looks at how a citizen (in this case, a train traveller) makes a trade-off in a policy issue from the policymaker's perspective (in this case, a rail company), but also compares it to how the policymaker makes the same trade-off. In addition, to the best of our knowledge, consulting train travellers through the eyes of the rail company has not been done before in a scientific context.

The remainder of this paper is structured as follows. Chapter 2 presents the knowledge gained from the literature review and additional interviews. Next, Chapter 3 describes the developed method for consulting train travellers and station developers. Chapter 4 contains the data analysis of the application of a case

study. Then the results are discussed in Chapter 5. Finally, a conclusion is drawn in Chapter 6, including a discussion of the method and results.

2. Literature & Interviews

Literature is reviewed to study current decision-making and various potential consultation methods. To the best of our knowledge, there is a lack of literature regarding decision-making. Therefore additional interviews are conducted with experts.

2.1. Current decision-making process

In literature, it is found that NS Stations and ProRail are in theory aware of the space usage of the distinct access and egress modalities, which are located in the 'station-environment domain' (Bezema et al., 2019; Spoorbeeld, 2010). When it comes to prioritization, NS formulates three main priorities in the theoretical 'station environment rights of way': cleaner power, shared economy and space efficiency. While the 'station environment rights of way' is mentioned in literature as a prioritization tool, it follows from the interviews that the STOMP principle is used in practice. CROW (2020) states that the STOMP principle can be used for integrating mobility in the spatial environment. Theoretical guidelines or descriptions on how to treat trade-offs between access/egress facilities and space are limited to these overarching prioritization tools. Also, it follows from the interviews that access/egress facilities are often developed individually. It follows that integral decision-making based on clear and objective criteria is lacking. In the current situation, it is a political process. This underlines the relevance of this research: choices will be studied in a more transparent and more neutral manner and the trade-offs between facilities are studied in an integral approach. At the same time, this study investigates which factors play a role in decision-making, which is not explicitly clear in the current situation.

2.2. Consultation methods

First, literature is consulted regarding the choice between qualitative or quantitative methods. At the aggregate level, there are differences in the application of qualitative and quantitative methods. According to Queirós et al. (2017), qualitative methods aim for an in-depth understanding of a problem that cannot be quantified. They explain that its focus is on the understanding and explanation of meanings, motives, aspirations, beliefs, values and attitudes. In contrast, quantitative methods are focused on a numerical representation of data, which can help identify correlations between given variables and outcomes (Pasco and Choy, 2014). Kleih (2000) discusses the combination of qualitative and quantitative methods which could complement each other. He states that the trustworthiness of the information gathered will be greater when methods are combined. Besides that, he mentions the relevance of 'participatory activities within a research or development context', which matches this study. Pasco and Choy (2014) discusses cases in which a complementary approach between qualitative and quantitative methods could result in better solutions. A comparison between separate methods and a combination shows a potential reduction of limitations and biases of each method when combined. Based on this analysis, it can be concluded that a combination of qualitative and quantitative methods is relevant to this study.

The following methods are considered applicable in this study: qualitative survey, quantitative survey, interviews and PVE. For each method, pros and cons are listed based on the literature. Table 1 lists pros and cons for surveys, based on Queirós et al. (2017); Braun et al. (2021). Pros and cons for semi-structured interviews are listed in Table 2, based on Wilson (2014); Kakilla (2021); Adhabi and Anozie (2017). For PVE are pros and cons formulated based on TU Delft (2022a); Mouter et al. (2021); TU Delft (2022b); Mouter et al. (2019) and listed in Table 3.

Table 1: Pros and cons of surveys (Querios et al, 2017; Braun et al. 2021)

Pros
Low development time
Cost-effective
Easy data collection and statistical analysis
Can reach high audiences
High representativeness
Not affected by the subjectivity of the researchers
Openness and flexibiliy for range of questions
Observing different perspectives
Participation not time and location bounded
No participation time pressure
Feeling anonymous and thus expressing views
Cons
Reliability depends on answer quality
Reliability depends on survey design
Rigidity of the structure
Don't captures emotions and behavior
Responses on individual level lack detail
Excludes illiterates and low digitally skilleds

In order to make sure a method is chosen that fits the research objective best, a Multi Criteria Analysis is performed. A set of criteria is formulated based on the research objective and are listed in Table 4. The scores in the performance matrix represent the method's performance on all the individual criteria. These performances are estimated with respect to the research objective and relative to each other. The set criteria consist of four topic-related criteria (1-4) and four process and data analysis related criteria (5-8). As can be seen in Table 4, the *qualitative survey* and *quantitative survey* methods score best. In order to further enhance the performance, the two methods could be combined. In that case, the two methods can compensate limitations of each other. More specifically, the low score of quantitative surveys on 'gives full freedom in responses' can be compensated by the qualitative survey. However, some criteria with a lower score can disadvantage the combination. For

Table 2: Pros and cons of semi-structured interviews

Pros
Redirecting when out of topic
Flexibility for interviewers
Broad comparisons across results
Low training time, compared to unstructured
In-depth conversations
Non-verbal communication
Could find unknown issues
Predefined topics + additional input
Duration adjustable to audience
'Accredited' for statistics and science
Cons
Reduced detail due to 'interviewer effect'
Training needed to prevent directing
Multiple interviewers affect consistency
Quantitative and qualitative data time-consuming
Hard to generalize due to different sub-questions
Data loss if non-verbal signals are missed
Costly and time consuming
Limited geographical coverage
Interviewer could be biased

Table 3: Pros and cons of PVE

Pros
Respondent on seat of decision-maker
Lower participation threshold compared to offline
Possible to allocate budget partly
Multiple alternatives can be choosen
Studies preferences of allocating public resources
Quantitative data for statistical analysis
Qualitative data for further substantiation
Cons
20-30 minutes participation
Limited to predetermined options
Non-paternalistic

example, the criterion *participation duration between 5-10min* scores less for a qualitative survey and this score becomes dominant in a combination of the two survey types. Because of the dominance of certain criteria, an additional alternative called 'survey combination' is added to estimate the scores of a combination on all the criteria. From this, it becomes clear that in the end, the two methods enhance each other, as the resulting score of the combination is higher than the individual scores of the two survey types. This is in line with the statements by Kleih (2000) and Pasco and Choy (2014) that qualitative and quantitative methods can reinforce each other.

3. Methodology

3.1. Survey

Gathering data ourselves is necessary as there is, to the best of our knowledge, no literature available about consulting train travellers from a station developer's perspective. Data is gathered through an experiment: travellers are presented with a trade-off and are observed on how they approach it. The experiment is conducted using a consultation method that consists of a combination of a qualitative and quantitative survey. In an online web tool, a survey is designed that first presents a dilemma to the respondent in which a trade-off must be made between access/egress facilities based on space usage. In a choice task the respondent has to distribute 100 points over eight access/egress facilities, considering two constraints: minimum capacity and maximum amount of space. In the second, qualitative part, follow-up questions are asked about how the respondent made this trade-off. The objective is to explore the themes and factors involved in making this trade-off and to compare this between the two sample groups: train travellers and station developers.

3.2. Case Study

The established consultation method is applied to a case study. This evaluates the established method on the one hand and obtains empirical data on the other, both contributing to answering the research question. It is expected that better quality data will be obtained if the experiment (i.e. the survey) is tailored to a station known to the respondent. Therefore, only travellers who are familiar with the train station in the case study are asked to participate. Respondents for the train traveller sample are recruited through personal networks, LinkedIn and through flyers at the station. Respondents for the station developers sample are recruited within NS Stations. The case study is station Nijmegen. This station was selected because of its roughly equal number of home-end and activity-end users, almost no transfer travellers and because it is an average-sized station with an average of 48,330 travellers a day.

To structure and guide the empirical research, "preliminary expectations" are formulated. These expectations are evaluated within the application of the method in the case study at Nijmegen Station.

1. As the entire sample group, travellers and station developers allocate space differently, with different justifications involved.
2. Compared to travellers, station developers are more homogeneous in distributing space.
3. The distribution proposed by station developers follows the hierarchy of the STOMP principle.
4. The trade-offs made by travellers reflect their demographic characteristics (age, gender and education).
5. The trade-offs made by travellers reflect their traveller characteristics (personally used access/egress transportation, travel frequency and travel purpose.

The constructed choice task and associated open-ended questions are included in Appendix B.

Table 4: Multi Criteria Analysis consultation methods

Criteria	Quantitative survey	Qualitative survey	Interviews	PVE	Combination
Topic-related					
Able to ”place respondent on the seat of the decision maker”	+	-	+	++	++
Provides full freedom of answers (i.e. qualitative data)	–	+	++	+	+
Ease of making it representative for a larger population	++	+	–	+	-
Applicable to both ’laymans’ and ’professionals’	+/-	+	-	-	++
Process and performance related					
Maximum participation duration between 5-10 min	++	+	–	-	+
Low (execution) costs	+	+	+/-	-	+/-
Many respondents can participate (at least 50)	++	++	–	++	++
Can participate whenever and wherever desired	++	++	–	+	++
Total score	8	8	-6	4	10

3.3. Data analysis

The data analysis consists of quantitative data and qualitative data analysis. The quantitative analysis analyses the point distributions by the two sample groups. We look at mean values, the range and the deviation from the starting values (which reflect the current situation). A T-test assesses the significance of the differences between train travellers and station developers. In the qualitative analysis, the open-ended responses are labelled with keywords that represent the essence of the answer. The keywords are then aggregated into a selection of categories. Based on this, we identify what factors come into play when trading off access/egress facilities based on space utilization.

4. Data: Application to Case Study Nijmegen

There are a total of 110 valid responses to the survey, including 104 travellers and six station developers.

4.1. Quantitative analysis

Each respondent divides 100 points among eight alternatives, resulting in one value per alternative. From these values, the mean, range and deviation of the mean from the initial value are calculated, for all subgroups. The subgroups are based on travel characteristics (access/egress transportation, travel frequency, and travel motive) and demographic characteristics (gender, age, education).

Mean values

The mean values provide an insight into the ranking of how much space all access/egress facilities are allocated relative to each other. From this, it is immediately clear that there are both differences and similarities between travellers and station developers, which can be seen in Figure 1. Two outstanding variations can be observed. First, travellers allocate only 15%-points to walking whereas station developers allocate 30%-points. Second, travellers allocate 26%-points to bus stop whereas station developers allocate only 16%-points. To all other facilities, the two groups allocate similar values. These values clearly reflect how much space the modes of transportation should get relative to each other according to the respondents.

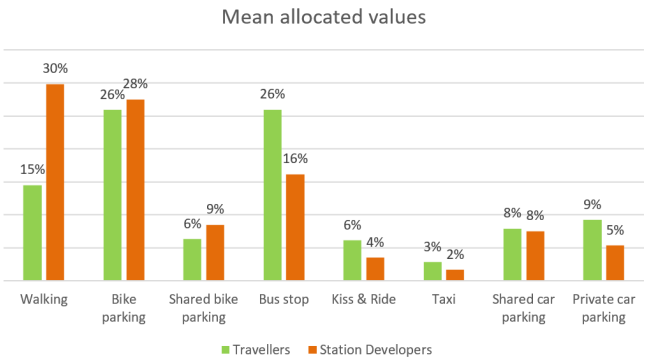

Figure 1: Mean allocated %-points

Range values

The range indicates the homogeneity of respondents within their group. It gives the difference between the minimum and maximum allocated %-points within that group, for each of the eight access/egress options. The range is calculated for each sample group and all eight access/egress facilities. Figure 2 shows that among both the group of travellers and station developers, the range is greatest for walking, bike parking and bus stop. The smallest range is observed in both groups at taxi-station. For all eight access/egress facilities, the group of station developers shows a smaller range compared to travellers. However, the large difference in N must be taken into account in this case.

Deviation of mean values in relation to start values

The choice task includes starting values. The respondent divides the 100 points with respect to these starting values, resulting in a relative increase or decrease of the starting value. The mean value indicates the average number of points given to an alternative and thus does not look at the deviation from the starting value. This provides insight into whether the respondent

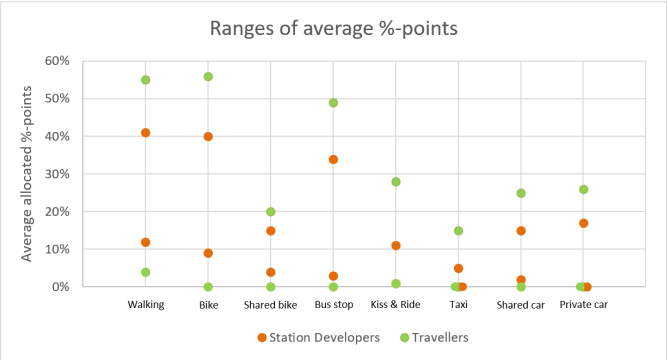

Figure 2: Ranges of average %-points

considers that an access/egress facility should be given more or less space compared to the current situation. This determines which access/egress facility the respondent considers relatively more important compared to the others. Figure A.6 shows the cross table in which the mean values for each subgroup are corrected to the initial values, in other words, the deviation of the mean value from the starting value. Figure 3 represents the values graphically.

The choice task lists the access/egress facilities in order of space use per traveller (i.e. footprint). The deviation of the average number of points compared to the starting value follows the order of the footprints: the largest increase in points for the option with the smallest footprint and the largest decrease in points for the option with the largest footprint. The only exception in this trend is the bus stop. Looking at the values in the table, one thing immediately stands out. Walking is assigned the largest increase in space among all (sub)groups (+17%-points on average) while car parking is assigned the largest decrease in space (-64%-points on average).

As with the mean values, the largest differences can be seen between travellers and station developers at walking and bus stop. Travellers assign walking +10%-points increase of space while station developers assign +25%-points. At the bus stop facility, travellers allocate a -8%-points decrease of space and station developers a -18%-points space decrease compared to the initial values. At all other facilities, both groups propose a similar increase or decrease in space. In terms of an increase or decrease in space from the starting value, both groups are equal. They both allocate more space to walking, bicycle parking, share bike parking, Kiss&Ride, and taxi-station. A decrease in space is assigned to bus stop, shared car parking, and private car parking.

Three differences between subgroups of travellers are observed. First, the largest increase in space allocated to a certain facility is given by people who frequently use the associated means of transportation. For example, travellers walking to/from the station assign the largest increase in points to walking (relative to the starting value) in their distribution of points. The same is true for cyclists, who assign the largest increase to bicycle parking in their distribution of points. Shared bike users assign the largest increase in space to walking and share bike parking in their distribution of points. Among bus users, no potential relation is observed between used access/egress transportation and the largest deviation from the starting value, as they assign the largest increase in points to walking. Second, among the gender-based subgroups, it is observed that men (+11%-points) allocate more space to walking than women (+8%-points). Men (-10%-points) also assign a greater decrease in space to bus than women (-5%-points). To the other facilities, men and women assign almost the same average values. Third, the 50-69 year age group (+14%-points) propose a greater increase in space for walking compared to the 18-29 year age group (+8%-points) and the 30-49 year age group (+10%-points). For bicycle parking, the opposite is observed: the 18-29 age group (+8%-points) suggest the greatest increase in space compared to the 39-49 age group (+6%-points) and the 50-69 age group (+3%-points). Between subgroups based on travel frequency and travel purpose, no notable differences are observed.

An Independent-Samples T-Test compares the mean values of two independent samples. The T-test evaluates whether the differences in mean (relative to the starting values) for each access/egress facility between the two groups are significant. The null hypothesis is: the average number of points, relative to the starting value, that train travellers and station developers assign to an alternative do not differ from each other. Walking has a p-value of p=0.020 and bus stop has a p-value of p=0.091. According to Fernandez (2023), these p-values can be interpreted as follows: there is 'evidence' is that the null hypothesis can be rejected for walking and there is 'strong evidence' that the null hypothesis can be rejected for bus stop. As a result, it can be concluded that travellers and station developers assign significantly different points to walking and bus, and that there are no indications that they assign points differently to the other facilities. This t-test substantiates the observation in the previous section, in which it is found that walking and bus have a noticeable deviation between the two sample groups and that the other alternatives have no noticeable deviation.

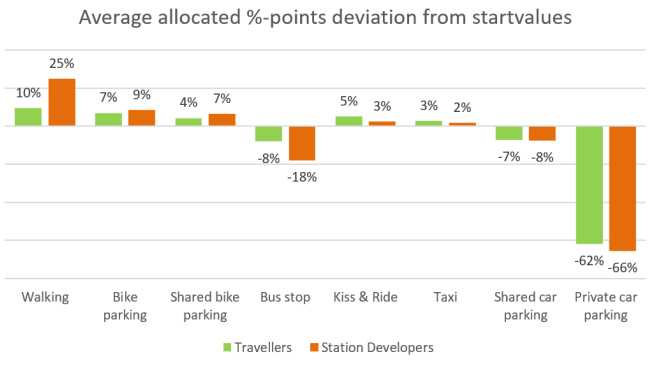

Figure 3: Average allocated %-points deviation from startvalues

4.2. *Qualitative analysis*

The qualitative analysis examines the answers given to the four open-ended questions in the survey. It provides insight into

what plays a role in the distribution of points in the choice task. Answers to the open-ended questions are labelled using keywords that capture the essence of the answer. All keywords are categorized into groups of corresponding keywords. The categories are broken down by sample group: the number of times each category is mentioned by travellers and the number of times mentioned by station developers. Table A.5 presents the top 5 most mentioned categories in each question (for questions 1, 2, and 3) and the top 3 most mentioned categories for question 4. It can be seen that the number of times an argument is mentioned in the responses decreases across the four questions. This can be explained by respondents giving an argument in the first question that also applies to the second and/or third question without mentioning it again.

From all responses to the first open-ended question, seventeen categories are extracted. The five most frequently mentioned are: sustainable modes (22x), space efficient (17x), impact on mobility system (16x), city type (11x) and most people use this (11x). Within the group of travellers all seventeen categories are mentioned at least once. Within the group of station developers, eight out of the seventeen categories are mentioned. A total of 142 times an argument from these categories is mentioned in the answers to open question 1.

From all responses to the second open-ended question, fourteen categories are extracted. The five most frequently mentioned are: does not belong to a railway system (15x), efficiency (15x), rarely used (15x), sufficient alternatives available (14x) and most people use this (11x). Within the group of travellers, all fourteen categories are mentioned at least once. Among station developers, three categories were mentioned. A total of 108 times an argument from these categories is mentioned in the answers to open question 2.

From all responses to the third open-ended question, nineteen categories are extracted. The five most frequently mentioned were sustainable mode (24x), space efficient (11x), impact on mobility system (8x), safety and liveability (8x) and city type (8x). In the group of travellers all categories are mentioned at least once. Within the group of station developers, seven out of nineteen categories are mentioned. In total, an argument from these categories is mentioned 102 times in the answers to open question 3.

When analyzing the categories mentioned in the justifications of the first three questions, it is noticeable that the categories mentioned by both station developers and travellers are in the top five most mentioned categories of each question. In other words, if a category is often mentioned by travellers, then that category was usually also mentioned by station developers. It can also be clearly seen that in questions 1, 2 and 3 there are no categories mentioned exclusively by station developers. The difference in sample size should be taken into account here, as we expect fewer different categories to be mentioned within a smaller sample size.

From all 45 responses to the fourth open-ended question, six categories are extracted. By far the most frequently mentioned was 'no' (30x). The answer 'more' was mentioned seven times. This answer is surprising since the question is whether the respondent would have liked to use fewer points and if so, why. An argument was given eight times to explain why the respondent would like to allocate fewer points, covered in five categories. Only travellers answered this question with 'more' or 'yes, because...'.

4.3. Integral analysis of quantitative data and qualitative data

The quantitative analysis found a significant difference between travellers and station developers in assigning points to walking and to bus. This analysis integrally analyzes the combination of quantitative choice task and the qualitative open-ended questions in the survey. It specifically analyzes the significant differences between the two sample groups for walking and bus.

Station developers give a significantly greater increase in %-points to walking than travellers. In the qualitative substantiation, three station developers are considered who gave walking the highest number of %-points and at the same time in their distribution gave the most points to walking. In the qualitative substantiation of why they have given most points to walking, they indicate that walking is an excellent alternative given the young population in Nijmegen and the location of the station close to the city.

Travellers give a significantly smaller decrease in points for the bus than station developers. We consider the twenty travellers who give the highest number of points to bus and at the same time give the highest number to bus in their distribution. In the qualitative substantiation, they mention inclusiveness / disabled people (5x) most often.

This analysis indicates that station developers are proposing a modal split for travellers. Travellers, on the other hand, actually think about the needs of fellow travellers and want to facilitate them.

4.4. Respondent experience

The last page of the survey contains questions about the design and purpose of the study. This provides insight into how the respondent experienced this method of surveying and what they think should be done with the results. Finally, there is room for other comments.

More than half of traveller respondents (54%) feel that traveller advice is as important as that of station developers (experts). Within the traveller group, the advice of experts is more important than that of travellers (38%) is mentioned the second most. The other categories are mentioned by only less than 5% of travellers. Within the station developer group (i.e. the experts), 33% say the advice is equally important and 50% say the advice of experts is more important than that of travellers. These results indicate that travellers and station developers have the

same opinion: the advice is equally important or the advice of experts is more important.

Out of a total of 77 responses to the question, 59 indicated a good understanding of the questions, which is 77% of the respondents who answered this question. This includes all respondents from the station developer sample group. Added to that, eleven respondents also found the questions understandable, but added a comment: 'may be difficult for other people', 'but the choice task was difficult', and 'but too much to do in limited time'. Altogether, 65 out of 77 respondents indicated that they could understand the questions well, which is 91% of the respondents who answered this question. As last, three respondents indicated medium understanding (4%) and four respondents said it was too difficult (5%).

5. Results

5.1. Evaluation of preliminary expectations

In this section, the *preliminary expectations* in relation to the survey results are discussed. First, the preliminary expectations are evaluated in relation to the case study and subsequently in relation to the methodology.

1. As the entire sample group, travellers and station developers allocate space differently, with different justifications involved.
The results indicate the opposite: travellers and station developers do not allocate space differently, nor are there other justifications. The case study results show that on an aggregate scale, both groups distribute the points in the same way, see Figure 3. The way in which both travellers and station developers distribute points among facilities is in line with the STOMP principle. As a result, the outcome of the trade-off made by travellers and station developers seems to have the same outcome. At the same time, station developers give arguments that travellers also mention. This indicates that station developers and travellers do not use opposing arguments. How strongly a factor category plays a role (i.e. the number of times it is mentioned in the answers), we cannot compare with travellers using this method, given the different population size of the station developers sample group.

Although the direction of the deviation from the starting values (i.e., more or less facility space) is the same for both groups, there are interesting nuances: there are differences in the extent to which the groups assign the increase and decrease. Station developers give a significantly greater increase in space to walking (+25% points) than train travellers (+10% points). At the same time, station developers give a significantly greater decrease in space to bus (-18% points) versus train travellers (-8% points).

2. Compared to travellers, station developers are more homogeneous in distributing space.
We see that both travellers and station developers do not agree within their groups for every alternative. We see this through the differences in range for each alternative. For all alternatives, we see a smaller range among station developers than among rail travellers. This indicates that station developers are more homogeneous in making the trade-off compared to train travellers. However, the difference in N has to be considered here.

3. The distribution proposed by station developers follows the STOMP principle.
The distributions made by both travellers and station developers are compliant with the STOMP principle, see Figure 4. Since station developers seem to be more homogeneous than travellers, they also automatically follow the STOMP principle more strictly. The STOMP principle is about prioritizing modes in relation to distance from the station. In the context of this study, station developers allocate space at the station according to the same prioritization: steps over stairs over public transport over MaaS over private transport.

4. The trade-offs made by travellers reflect their demographic characteristics (age, gender and education). Between genders, we see slight differences: men, relative to women, assign a larger increase for walking and a larger decrease for bus. For the six other facilities, there are no remarkable differences. Within age groups, we see a greater preference for walking among the 50-69 group and a greater preference for cycling among the 18-29 group. This indicates that train travellers' responses are affected by their demographic characteristics. However, we cannot measure the significance of this effect from this dataset. Also, for subgroups based on education, nothing can be said because of the skewed distribution of respondents among the subgroups.

5. The trade-offs made by travellers reflect their traveller characteristics (personally used access/egress transportation, travel frequency and travel purpose.
Although no notable differences were found between subgroups of travellers based on trip frequency and trip purpose, train travellers do tend to allocate relatively more space to the mode of transportation they personally use most often. This means that the traveller includes personal interest in making decisions. This is an important observation, since the respondent is explicitly instructed to make a choice that is in everyone's interest. However, we cannot measure how strong the tendency is based on this data set.

The last questions of the survey are about what the respondent thinks of this consultation method. Respondents are asked to indicate whether they consider the traveller's advice more important, equally important, or less important than the station developer's advice. The results indicate that travellers and station developers have the same opinion: the advice is equally important or the advice of experts is more important. Remarkable is that no one from travellers and station developers indicates that experts' advice (i.e., station developers) is most important and that NS should adopt that advice. Regarding the difficulty of the survey, 65 out of 77 respondents indicated that they could

understand the questions well, which is 91% of the respondents who answered this question.

5.2. Interpretation of case study results

The results of the case study can be interpreted from a theoretical and practical point of view. This evaluates what can be learned from the results and respondents' approaches to trading off access/egress facilities. The theoretical interpretation involves considering the results in light of the literature review. The practical interpretation concerns translating the results into practical relevance and insights.

The results of the case study are interpreted from a theoretical perspective. First, in the open-ended questions, both groups of respondents do not explicitly distinguish between the activity-end and home-end functions of the train station, which indicates that the respondents make the trade-off integrally to both functions. Second, walking, which is often excluded in literature when studying access/egress facilities, is found to be highly important and receives the largest increase in space allocation according to both groups of respondents. Walking is valued for its small footprint and sustainability, suggesting that it must be considered in planning access/egress facilities. Third, respondents often weigh facilities as overarching categories. For example, they consider Kiss& Ride and Taxi as one category. Fourth, the survey results show that for Nijmegen station the following hierarchy applies: walking, bicycle, shared bicycle, Kiss & Ride, Taxi, shared car, bus, and private car. This is similar, except for the position of the bus, to the hierarchy in the STOMP principle, which indicates that STOMP can also be used for space distribution (see Figure 4). Last, the hierarchy resulting from the experiment aligns with NS' theoretical desired shifts toward cleaner power, shared economy, and space efficiency in the station environment. Respondents frequently justified their choices based on sustainable modes and space efficiency, while others emphasised the importance of shared mobility.

The practical interpretation is based on the Expert Discussion Group and evaluates how the results contribute to station development. First, the results provide insight into which modality the respondent considers most important to allocate space to. This does not need to be equal to the actual modal split. Hence, this complements the modal split. Second, in addition to finding out what the traveller thinks is the most important means of transportation, we also know what means of transportation they think is second most important, and third, and so on. This can be used in discussions about a modal shift and to predict the new choice of travellers when their preferred mode of transportation becomes less available. Third, by allocating points in this way with justification about why certain means of transport are allocated the least space, we can find out why people do not use certain means of transport.

6. Conclusion and Discussion

6.1. Conclusion

This study shows that consulting train travellers from the perspective of the station owner provide new insights when considering access/egress facilities at stations. These involve insights ranging from an aggregate methodological level to a higher level of detail within the case study. Figure 5 shows the four categories of new insights based on this study.

To answer the research question, we first have to gain **insight into the current decision-making process** in trading off access/egress facilities. The "station environment rights of way" formulates three main priorities: cleaner power, shared economy and space efficiency. Also, the interviewed experts indicate that they themselves use STOMP for prioritization. The theoretical and practical approaches for making trade-offs are limited to these two principles. In the end, there are no clear guidelines on how to trade off access/egress facilities at railway stations based on available space. Also, access/egress facilities are often developed individually. Integral decision-making based on clear and objective criteria is lacking. In fact, in the current situation, it is a political process.

Next, **insight into a relevant consultation method and how it works** is required in order to be able to gather data. In this study, a consultation method is developed which consists of a combination of a quantitative and qualitative survey. It applies the thinking of PVE in which the traveller takes the place of the station developer. In addition, it maintains the depth and level of detail of interviews and qualitative surveys while at the same time maintaining a short participation time and low participation threshold. This creates a survey that allows a quantitative question to be presented in the first part. Here, the respondent has to trade off the alternatives. In the second, qualitative part, textual justifications are asked to motivate the choices made in the quantitative part. This method is suitable for consulting train travellers from the point of view of the station owner. At the same time, this method can also be used to present station developers with the same issue to objectively compare the outcomes.

The most remarkable **insight into the differences and similarities between travellers and station developers when trading off access/egress facilities**, is that travellers and station developers make roughly the same choice of whether to allocate more or less space to an access/egress facility. Relative to the current situation, both groups propose an increase or decrease in space that corresponds to the order of the facilities' footprints. That means the largest increase in space is assigned to walking, which has the smallest footprint, and the largest decrease in space to private car parking, which has the largest footprint. Additionally, station developers give arguments that travellers also mention. This indicates that station developers and travellers do not use opposing arguments. While the directions of the increases or decreases are identical, the magnitudes differ. Travellers and station developers give significantly

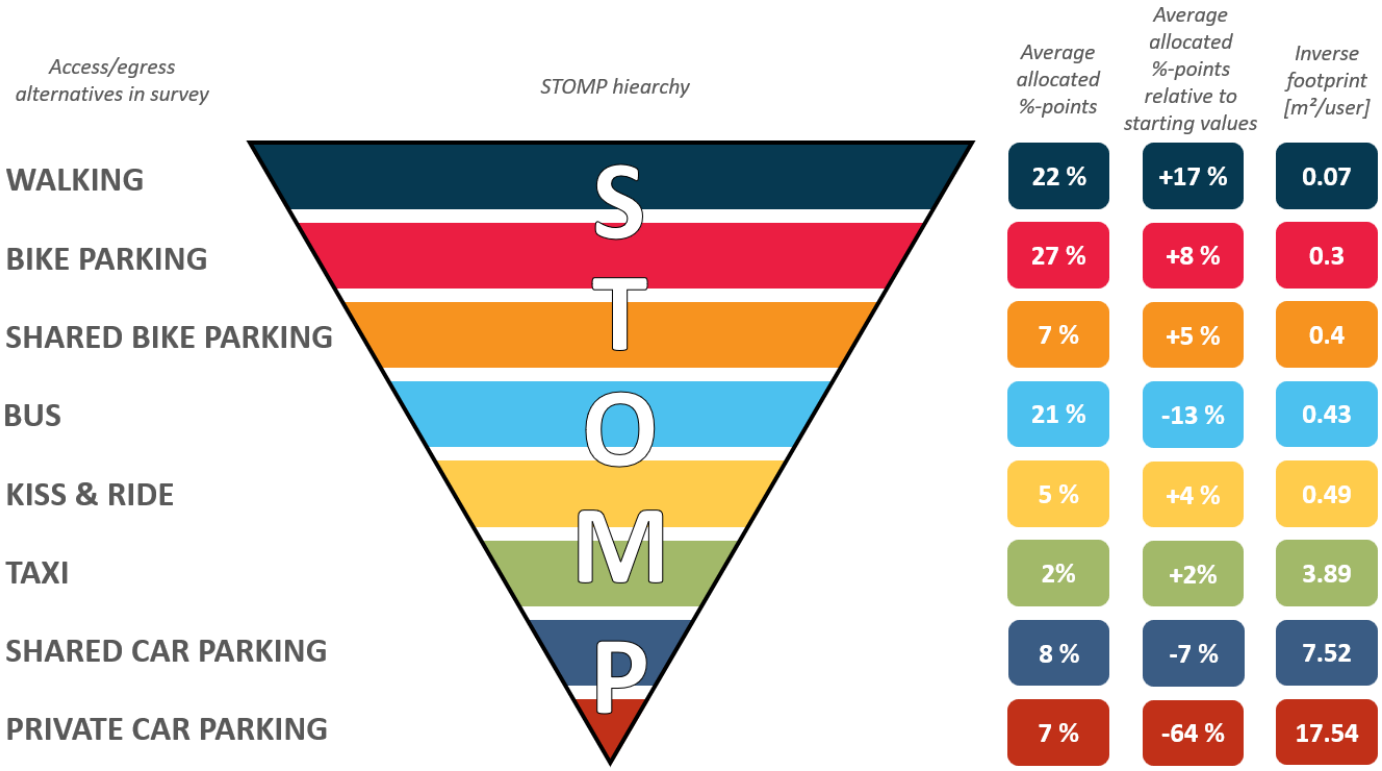

Figure 4: STOMP principle in relation to case study results

different increases to walking and decreases to bus. Also, differences between the two groups can be seen in the ranges of the point distributions. This shows that station developers give more homogeneous answers than travellers. This may be due to the difference in sample size, but also due to indications that travellers are (unconsciously) influenced by their demographic (age, gender) and traveller characteristics (preferred modality).

This method ultimately provides **insight into how the respondent approaches the trade-off**. First, train travellers and station developers weigh access/egress facilities integrally without distinction between home-end and activity-end functions. Second, walking is considered the most prominent mode by both participant groups, while in literature walking is left out of consideration when determining space use. Third, respondents consider several modes at an aggregate level. They combine, for example, Kiss&Ride and Taxi. Fourth, the results largely support the generally formulated 'priorities in the station environment right of way', since the two most frequently mentioned arguments (i.e. sustainable mode and space efficiency) correspond to two of the three listed priorities. Last, the STOMP-principle, adapted to the specific situation at a station, can be used for prioritization. Another important 'content-related' insight coming from this study is which modalities the traveller considers most important, as second, as third, and so on. This is interesting because the modal split indicates which mode a traveller uses, but it does not have to equal the preferred mode. Which modality travellers have as their second or third preference is also a valuable new insight.

6.2. Discussion

The **research methods** used have a certain sensitivity, which may influence the results. First, this study takes a qualitative and exploratory approach, involving expert views and insights. Since the experts are part of a sample, not all views may have been included and there may be different nuances in the results if a different sample is taken. Second, a different station as a case study may yield different results given a different population of travellers. Nijmegen station is selected as it is an average station in terms of size, with the goal of being in the middle of a possible bandwidth of the results among all train stations. Third, based on the travellers' sample in the survey, it can be concluded that they understand the questions and can successfully complete the survey. However, there are respondents who did not complete the survey, so the possibility exists that there is a certain group that drops out because of the difficulty. Fourth, based on the result, it cannot be shown that travellers actually look through the eyes of the station developer and make trade-offs in the interest of all travellers. However, the results show that travellers make nuanced choices and consider other traveller groups, rather than just reasoning from their own interests. Finally, it has been experienced that without a (representative) panel or varied channels, it is challenging to obtain a representative sample or to reach and get all subgroups willing to participate at all.

In this study, a consultation method is established that has characteristics of several existing methods. The thinking where the citizen experiences a problem through the eyes of the policy maker is based on PVE. In addition to finding a middle ground

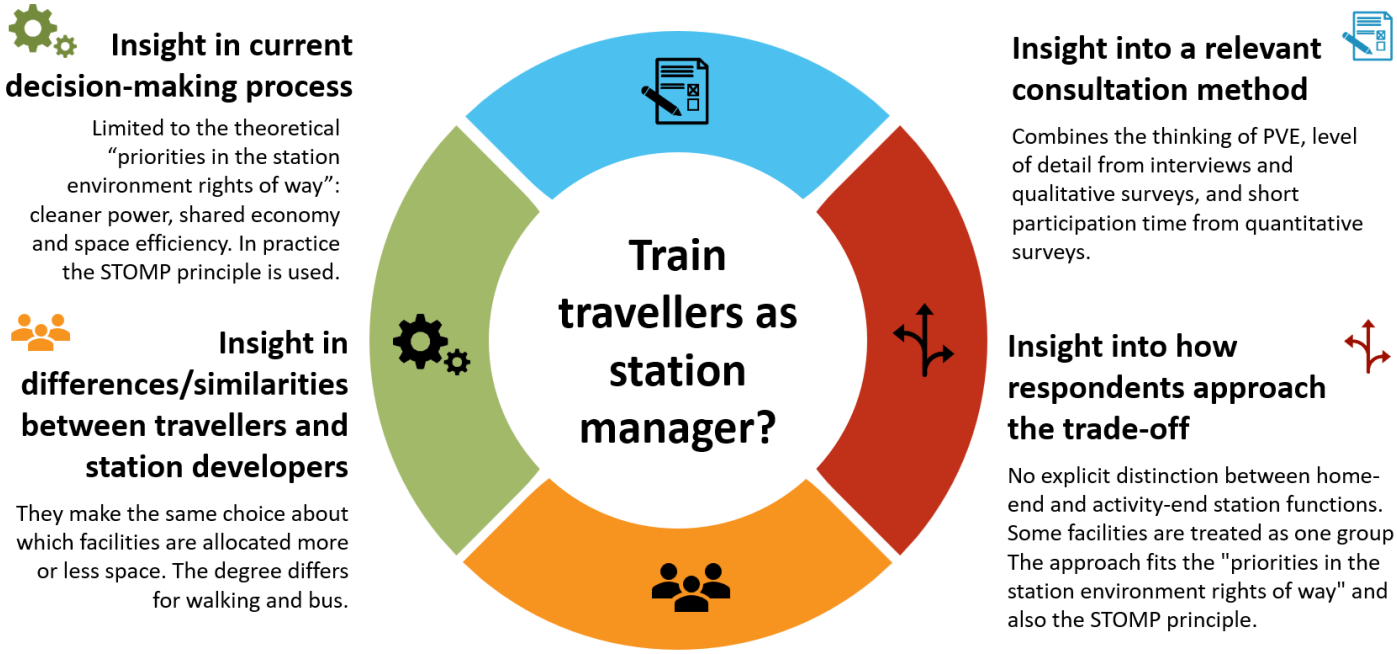

Figure 5: Obtained insights from this study

between interviews and short surveys to minimize the participation time and threshold, we seek a middle ground between in-depth interviews and more general surveys to be able to present both laymen and professionals with the same question. As a result, comparing how citizens make a trade-off and how policymakers themselves do so, is an innovative addition to existing consultation techniques.

The samples in this study have varying degrees of **representativeness**. The interviews and Expert Discussion Group samples encompass a large part of the population, so the differences will be small when a new sample is taken. Since the population of experts is small, about twenty experts, the individual influence is large. The same goes for the sample of station developers for the survey. In contrast, the sample of train travellers in the survey (n=106) represents only 0.2% of the average daily number of travellers at Nijmegen (48.330 in 2019). A representative or heterogeneous sample is likely to generate different results. Also, missing subgroups such as youth, elderly, non-university educated people and car users will then be able to be studied, which are now missing in the sample. It is expected that fewer points will go to sustainable modes since the travellers in the sample group in the case study travels to and from the station by sustainable modes themselves. In the end, the case study results do not fully consider the situation at Nijmegen and the results cannot be generalized for other stations. The main conclusion that station developers and travellers largely make the same consideration applies only to this sample. Nevertheless, this observation can serve as a starting point for follow-up research and the hypothesis "station developers and travellers make the same trade-offs when allocating space among access/egress facilities" can be tested. This is a lot more specific than the research question this study started with.

The study has two **limitations** for future applications. First, the current situation in the case study is based on the 2019 modal split, since that is the last year without corona measures. This is a pre-covid situation, and travel behavior and attitudes toward travel and working from home are different in the post-covid situation. In addition, the footprints used by Stam (2019) are based on traditional peak hours of the pre-covid situation. Since Ton et al. (2022) expects changing peaks in train usage, occupancy rates may be different during the (new) peak hours. Therefore, footprints may need to be revised for the current situation.

The Expert Discussion Group discusses the applicability and usefulness of this consultation method in a **broader context**: application at different stations, different trade-offs and different stakeholders. First, station developers and travellers can collaboratively establish a hierarchy for access/egress transport for each station type. Second, distributing functions at and around the station such as locations of stores and other services. This may involve trade-offs based on the use of space, locations or costs. Third, application with other stakeholders, for example, as participation tool and informing local residents. In a professional setting with municipalities and other stakeholders, for example, to clarify everyone's references, points of view or interests.

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Figure 4 and Figure 5 are inspired by figures from www.presentationgo.com

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Appendix A. Survey Data

		Sample size	Walking	Bike parking	Shared bike parking	Bus stop	Kiss & Ride	Taxi	Shared car parking	Private car parking
Sample group	Traveller	104	10%	7%	4%	-8%	5%	3%	-7%	-62%
	NS	6	25%	9%	7%	-18%	3%	2%	-8%	-66%
						Subgroups Travellers				
Access/egress	Walking	34	11%	4%	5%	-8%	6%	3%	-7%	-63%
	Bike	38	7%	11%	3%	-7%	4%	2%	-7%	-62%
	Shared bike	6	14%	4%	13%	-15%	5%	5%	-7%	-66%
	Bus	20	11%	6%	4%	-8%	6%	3%	-8%	-61%
	Kiss & Ride	2	2%	4%	0%	1%	4%	1%	0%	-59%
	Taxi	-	-	-	-	-	-	-	-	-
	Shared car	-	-	-	-	-	-	-	-	-
	Private car	-	-	-	-	-	-	-	-	-
Gender	Woman	37	8%	6%	4%	-5%	5%	2%	-7%	-62%
	Man	66	11%	7%	4%	-10%	5%	3%	-7%	-62%
Age group	17 years or younger	-	-	-	-	-	-	-	-	-
	18 – 29 years	47	8%	8%	3%	-6%	4%	2%	-6%	-60%
	30 – 49 years	43	10%	6%	6%	-9%	7%	4%	-8%	-64%
	50 – 69 years	13	14%	3%	6%	-10%	4%	4%	-8%	-64%
	70 years or older	-	-	-	-	-	-	-	-	-
Trip frequency	Less than once a year	-	-	-	-	-	-	-	-	-
	Approx. once a month	31	9%	5%	6%	-6%	6%	3%	-8%	-62%
	More than once a month	73	10%	8%	4%	-9%	5%	3%	-7%	-62%
Trip purpose	Family, leisure	49	7%	7%	5%	-6%	5%	3%	-8%	-61%
	Study, school	17	10%	9%	4%	-7%	4%	1%	-8%	-61%
	Work, business	68	11%	6%	5%	-9%	5%	3%	-7%	-63%
Education	Basisonderwijs	-	-	-	-	-	-	-	-	-
	Middelbaaronderwijs	6	4%	6%	3%	-2%	2%	1%	-6%	-55%
	MBO	2	33%	-2%	5%	-16%	3%	5%	-8%	-66%
	HBO	14	8%	9%	5%	-9%	5%	3%	-6%	-62%
	WO	81	10%	7%	4%	-8%	6%	3%	-7%	-62%

Figure A.6: Deviation of mean values from initial values, per traveller subgroup

Table A.5: Most frequently mentioned categories within answers to open questions 1, 2, 3, and 4

	Substantiation categories	Travellers	% Travellers	Station Developers	% Station Developers
Q1: This question is about the mode of transportation you gave the highest percentages to. Can you explain why you gave the most percentages to this one?					
1	Sustainable mode (environment, clean, efficient)	21	20%	1	17%
2	Space efficient	15	14%	2	33%
3	Impact/contribution to mobility system	15	14%	1	17%
4	City type (students, car free, green)	10	9%	1	17%
5	Most people use this	9	8%	2	33%
Q2: This question is about the mode of transportation you gave the least percent to. Can you explain why you gave the least percent to this one?					
1	Does not belong at a railway station	15	14%	0	0%
2	Efficiency (space, capacity)	15	14%	0	0%
3	Rarely used	15	14%	0	0%
4	Sufficient alternatives available	12	12%	2	33%
5	Can be located further away or on demand	9	9%	0	0%
Q3: Which other things played a role into the distribution of points (e.g., what trade-offs did you makeand what themes played a role)?					
1	Sustainable mode (environment, clean, efficient)	22	21%	2	33%
2	Space efficient	8	8%	3	50%
3	Impact/contribution to mobility system	7	7%	1	17%
4	(Traffic) safety and liveability	8	8%	0	0%
5	City type (students, car free, green)	8	8%	0	0%
Q4: When you would have preferred to use less than 100 points, could you explain your preferences?					
1	No	26	25%	4	67%
2	More	7	7%	0	0%
3	Yes, for greenery (parks, trees)	5	5%	0	0%

Appendix B. Survey Questions

The respondent is presented with a dilemma through a 'choice task' which simulates the trade-off of access/egress facilities based on space usage. Figure B.7 shows the choice task presented to the respondent. The choice task consists of eight access/egress facilities. Using the corresponding sliders, the respondent is able to assign the number of desired percentage points to each alternative. The initial value, as presented in the figure, represents the current situation in which too much space is being used. To the upper right are two gauges representing the two constraints: the minimum total capacity (minimum 9,999 travellers) and the maximum available space (maximum 100 points). If the two constraints are met, the respondent is allowed proceed to the next part of the survey.

To gain insight into why one facility gets more priority than another, respondents are asked which facility gets the most space and which gets the least space. These are the extreme values, and it is expected that this is where it becomes most clear why one is more desirable than another. Because of time constraints to complete the survey, only the extremes are asked for. The following questions are formulated:

1. This question is about the mode of transportation you gave the highest percentages to. Can you explain why you gave the most percentages to this one?
2. This question is about the mode of transportation you gave the least percent to. Can you explain why you gave the least percent to this one?

Next, the respondent is asked if there are any other things that he/she would like to mention about the allocation of points to access/egress facilities. This question was added in order to not lose potential interesting elements, such as out of the box ideas, sentiment that comes into play or certain important elements not asked in the previous questions. The question is formulated as follows:

3. Which other things played a role into the distribution of points (e.g., what trade-offs did you make and what themes played a role)?

The respondent is asked to allocate 100 percentage points. No hard constraints are built in to maintain a good user experience. Due to the exploratory nature of this study and the desire to maximize the freedom of the respondents, respondents are asked if they would rather have distributed fewer points. There may be an interesting rationale behind this that plays into the consideration of access/egress facilities. The question reads:

4. When you would have preferred to use less than 100 points, could you explain your preferences?

The traveller characteristics questions are formulated as follows:

1. Which means of transport do you use most often to or from station X (more than half of the times)?
   a. Walking
   b. Bicycle
   c. Shared bicycle
   d. Bus
   e. Kiss & Ride
   f. Taxi
   g. Shared car
   h. Private car
   i. I don't know / I prefer not to say
2. On average, how often do you travel by train?
   a. Less than once a year
   b. 1-5 times a month
   c. More than once a week
3. What is usually your travel purpose?
   a. Family, leisure, social activities, hobby
   b. Study or school
   c. Work, business trip
   d. Other: ...

The following demographic questions are considered relevant to the data analysis:

1. Are you ... ?
   a. Male
   b. Female
   c. Other
   I don't know / I prefer not to say
2. What is your age?
   a. 17 years or younger
   b. 18 - 29 years
   c. 30 - 49 years
   d. 50 - 69 years
   e. 70 years or older
   f. I don't know / I prefer not to say
3. What is your highest obtained degree?
   a. Elementary school
   b. High school
   d. MBO
   e. HBO
   f. WO
   h. I don't know / I prefer not to say

The last page of the survey asks respondents what they think of this method of consultation. In addition, there is room for any other comments.

1. In this survey, we asked the advice of travellers, by letting you, the traveller, take a seat in the chair of the 'station boss'. We also ask advice from experts. Which advice do you think is most important?
   a. NS should adopt travellers' advice
   b. travellers' advice is more important than experts' advice
   c. travellers' advice is equally important as experts' advice

d. Experts' advice is more important than travellers' advice
e. NS should adopt experts' advice
f. I don't know / I prefer not to say

2. Do you think the questions in this survey are easy to understand?
   Open field
3. Are there any other things you would like to say about this survey?
   Open field

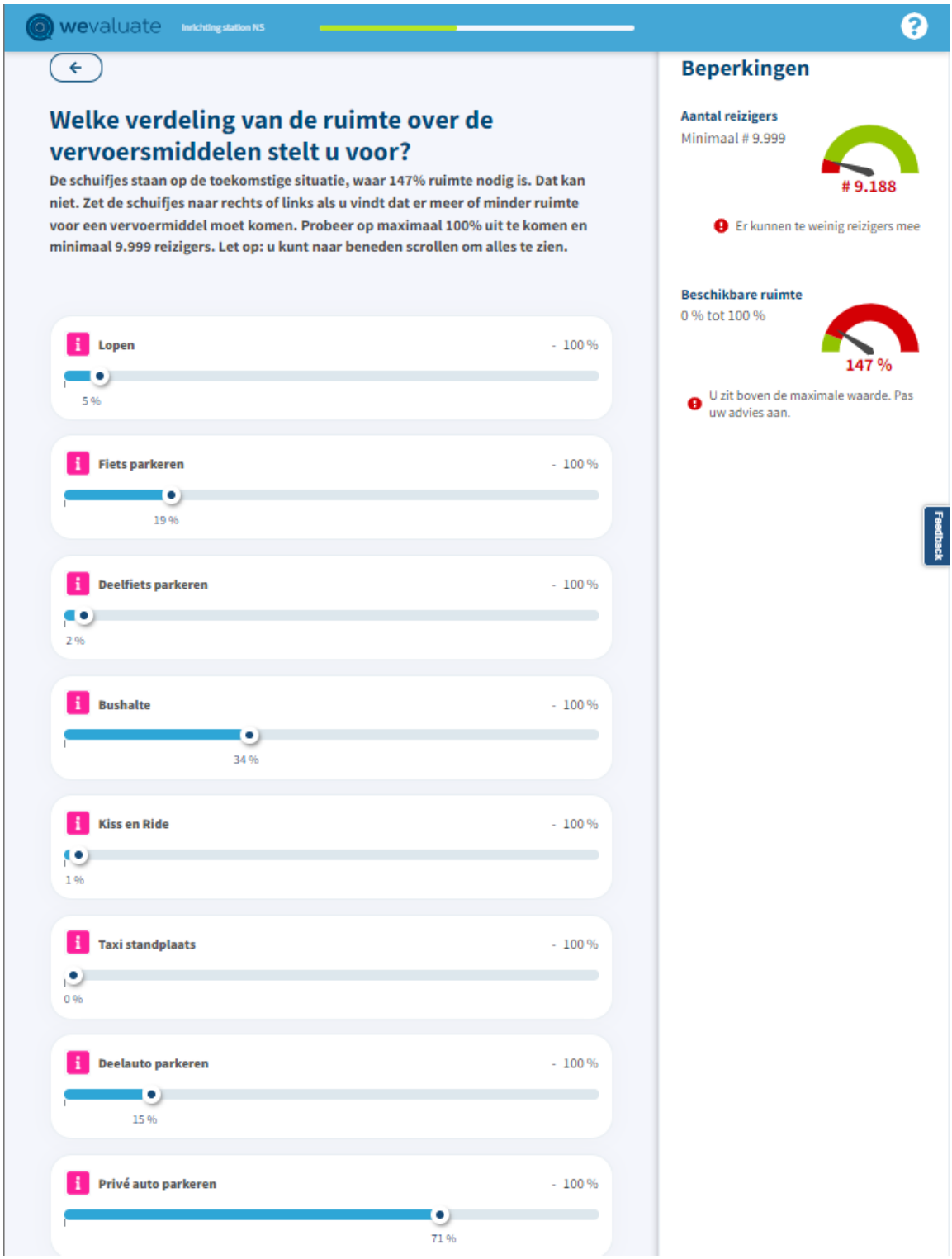

Figure B.7: Survey Choice Task

B

Methodology

Table B.1: Experiment validation of qualitative data analysis method

	Deze vraag gaat over het vervoermiddel dat u de meeste procenten heeft gegeven. Kunt u toelichten waarom u hier de meeste procenten aan heeft gegeven?	Keywords	Deze vraag gaat over het vervoermiddel dat u de minste procenten heeft gegeven. Kunt u toelichten waarom u hier de minste procenten aan heeft gegeven?	Keywords	Zijn er nog andere dingen die meespeelden bij het verdelen van de procenten? (bijvoorbeeld welke afweging maakte u en welke thema's speelden er mee?)	Keywords
1	Nijmegen heeft veel studenten die met de fiets naar het station komen. Daarnaast is Nijmegen een groene stad u waardoor fietsen wordt gepromoot.	Studentenstad Student Fiets Groene stad Student Groene stad Fietsen Studenten Fiets Groene stad Studenten Groen Beleid gemeente Studenten Groen Fiets Student	Nijmegen is een groene stad en auto rijden wordt niet gestimuleerd.	Autoluwe stad Groene stad Ruimte Groene stad Groene stad Beleid gemeente Groen Niet stimuleren auto Groene stad	Nee	
2	Het beste vervoermiddel is de fiets. Gezond en milieu vriendelijk.	Gezondheid Milieu Fiets Gezond Duurzaam Gezond Milieu Fiets Milieu Gezond Duurzaam Gezond Milieuvriendelijk Fiets beste Gezond	Het parkeren van eigen prive autos past niet bij een station. Dus minimaliseren.	Auto hoort niet bij station (of past niet qua ruimte?) Auto's geen plek bij stations Ruimte Parkeren auto / privé auto Past niet bij een station Ruimtegebruik Past niet Privé auto Minimaal Eigen auto	Ruimte voor alle opties is belangrijk. Maar de onhandige opties wel de minste ruimte. Ook belangrijk om deel systemen aan te moedigen.	Deelvervoer belangrijk Alle opties deelsystemen Ruimte Ruimte Deelsystemen Onhandige opties minste ruimte Ruimtegebruik Deelsystemen altijd belangrijk
3	Ik vind openbaar vervoer belangrijk. Zeker binnen een stad als Nijmegen zijn bussen de ruggengraat van de niet-railgebonden wijken naar het station (en daarmee de rest van Nederland). Tevens als je bussen goed wilt uitspelen (zowel snelle directe streeklijnen als tragere slingerende stadlijnen) heb je ruimte nodig in de vorm van een dicht-bij-de-perrons zijnde bustransferium.	Busvervoer cruciaal voor de stad Belang bussen voor de stad Ruimte Bus Snelle lijnen Ruimte Openbaar vervoer Ruimte nodig Bustransferium Bus als feeder Nabijheid bus station Bus Ruggengraat Ruimte dichtbij Toegang OV	Auto's nemen te veel ruimte in bij een station voor (Lang) parkeren. Snelle kiss n ride of deelauto's zijn oké, maar het gros van de auto's staat alleen maar in de weg. Zeker voor een station als bij Nijmegen dat geen gemakkelijke aansluiting heeft met de streek. Auto's bij het station parkeren passen dan ook niet bij een autoluwe stad.	Auto past / hoort niet bij een station Autoluwe stad Auto's te veel ruimte Autoluwe stad Ruimte Te veel ruimte Deelauto Kiss 'n ride Parkeren Te veel ruimte Ruimte gebruik Beleid gemeente Teveel ruimte K&R en deelauto prima Aansluiting streek Autoluw Geen ruimte	Kiss n Ride's zijn handig voor de reiziger die wordt opgehaald omdat bussen niet altijd goed zijn. Nijmegen is dichtbij het centrum, dus het aandeel lopen zal vrij hoog zijn.	Locatie station t.o.v. centrum Handig Bereikbaarheid Kiss 'n Ride Lopen Kiss 'n Rides zijn handig Centrum Lopen Nabijheid centrum Handig K&R handig Centrum Lopen Ophalen

Table B.2: Experiment validation of qualitative data analysis method [continuation]

	Deze vraag gaat over het vervoermiddel dat u de meeste procenten heeft gegeven. Kunt u toelichten waarom u hier de meeste procenten aan heeft gegeven?	Keywords	Deze vraag gaat over het vervoermiddel dat u de minste procenten heeft gegeven. Kunt u toelichten waarom u hier de minste procenten aan heeft gegeven?	Keywords	Zijn er nog andere dingen die meespeelden bij het verdelen van de procenten? (bijvoorbeeld welke afweging maakte u en welke thema's speelden er mee?)	Keywords
4	Lopen en fietsen is voor iedereen die dat kan een goede optie, en is fijn voor de omgeving.	Impact omgeving (sociale veiligheid, reuring, overlast) Voor iedereen Omgeving Ruimte Lopen Fietsen Lopen en fietsen goede optie Fijn voor omgeving Goed Fijn Omgeving Lopen Iedereen	Echt niemand hoeft de privé-auto te parkeren op Nijmegen Centraal. Je kunt als je niet mobiel bent met het OV of je kunt met de auto naar een OV-knooppunt buiten de stad. Deze plek is te duur voor parkeerruimte.	Dure grond Auto niet nodig Te duur Ruimte Te duur Auto Niemand hoeft de privé auto Ruimtegebruik Beschikbare alternatieven Niemand OV alternatief Transferium Te duur voor auto Democratie Gelijkheid		
5	Iedereen wordt op een bepaald moment voetganger. Voetgangers hebben daarnaast positief effect op sociale veiligheid en reuring.	Impact omgeving (sociale veiligheid, reuring, overlast) Voor iedereen Sociale veiligheid Levendigheid Sociale veiligheid Voetganger Sociale veiligheid Reuring Iedereen voetganger Positief sociale veiligheid Reuring Positief effect	Er zijn genoeg alternatieven om naar het station te komen.	Voldoende alternatieven Alternatief Bereikbaarheid Genoeg alternatieven Beschikbare alternatieven Alternatieven Alternatieven	Ruimtebeslag, toegankelijkheid, duurzaamheid.	Ruimtebeslag Toegankelijkheid Duurzaamheid Kwaliteit Toegankelijkheid Duurzaamheid Ruimtebeslag Toegankelijkheid "keywords staan er al" Ruimtebeslag Toegankelijkheid Duurzaamheid Ruimte

C

Interviews

This Appendix contains documentation related to the additional interviews performed with experts within the Dutch National Railways (NS). The semi-structured interview questions are listed first. Then the answers are presented. The answers are summarized, paraphrased and subsequently approved by each interviewee. The interviews were held in Dutch. To avoid changing the meaning of the questions and answers the original texts are included and thus not translated to English.

C.1. Semi-structured interview questions

0.1 Is het akkoord dat dit informele interview wordt opgenomen, t.b.v. wetenschappelijke verantwoording?

Dit informele interview is onderdeel van mijn thesis onderzoek. In het onderzoek wordt gekeken of reizigers vanuit het perspectief van 'de stationsbaas' vergelijkbare of andere afwegingen maken t.o.v. NS'ers bij het maken van keuzes. De keuze tussen voor- en natransport faciliteiten op basis van ruimte op één specifiek station wordt voorgeschoteld in een enquête, uitgezet onder zowel reizigers als NS'ers.

Er is geen handleiding die aangeeft hoe voor- en natransport faciliteiten afgewogen moeten worden op basis van ruimte. Aan een aantal collega's binnen NS wil ik daarom vragen stellen ter voorbereiding en ter onderbouwing van de enquête. Op deze manier wil ik kennis van NS'ers benutten om informatie te verzamelen over het ontwikkelen van voor- na transport faciliteiten. Onder voor- en natransport faciliteiten worden de fysieke locaties bedoeld waar een reiziger het voortransport vervoersmiddel verlaat of waar een reiziger het natransport middel opstapt. Dat zijn onder andere: fietsparkeerplaatsen, autoparkeerplaatsen, K&R, taxi standplaats, shared mobility hubs en BTM haltes.

1.1 Wat is – in het kort – je functie binnen NS Stations, wat voor projecten doe je en wat is jouw rol daarbinnen?

1.2 Ben je betrokken bij het inrichten/ontwerpen/ontwikkelen van stations en wat is daarbij jouw rol? (ontwikkelen van faciliteiten, ontwerpen, indeling, etc.)

De volgende vragen gaan over het ontwerpen van de stationsomgeving in het algemeen (het omgevingsdomein, waarin voor- en natransport faciliteiten zich bevinden).

2.1 Als er keuzes gemaakt worden bij het ontwerpen van een stationsomgeving, heb je daar een beeld bij hoe dat besluitvormingsproces eruit ziet? (Vb van keuzes: welke voorzieningen, hoeveel en waar).

2.2 Indien ja: Hoe ziet dat proces er dan uit? (Welke stappen worden er doorlopen, door wie en wanneer?)

De volgende vragen gaan specifiek over de afwegingen tussen verschillende voor- en natransport faciliteiten op stations ten opzichte van ruimte. In de praktijk zijn er meerdere stakeholders die daar over gaan en NS Stations is daarbij niet altijd de gene die de keuzes maakt. De volgende vragen hoeven daarom ook niet slechts vanuit NS Stations oogpunt beantwoord te worden.

3.1 Op een station is maar een bepaalde hoeveelheid ruimte beschikbaar (m²). Weet je hoe in de huidige situatie wordt afgewogen hoeveel ruimte aan welke voorziening wordt toebedeeld?

3.2 Indien ja: welke factoren spelen daar dan allemaal bij mee? Wie bepaalt wat en wanneer?

3.3 Indien nee: zou het logisch zijn om dat in het vervolg wel te doen? Waarom wel/niet?

Dit afstudeeronderzoek gaat over het betrekken van reizigers bij het maken van keuzes bij het inrichten van stations m.b.t. voor- en natransport faciliteiten. Aan de hand van een enquête wordt onderzocht hoe de reiziger, op de stoel van NS / 'de stationsbaas', verschillende voor- en natransport faciliteiten afweegt op basis van de beschikbare ruimte. Deel 1 van de enquête bestaat uit een keuzetaak waarin een bepaalde verdeling van faciliteiten gemaakt moet worden, met beschikbare ruimte als beperking en minimale capaciteit als eis. Deel 2 bestaat uit open vragen waarin gevraagd wordt om de gemaakte keuze te onderbouwen en nader toe te lichten. Deze enquête zal aan NS'ers voorgelegd worden om te kijken wat de verschillen en/of overeenkomsten zijn met de reizigers.

4.1 Interviewer presenteert de concept enquête: Kun je uitleggen wat er gevraagd wordt? Hoe interpreteer je dit vraagstuk?

4.2 Verwacht je dat reizigers dit begrijpen en op dezelfde manier interpreteren?

4.3 Wat verwacht je dat NS collega's en reizigers invullen? Verwacht je overeenkomsten / verschillen?

4.4 Heb je suggesties en/of ideeën?

5.1 Denk je dat de case study station Nijmegen geschikt is en waarom?

5.2 Weet je of er intern bij NS documenten zijn die gaan over het maken van keuzes voor voor- en natransport faciliteiten?

C.2. Answers interviewee 1

0.1: Ja, dat is akkoord.

1.1: Service developer, regio Randstad Noord. De functie als Service Developer richt zich vooral op voor en natransport, met name auto parkeren, fiets parkeren en OV-fiets (de ketendiensten) ruimtelijk goed inpassen in en rond stations. Hiermee de afdelingen 'planontwikkeling' en 'services' aan elkaar koppelen. Dus eigenlijk daartussen een 'bemiddelaar' spelen, zowel intern als extern naar gemeenten

en ProRail.

1.2: Als Service Development gaan we heel plat gezegd met gemeenten, provincies en interne afdelingen een rondje langs 'het veld' en vragen we of we allemaal een bepaalde plek voor een fietsenstalling allemaal goed vinden en waarom wel of waarom niet, om tot de beste oplossing te komen waar iedereen achter staat. Zo zorgen we dat er ergens een PR wordt ontwikkeld of gereguleerd, er OV-fietsen worden geplaatst of uitgebreid of dat er een fietsenstalling komt in een bepaalde vorm en exploitatie.

2.1: Het proces verschilt per ketendienst. Bij fiets parkeren initiatief vanuit ProRail of gemeente, zij financieren de bouw of herinrichting. ProRail doet het vanuit capaciteit opgave vanuit ministerie. Maaiveld fietsenstalling heeft NS heel weinig te maken. Bij bemenste of onbemenste bewaakte stallingen kijken we wel mee want we willen daar de exploitatie hebben (deels verplicht vanuit concessie). Daarnaast vindt NS het onderdeel van de volledige reis van deur tot deur, dus we willen de exploitatie hebben.

2.2: Het begint met dat de gemeente en ProRail het er over eens zijn dat ze ergens een bewaakte fietsenstalling willen realiseren of uitbreiden en dan proberen ze eerst de financiering rond proberen te krijgen. Daarna kiezen ze een ontwerper / ingenieursbureau en die gaat dan aan de slag met de eisen en wensen van de betrokken partijen, waaronder NS. Vanaf dat moment komt NS aan tafel. Dan gaan wij meegeven 'zet de stalling zo neer', houd rekening met zoveel vierkante meter, houd rekening met in- en uitcheck palen, zoveel vierkante meter Fietst&Service. Dat is eigenlijk het opstellen van het programma van Eisen. Daar gaat een ontwerper dan mee aan de slag. Die komt dan met een ontwerpvoorstel of een aantal voorkeursvarianten. Dan gaan wij ook echt mee reviewen op de technische tekeningen daarvan om ervoor te zorgen dat als de tekeningen naar een aanbesteding en een bouwer gaan, dat de tekeningen dan ook echt voldoen aan ons wensenlijstje. Parallel daaraan gaan we met de gemeente in gesprek over een exploitatieovereenkomst.

3.1: Volgens mij heb je hier de vraag te pakken waar het allemaal om draait. Er is niet echt een vast stramien voor, het ligt er ook aan wie de initiatiefnemer is. Veel gebeurt er vanuit gemeenten, die willen woningen bouwen door te verdichten in steden. Wat je nodig hebt voor verdichting in steden is in ieder geval minder auto's, want je wilt minder vervoersmiddelen die een grote druk leggen op de openbare ruimte. Waar kun je auto's makkelijk elimineren? Nou, op en rond het station. Dan stimuleer je mensen om lopend of fietsend naar het station te gaan. Of je kan daar iets creëren met deelmobiliteit. De gemeente gaat eerst op zoek naar de ruimte en klopt dan aan bij ProRail en NS als het raakt aan hun gebieden om te kijken of er bijvoorbeeld ruimte in de fietsenstallingen gebruikt kan worden voor omwonenden. Of dat er een nieuwe fietsenstalling moet komen en dan vraagt de gemeente of ze mee willen betalen. Hetzelfde geldt voor een P&R.

Vervolgvraag: Klopt het dat er dus geen ruimte rondom het station 'weggesnoept' wordt voor woningen, maar dat de huidige beschikbare ruimte intensiever gebruikt moet worden en dat daarom auto parkeerplaatsen als eerste afvallen?

Ja, dat klopt. Hierbij kun je dan het STOMP principe bekijken. Als een stationsgebied opnieuw wordt ingericht zullen gemeenten, ProRail en NS als eerst kijken wat er met de auto moet gebeuren. Gemeenten zullen dan snel zeggen dat er minder auto's moeten komen, maar NS zal dan zeggen dat een P&R ook een functie heeft. Het bedient namelijk reizigers uit de omgeving die niet makkelijk met de fiets of lopend naar het station kunnen komen. Als zij geen P&R hebben, dan zullen zij eerder geneigd zijn de volledige reis met de auto af te leggen i.p.v. de trein te gebruiken.

3.2: Er is geen vast patroon op te pinnen. Het hangt er heel erg vanaf of wij (NS Stations) grond in bezit hebben. Als een P&R op grond van de gemeente ligt dan is het lastig om die te behouden, want de gemeente zal eerder kiezen voor minder ruimte voor de auto en bijvoorbeeld meer voor ruimtelijke kwaliteiten (zoals autovrije pleinen en straten, looproutes vergroten of stallingen uitbreiden). Dus, als de gemeente het voor het zeggen heeft dan zo min mogelijk auto en zo veel mogelijk lopen.

Duurzaamheid, flexibiliteit en ruimtelijke kwaliteit (minder auto's geeft mogelijkheden tot een mooi plein of een woontoren). De missie van NS vat het mooi samen: Nederland duurzaam bereikbaar maken, voor iedereen. Het is dus niet de keuze tussen vervoersmiddelen, maar juist allemaal (én fiets parkeren én deelmobiliteit én auto parkeren etc). De verdeling daarvan kun je uitrekenen met een model, en dat doe je dan per station en per stakeholder.

3.3: X

4.1: Zoals ik hem interpreteer kun je maar een bepaald aantal dingen doen en aan de andere kant mag het niet iets overschrijden. Het doet me denken aan Fantasy Football, waar je voor maximaal 100 experience points spelers mag kopen en iedere speler is dan duurder of minder duur en je mag dan maximaal 10.000 dollar uitgeven. Dat is volgens mij wat je mensen vraagt. Het is interessant om te zien welk optimum de respondent zoekt.

4.2: Dat denk ik wel. De linker kolom moet minimaal 30.000 zijn en de rechter kolom mag niet boven de 15.000 uitkomen. Ik weet niet wat het menselijk gedrag is bij enquêtes wat betreft spanningsboog en tijdsinvestering.

Vervolgvraag: Schat je in dat dit haalbaar is in 10min voor niet professionals?

Het is een aanname, maar ik zou zeggen dat mensen hier wat langer de tijd voor nodig hebben. Maar ik kan het dus lastig inschatten, want ik heb hier geen verstand van.

4.3: Ik denk dat reizigers andere afwegingen maken dan NS collega's.

Vervolgvraag: Denk je dat het alleen een andere verdeling is van vervoersmiddelen of ook andere factoren die meespelen?

Goeie vraag, ik denk allebei. Collega's van NS kijken er als een helikopter naar en meer vanuit hun beroep en dus minder vanuit de dagelijkse praktijk, wat de reizigers wel weer doen. Zij zullen dan met dingen komen zoals afvalbakken die in de weg staan. Maar mogelijk dat iemand die met de auto komt ook eerder een PR ruimte geeft.

Vervolgvraag: Kan ik het zo samenvatten dat reizigers minder relevante dingen noemen en wellicht ook biased zijn door het vervoersmiddel dat ze vaak gebruiken?

Ja. Ik denk ook dat reizigers dingen uit de praktijk kunnen noemen die wij als NS'ers mogelijk overslaan of minder snel zullen zien. Maar zij zullen het totaalplaatje minder goed overzien, wat NS'ers weer wel doen.

4.4: Nee niet echt, ik ben vooral heel erg benieuwd.

5.1: Geen idee, dan moet je bij ... zijn.

5.2: Het is eigenlijk alleen het STOMP principe dat we hanteren.

C.3. Answers interviewee 2

0.1: Ja, dat is akkoord.

Opmerking halverwege de introductie na de zin "Er is geen handleiding die aangeeft hoe voor- en natransport faciliteiten afgewogen moeten worden op basis van ruimte..."

Klopt, maar wel op welke volgorde. STOMP is daarbij een belangrijke. Daarnaast is er in 2006 "het basis station" vastgelegd van ProRail. Daar staat een hiërarchiecirkel in met wat het dichtstbij het station komt qua voor- en natransport middelen. Als je bijv. een afweging moet maken tussen fiets en auto, dan zie je dat fietsenstallingen dichterbij het station komen.

1.1: Senior ontwikkelaar. Dat senior noem ik nooit zo zeer, ik noem mezelf een stations ontwikkelaar. Ik ben geen ontwikkelaar van woningbouw of iets anders, maar echt van een station. Ik werk aan stations projecten, meestal vanaf het begin (haalbaarheidsfase, begin van planontwikkeling) tot en met het definitieve ontwerp. Daarnaast doe ik wat voor visie en beleid voor stations. We werken heel erg samen met ProRail en adviesbureau Bouwmeester. Met collega's van ProRail en Bureauspoorbouwmeester werk ik daarnaast aan het inhoudelijk opstellen van het beleid en het beheren van de kunstcollectie op stations.

1.2: Ja, want het betreft stedenbouwkundig ontwerp waarin de gemeente de leiding heeft. Daar kijk je dan naar de aansluiting op bijvoorbeeld fietspaden. Maar ook het gebouw zelf (meer architectuur) en dat is het ontwerpen van het gebouw. Dan kijk je naar hoe de stationsomgeving over gaat in het station, totdat de reiziger in de trein zit. Ik kijk dus naar het complete plaatje.

2.1: Je hebt echt een stedenbouwkundig plan nodig, waar dan bijna altijd de gemeente in de lead is. Of een partij die een behoefte heeft, bijvoorbeeld NS Stations die een P&R terrein wil uitbreiden. Ze zal dan zelf het initiatief nemen in de ontwikkeling. Of ProRail die een fietsenstalling wil uitbreiden, dan zal ProRail in de lead zijn. Wat bijna altijd wel is, is dat ProRail gemeente en NS het samen doen. Want iedereen heeft een stukje verantwoordelijkheid, een stukje eigendom en een beheerrol. Het maken is één ding, maar daarna moet het ook goed blijven en beheerd worden.

2.2: Het gaat heel vaak over de openbare ruimte, dus welke partij dan ook de trekker is, een deel gaat over de stad en ligt dus bij de gemeente. Die hebben een zware stem in de besluitvorming. Het heeft ook heel erg te maken met wat voor programma je hebt op te lossen met elkaar. Als er een busstation is, dan zit de provincie ook aan tafel. Want de provincie is de concessie verlener voor de bus.

We nemen even Rotterdam. Aan de centrumzijde bij het voorplein is de aansluiting op de stad, en er zijn bus en tram halte. Het tramstation is van de gemeente en het busstation van de provincie. Het voorplein (incl. entree naar fietsenstalling) is gemeente grond. Waarschijnlijk is er een overeenkomst met ProRail / NS over hoe de ingang naar de fietsenstalling beheerd gaat worden. Aan de achterzijde van t station heb je een onbewaakte fietsenstalling. Die zal of op ProRail, NS Vastgoed, of op gemeente grond staan. Omdat het een stalling van ProRail is, zal NS waarschijnlijk het dagelijks beheer doen. Toen er een nieuw ontwerp voor het nieuwe Rotterdam gemaakt moest worden hebben gemeente, ProRail en NS een overeenkomst gesloten om het gebied te gaan ontwikkelen.

Vervolgvraag: Klopt het dus dat iedere partij zijn of haar eigen belangen probeert te behartigen en dat er een neutrale partij ontbreekt die alles overziet?

Die afweging wordt wel gemaakt, maar met de partijen samen. Het gemeenschappelijke belang is om een goed OV knooppunt te realiseren en daarmee je eigen belang te overstijgen. Het gaat om de reiziger en die reiziger raakt meerdere partijen want een treinreiziger kan daarna zomaar een tram-reiziger worden. Het is dus van belang die reiziger tevreden te houden. De hele keten wordt namelijk beoordeeld op de zwakste schakel, dus je hebt allemaal belang bij dat de zwakste schakel goed is. Het scheelt ook dat het allemaal publieke partijen zijn.

3.1: Wat altijd voor elke stakeholder hard is, is de ruimte die zij minimaal nodig heeft in het kader van veiligheid en basiscomfort. Daarnaast wil je een stuk kwaliteit realiseren, dat staat boven de veiligheid en basiscomfort. Daar heb je dan met elkaar het gesprek over. Als je een tramstation zou ontwerpen, en je hebt geen belemmeringen, dan heb je een heel breed programma van eisen met veel wensen. Maar als de ruimte beperkt is, dan moet je voor sommige wensen of ambities wat inleveren omdat het niet past of omdat een andere stakeholder ook haar wensen/eisen heeft. Maar aan die basis ruimte wil je niet tornen, want dat wordt het een zwakke schakel.

Vervolgvraag: Stel er is te weinig ruimte voor alle basis ruimte?

Dan moet je terug naar de opdrachtgevers. Dan heb je eigenlijk een onmogelijke opdracht gekregen.

Vervolgvraag: Stel NS wil een P&R hebben, maar dat past niet met alle fietsenstallingen. Je zou dan kunnen zeggen we doen minder P&R?

Ja dat zou een vraag kunnen zijn en daar ga je dan over praten. Met het STOMP principe zou je dit kunnen onderbouwen.

3.2: Neem even zo'n concreet stuk zoals bij Rotterdam. Als Rotterdam Centraal minder plekken heeft voor auto parkeren, maar er zijn veel reizigers die uit de regio komen, dan wil ik die mensen graag bedienen vanaf een ander station. Voor die groep reizigers wil je dan extra parkeerplekken bij bijvoorbeeld Rotterdam Zuid als dit station een alternatief kan zijn, zodat je toch de auto's van de weg kan halen en mensen in de trein krijgen.

Vervolgvraag: Begrijp ik het goed en wil elke stakeholder zijn/haar klanten bedienen? Dus dan gaat het om de afweging 'bereikbaarheid'?

Ja. Bijvoorbeeld op Rotterdam Centraal heb je internationale treinen. Deze reiziger willen graag met de auto verder reizen omdat ze vaak veel bagage hebben of zakelijk reizen (bereid voor comfort te betalen). Je wilt niet hebben dat het vliegtuig weer interessanter wordt als er geen parkeerplekken zijn bij Rotterdam Centraal.

3.3: X

4.1: Wat je de reiziger dus eigenlijk vraagt is om zijn/haar prioritering en een inschatting te geven hoeveel reizigers naar het station komen (of ervan weg gaan). Daarmee wordt automatisch het aantal m² berekend het percentage. Mijn eerste vraag: komt die altijd uit? Kan er bijv. 120% ruimtegebruik uit komen?

Waarom staat er belbus? Als je zo al die vervoersmiddelen ziet, dan is dat stedelijk gebied. Maar een belbus zie je vooral in landelijk gebied. Wat je kan overwegen is dat je gewoon 'bus' neerzet en dan een klein sterretje met bijv. "op afroep". Anders leidt het iemand wellicht erg af. Een bus is een bus, en of die nou op afroep komt. Een belbus komt op afroep dus het klopt dat ie minder ruimte nodig heeft.

Als het inderdaad Nijmegen wordt, dan is het handig om even te checken wat nu de benodigde ruimte is, verhoudingsgewijs. Op Nijmegen is de ruimte voor de bus vele malen groter dan voor K&R. Ik moet even mijn eigen denkknop omzetten. Want eerst dacht ik een bus is veel groter dan een auto, maar vervoer dat je deelt is natuurlijk veel efficiënter dus dan kloppen jouw getallen wel.

4.2: Ik denk dat een reiziger prima begrijpt dat je ruimte verdeelt en dat 'ie even moet puzzelen. Het is een soort van spelletje. Ik denk dat het ook helpt dat het voorbeeld concreet is, dat helpt mensen in het denken. Je wilt weinig ruimte hebben voor vrij interpretatie. Je wilt wel dat de respondent de opgave eenduidig leest. Zoals ik net een knopje moest omzetten, wil je niet dat er bij mensen meerdere knopjes omgezet worden. Het is wel een zoektocht hoe je hem zo concreet kan maken en dat je er dan uit krijgt wat je wilt weten. Je wilt weten wat de respondent de belangrijkste vervoersmiddelen vindt (prioritering) en dat hij/zij weet dat het impact heeft op de ruimte.

4.3: De collega's hier zullen steunen op de kennis de ze al hebben. Dus collega's die heel erg bezig zijn met fiets zullen fietsenstallingen hoger zetten. Bij reiziger zou het interessant zijn om te zien of ze het beantwoorden vanuit hun eigen reis of wat ze graag op maaiveld zien of dat ze het beantwoorden op sociaal wenselijkheid. Een verstokt fietser zal fiets op 1 zetten. De meeste mensen zijn bijv. niet zo gecharmeerd van busstations, dus die zullen ze misschien minder ruimte geven. Bij sociaal wenselijkheid zou iemand auto als laatste zetten omdat het om OV gaat.

De formulering 'welk vervoersmiddel gebruikt u doorgaans het meest' is iets te vrijblijvend. Ik zou bijvoorbeeld zeggen 'minimaal 50% van de tijd'. Dus probeer het wat concreter te maken zonder dat je het antwoord meteen dicht zet. Dus iemand die vaak met de fiets gaat en ook vaak met te voet, maar dan wil je toch weten welke het meeste.

4.4: Ik zou denk ik bij het tweede punt van die vierkante meters ook benoemen dat een bus en tram efficiënter zijn dan een auto. Dat is die knop die ik net even moest omzetten, misschien is daarom een toelichting handig. Alles wat je beeldend kan maken zou ik overwegen. Plaatjes die de tekst ondersteunen of tekst die de plaatjes ondersteunen. Bijvoorbeeld een foto van een fietsenrek met twee lagen.

Vervolgvraag: Bijv. een tekening wat laat zien hoeveel fietsers er in een bus passen en hoeveel bussen in een auto?

Ja, bijvoorbeeld.

Vervolgvraag: Ik heb even aangenomen dat we 25% van de beschikbare ruimte nodig hebben voor voetpaden.

Dat is veel hoor, dat kan wel minder denk ik. Een paar meter breedte en dan een paar meter lang, daar red je het al mee. Vraag even aan Jeroen wat een realistisch percentage is.

Wat ik me nog meer afvroeg, wil je reizigers nog wat meer op weg helpen, is dan een taart diagram een goed idee. Je zou een taartdiagram kunnen geven van de gemiddelde modal split, maar dan loop je

wel het risico dat mensen dat gaan namaken en je wilt ze juist niet beïnvloeden. Maar een taartdiagram van de ingevoerde waarden kan wel helpen. Of met een kolom of stapelgrafiek kun je laten zien hoe veel ruimte je al hebt gebruikt en hoe die verdeeld is. En dan met bijvoorbeeld een lijn aangeven wat de maximale ruimte is.

5.1: Ja, zeker. Omdat daar sowieso ruimte om het station is en al deze modaliteiten aanwezig zijn. Heb je ... al gesproken? ... weet ook heel veel van Nijmegen. Ik zou even met allebei gaan zitten. Waar je je wel bewust van moet zijn is de kleur van een gemeente. Dit is bijvoorbeeld een hele progressieve gemeente. De gemiddelde bewoner is waarschijnlijk meer OV-minded. Daar kun je vragen over verwachten. Dit is iets wat bij Nijmegen hoort. Wat Nijmegen ook heeft is dat het niet plat is daar. Je hebt hoogteverschillen. Een deelscooter of e-bike zou daar populair kunnen zijn. Dit zijn allemaal achtergrond kenmerken en dit kun je wellicht bespreken met je begeleiders.

5.2: Het Stationskwartier komt hier het dichtstbij. Dit gaat echt over het omgevingsdomein. Het document 'hartelijk welkom' is ook interessant. (Boeken staan in het rek bij de lift).

C.4. Answers interviewee 3

0.1: Ja, dat is akkoord.

1.1: Format manager, op fiets. Ik houd me bezig met fiets parkeren en Fiets&Service. Ik ben verantwoordelijk voor het format fiets parkeren en FietsService. Dat houdt voor mij in: dat ik me bezig hou met de ontwikkeling van de reiziger, de wijze waarop we fiets parkeren aanbieden en exploiteren. Hoeveel betaalt men, hoe ziet het eruit, hoe gebruikt men het? Daarnaast ook strategische doorontwikkeling. Zowel intern, zoals visies en meningen en extern zoals deelmobiliteit. Zo denk ik er over na waar we naartoe zouden moeten bewegen om een goed product te blijven aanbieden.

Binnen project stel ik de kaders en ben ik vaak een soort opdrachtgever voor pilots, hoe we omgaan met fiets kluizen, de ontwikkeling van hoe we omgaan met deelmobiliteit in fietsenstallingen. Daarnaast ontwikkel ik zelf de toekomstvisie ketendiensten, daar ben ik een schrijver. Binnen projecten loopt het dus van kaders stellen tot mening/visie vormend werk en soms ook wat uitvoering zoals voorwaarden creëren.

1.2: Ja zeker, op twee manieren eigenlijk. De bedoeling is dat je het format fiets parkeren zo door ontwikkelt dat het aansluit bij externe situaties (dus wat er speelt bij gemeenten en ProRail). Dus we maken zodanig keuzes voor het format dat we krijgen wat we willen (dat wij denken dat goed is). Op een gegeven moment hebben we een format ontwikkeld, maar we zijn dan heel erg afhankelijk van gemeenten en ProRail voor realisatie. Ik werk dan veel samen met service development (het team van Vincent de Heer).

En dan heb je nog product teams, daar wordt agile gewerkt, dat zijn teams dat op bepaalde producten multidisciplinaire teams hebben samengesteld voor bijvoorbeeld fiets parkeren. Daar werk ik ook veel mee samen.

2.1: Ja, dat denk ik wel.

2.2: In mijn beleving (maar ik maak het mogelijk veel te simpel) zijn er prognose modellen van ProRail waarin staat hoeveel fietsparkeercapaciteit we verwachten nodig te hebben in de toekomst. Gemeen-

ten hebben vaak behoeften in zo'n stationsgebied, zoals verdichten, bereikbaarheid en om ambities te realiseren waar fiets parkeren ook bij hoort. Dan worden er plannen gemaakt en op een gegeven moment komen wij aan tafel, vaak te laat als er al wat keuzes zijn gemaakt. Soms zitten we heel vroeg aan tafel en soms heel laat.

3.1: Keuzes, daar sta ik wat verder bij weg. Vaak op basis van studies, maar in dit land is het wel wie betaalt, die bepaalt. Zeker ook bij fiets parkeren. De gemeentes betalen het meest in de aanleg, dus die bepalen ook het meest. NS heeft dan een adviserende rol. We hebben dan wel wat juridische uitdagingen qua de gunning aan ons. Maar wij vinden het wel in het belang van de reiziger dat deze stallingen goed geëxploiteerd worden. Er gelden bij deze fietsenstallingen andere eisen dan bij de fietsenstalling 'op het marktplein' om het zo te zeggen. Bij de bemenste fietsenstallingen zijn we ook afhankelijk van de gemeente want die kosten ieder jaar weer geld en daar draagt de gemeente het meeste aan bij in de meeste gevallen. Ook daar hebben we veel afstemming en overtuiging dat onze manier van exploiteren de juiste is. Over de locatiekeuze en dergelijke sta ik wat verder vanaf. Ik denk er wel eens over mee, maar dat doen toch echt de stations ontwikkelaars, de service developers en ProRail.

3.2: X

3.3: X

4.1: Het derde puntje moest ik drie keer lezen. Maar wat je dus eigenlijk zegt is: vul gewoon aantallen reizigers in en ga daarmee schuiven, zorg dat je minimaal 30.000 reizigers heb en het ruimtebeslag minder is dan 15.000 m². Dat tabelletje vind ik wel logisch, maar belbus bestaat dat nog? Het zijn wel super precieze cijfers, de benodigde ruimte per reiziger. Misschien mis ik het, maar stel een hele duidelijke vraag! Ik weet het wel een beetje, maar vanuit de instructies en informatie was het niet meteen duidelijk. Daar staat ook teveel jargon in, als je het naar de reizigers stuurt. Twee lagen fietsenrek, waar heb je het over? "Overstapfaciliteiten" is er ook zo één. Kijk daar nog even goed naar. Wat is je doel, wat is je vraag? Dat moet je er echt heel goed bijzetten. In de introductie: dit is wat we gaan doen, alle antwoorden zijn goed zolang het voldoet aan de twee eisen.

Dit is een simplificatie en benadering van de werkelijkheid, maar de kentallen met twee cijfers achter de komma is niet bepaald een simplificatie. Je zou ervoor kunnen kiezen als je echt wil simplificeren dat je het op legoblokjes niveau doet.

Voor fiets parkeren doen we prognose ontwikkeling. Als daaruit naar voren komt dat er een behoefte is aan 10.000 fietsparkeerplekken, dan bouwen we er 10.000 en geen 9900. Ik weet niet zo goed in hoeverre we bezig zijn met het beïnvloeden van de modal split. Wel het STOMP principe. Maar als mensen met de auto naar het station willen, dan maken we parkeerplekken.

Wat je zou kunnen vragen: we hebben 30.000 reizigers en daarvan wil 40% met de fiets komen en 20% met de auto, maar dat past niet. Dan kun je vragen, wat zou jij nou doen om het wel passend te maken? Dan heb je heel duidelijk een vraag en een vertrekpunt waar wij ook mee werken. En dan komt het knelpunt! Je wilt natuurlijk ook niet dat mensen alles op bijvoorbeeld lopen zetten, want dan ben je klaar. Je wilt ze dus deze struggle voorleggen, dat we een verwachte behoefte hebben per mode en dat dat niet past. En dan is jouw vraag / hypothese dat de auto teveel plek inneemt, en daar moeten we wat aan doen. Of bijv. zoveel aantallen fietsplekken, past niet. Dus dit kun je wellicht toevoegen, dat je duidelijk maakt hoe mensen willen komen zodat een respondent niet alles op fiets zet bijvoorbeeld. Dan krijg je een beetje een Sim City idee.

Vervolgvraag: Dus als ik het goed begrijp zou ik de verwachte modal split erbij kunnen zetten, en als we dit willen realiseren past het niet?

Ja, precies. Dan moet de respondent gaan schuiven.

Hoe kan het dat een scooter minder ruimte inneemt dan een fiets? Dat lijkt mij niet te kloppen. Ik zou bijna 1,1m² en 1,13m² voor scooter en deelscooter rekenen ipv 0,1m². Ik had altijd het idee dat er bij bijvoorbeeld in Amsterdam en Rotterdam heel veel mensen met bus, tram en metro komen en dat we al die mensen echt niet kunnen faciliteren met de fiets. Dus dat bus, tram en metro minder ruimte inneemt.

Een struggle die wij hebben is dat we zoveel fiets parkeren nodig hebben, waar gaan we die ruimte vinden? Dan is het enige waar je naar kunt uitwijken lopen en op andere plekken ook bus, tram en metro. Daar zitten natuurlijk offers aan. Als je wilt kun je dit echt met lego blokjes doen met verschillende kleurtjes blokjes.

4.2: Zoals je het nu aan mij presenteert niet. Minder jargon en één hele duidelijke opdracht geven. En ik zou ze een modal split meegeven, want nu lijkt de taak om te kijken hoe het gemaximaliseerd kan worden en precies de 30.000 m² vult.

Vervolgvraag: Ik zit even hardop te denken, ik zou bijvoorbeeld de modal split en verachte aantal reizigers alvast kunnen invullen en dan laten zien dat dat niet past omdat het totaal de maximale ruimte overschrijdt en dat de respondent dan de getallen moet aanpassen totdat het wel past.

Ja, precies, zoiets. Dan dwing je ze om een afweging te maken. En dan zie je ook dat mensen die met een bepaald vervoersmiddel willen komen, dat dan niet meer kunnen.

4.3: Als je heel duidelijk de karakteristieken van het station nog omschrijft, dus wat zijn de behoeftes op het station dan hoop ik (en verwacht ik) dat NS collega's het volgens het STOMP principe gaan invullen. Het zou mij heel erg verbazen als het niet zo is, maar het ligt ook wel aan het type station. Dus het zou wel leuk zijn als je meerdere stations doet.

Wat betreft reizigers weet ik het niet zo goed, ik ben er wel benieuwd naar. Ben ook benieuwd hoe erg ze er in geïnteresseerd zijn. Ze kunnen bijv. zeggen dat dit jouw werk is en dat ze ook hun eigen problemen niet gaan voorleggen. Het is een beetje zoals mensen in de file, die vragen zich ook altijd af waarom al die anderen op dit tijdstip in de auto zitten terwijl ze zelf ook in de auto zitten. Dat is ook weer zo'n redenatie van ik ben niet het probleem, maar de rest is het probleem. Je zou dus kunnen zien dat mensen die met de fiets komen, zeggen dat zij gewoon hun fiets willen kunnen parkeren en dat anderen maar op een andere manier moeten komen.

Je zou voor je vervolgvragen niet alleen kunnen vragen hoe kom je doorgaans naar het station, maar ook vragen hoe zou je graag naar het station willen komen.

4.4: Dat heb ik allemaal al gedeeld met je. Ik ben benieuwd wat er uit gaat komen. Maar let vooral op je formulering en hoe je dingen gaat aanbieden aan de reiziger. Je verzand heel snel in jargon, dingen als bezettingsgraad zegt een buitenstaander wellicht helemaal niks. Je hoeft geen indruk te maken met je kennis op NS collega's dus je hoeft daar geen jargon voor te gaan gebruiken.

5.1: Ze gaan hier renoveren ja. Je zou met jouw onderzoek dit project wel kunnen helpen. Ik durf niet te zeggen of dit een goed station is qua uitdagingen. Haarlem, Groningen, er zijn nog veel meer stations die interessant zijn. Maar dat weten andere mensen beter dan ik.

5.2: Je kunt ... vragen of je het nieuwe document 'toekomstvisie ketendiensten' mag gebruiken, want het is nog niet goedgekeurd. Daar staat wel in hoe we om willen gaan met fiets parkeren. Qua keuzes kom je snel bij het STOMP principe uit. Maar daar zijn geen leidraad of afwegingskaders voor. Iedere gemeente heeft ook weer haar eigen beleid met welke type vervoersmiddelen ze voorrang willen geven. Het is aardig vergelijkbaar wel, meer fietsen en minder auto.

D

Survey

The traveller characteristics questions are formulated as follows:

1. Which means of transport do you use most often to or from station X (more than half of the times)?
   a. Walking
   b. Bicycle
   c. Shared bicycle
   d. Bus
   e. Kiss & Ride
   f. Taxi
   g. Shared car
   h. Private car
   i. I don’t know / I prefer not to say
2. On average, how often do you travel by train?
   a. Less than once a year
   b. 1-5 times a month
   c. More than once a week
3. What is usually your travel purpose?
   a. Family, leisure, social activities, hobby
   b. Study or school
   c. Work, business trip
   d. Other: ...

The following demographic questions are considered relevant to the data analysis:

1. Are you ... ?
   a. Male
   b. Female
   c. Other
   I don’t know / I prefer not to say
2. What is your age?
   a. < 17 years
   b. 18 - 29 years
   c. 30 - 49 years
   d. 50 - 69 years

e. > 70 years
f. I don’t know / I prefer not to say

3. What is your highest obtained degree?
   a. Elementary school
   b. High school
   d. MBO
   e. HBO
   f. WO
   h. I don’t know / I prefer not to say

The last page of the survey asks respondents what they think of this method of consultation. In addition, there is room for any other comments.

1. In this survey, we asked the advice of travellers, by letting you, the traveller, take a seat in the chair of the ’station boss’. We also ask advice from experts. Which advice do you think is most important?
   a. NS should adopt travellers’ advice
   b. travellers’ advice is more important than experts’ advice
   c. travellers’ advice is equally important as experts’ advice
   d. Experts’ advice is more important than travellers’ advice
   e. NS should adopt experts’ advice
   f. I don’t know / I prefer not to say

2. Do you think the questions in this survey are easy to understand?
   Open field

3. Are there any other things you would like to say about this survey?
   Open field

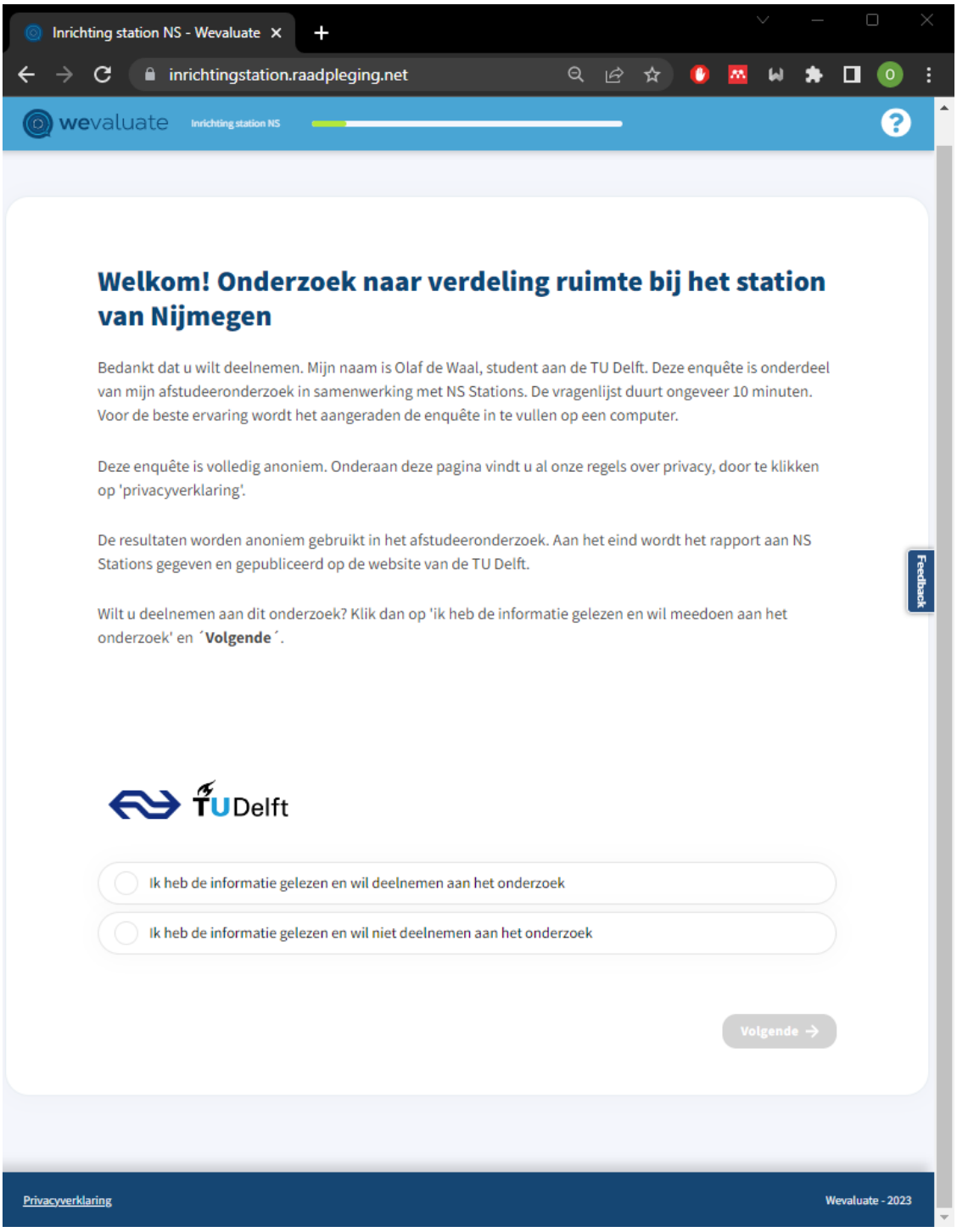

Figure D.1: Page 1

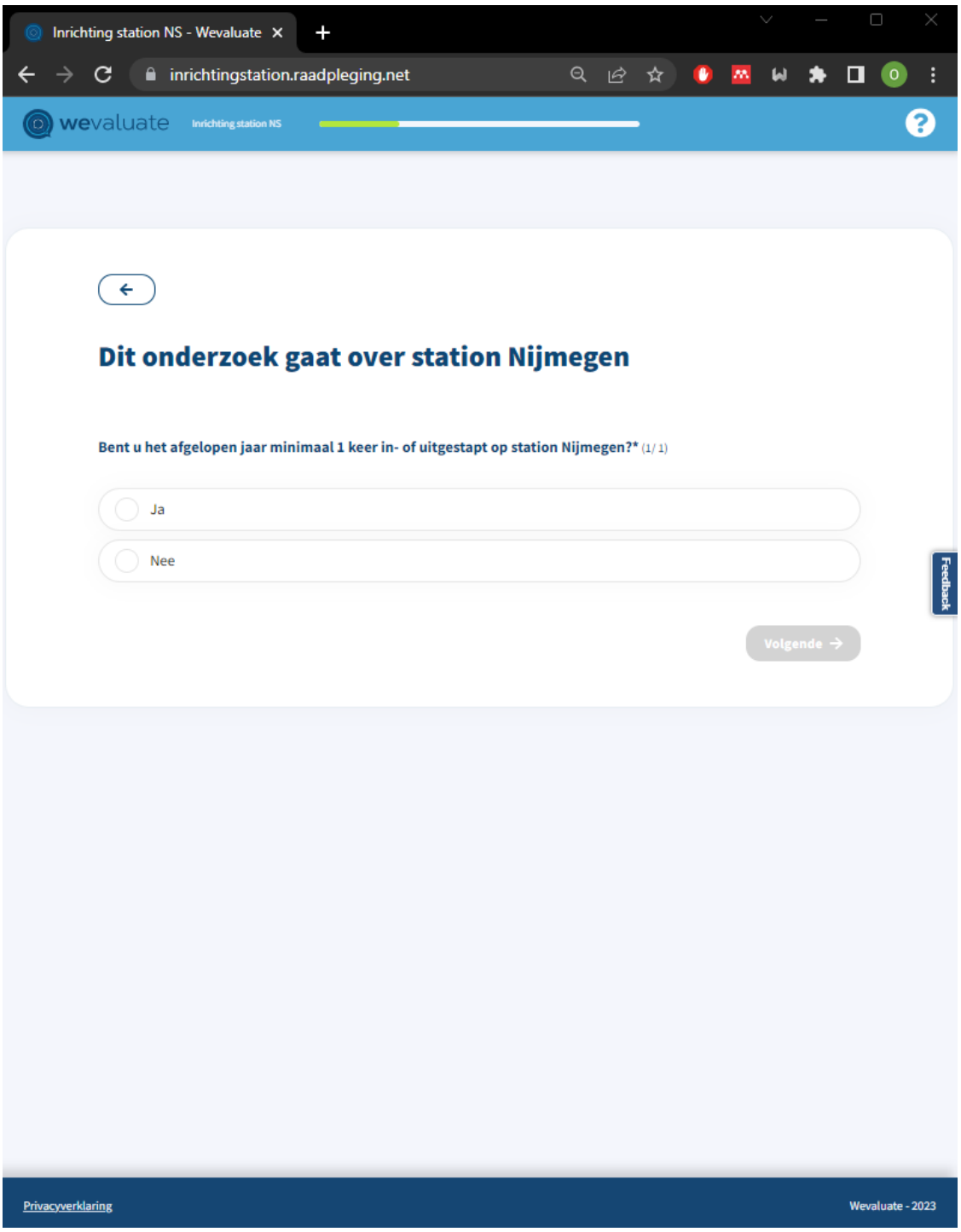

Figure D.2: Page 2

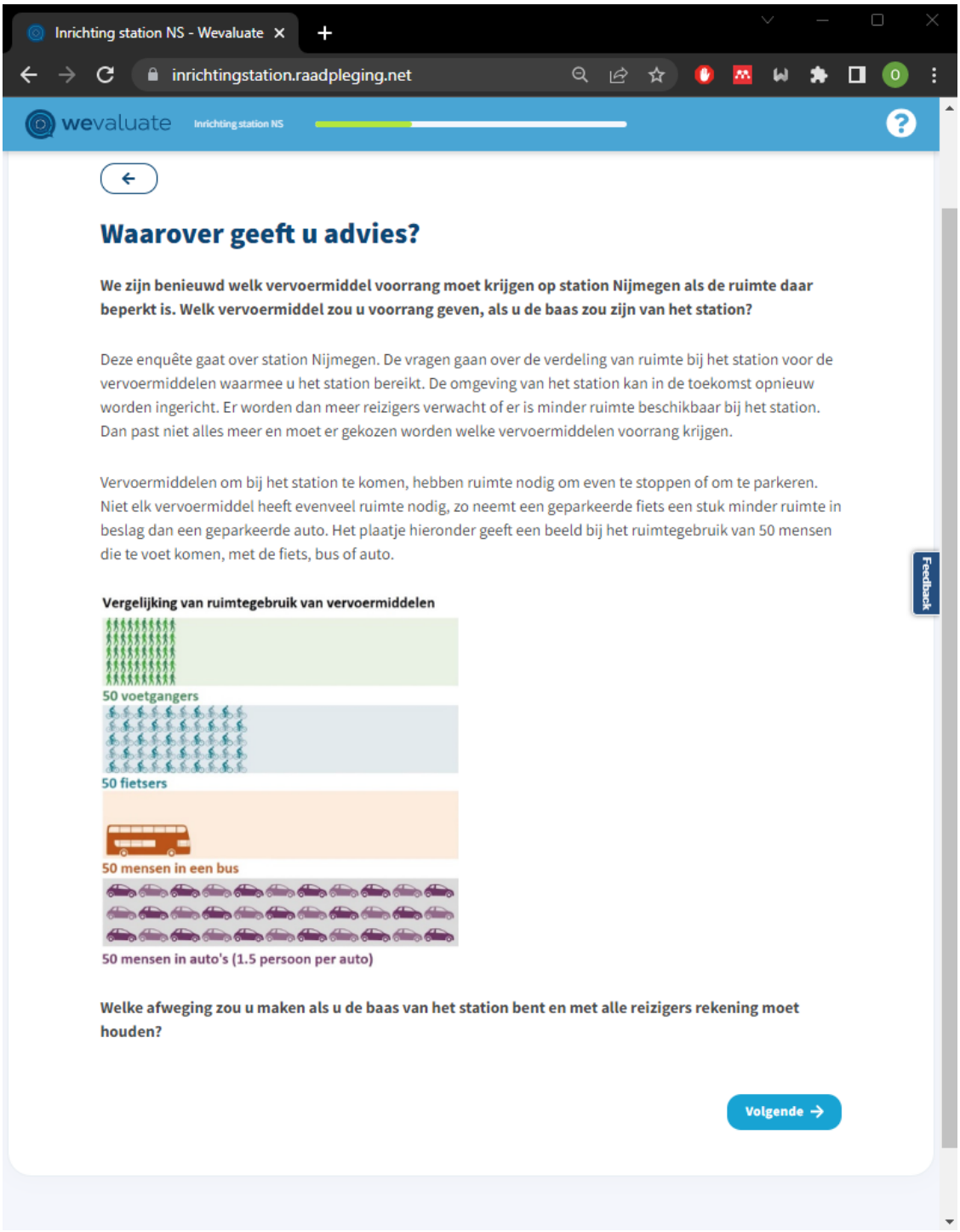

Figure D.3: Page 3

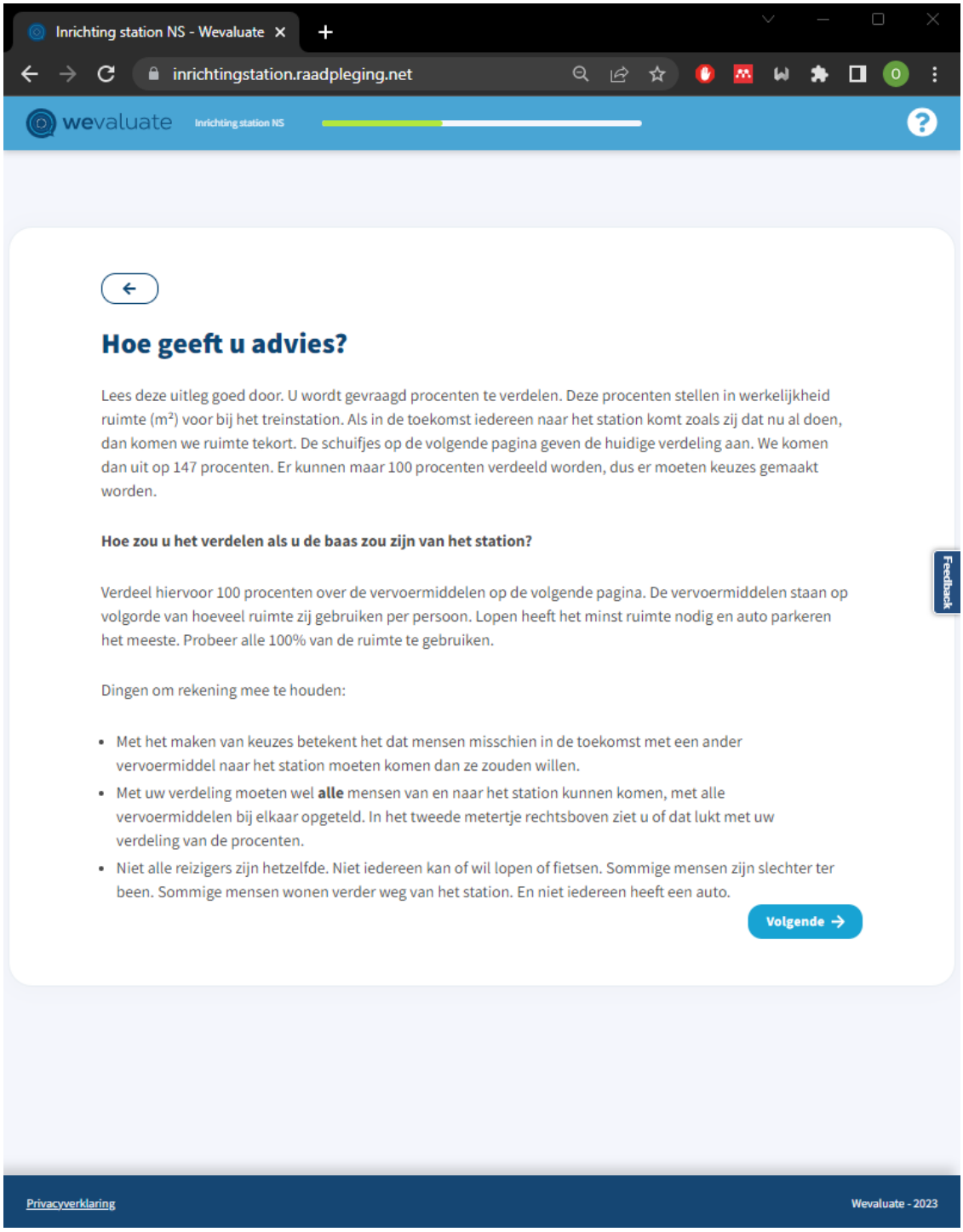

Figure D.4: Page 4

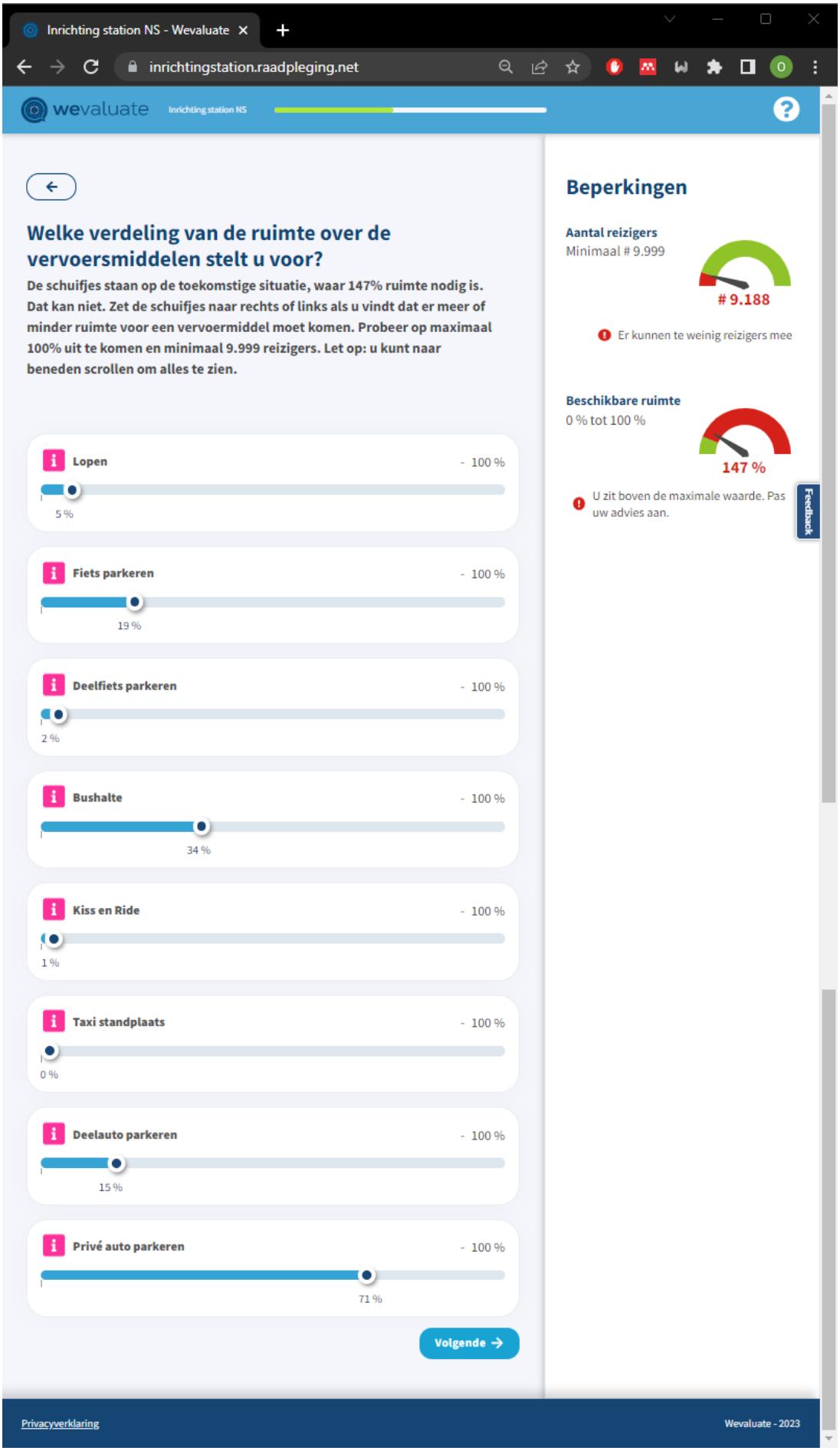

Figure D.5: Page 5

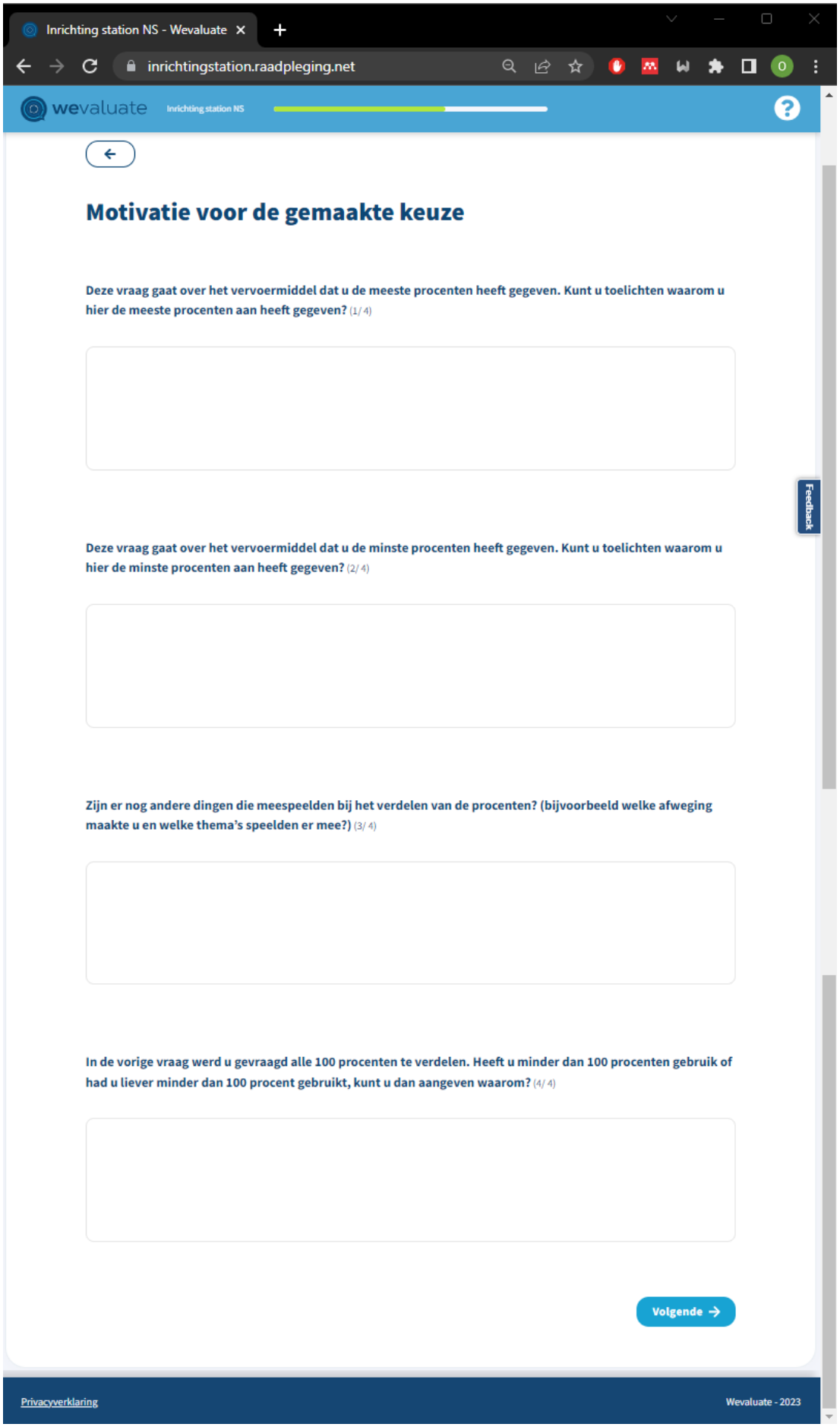

Figure D.6: Page 6

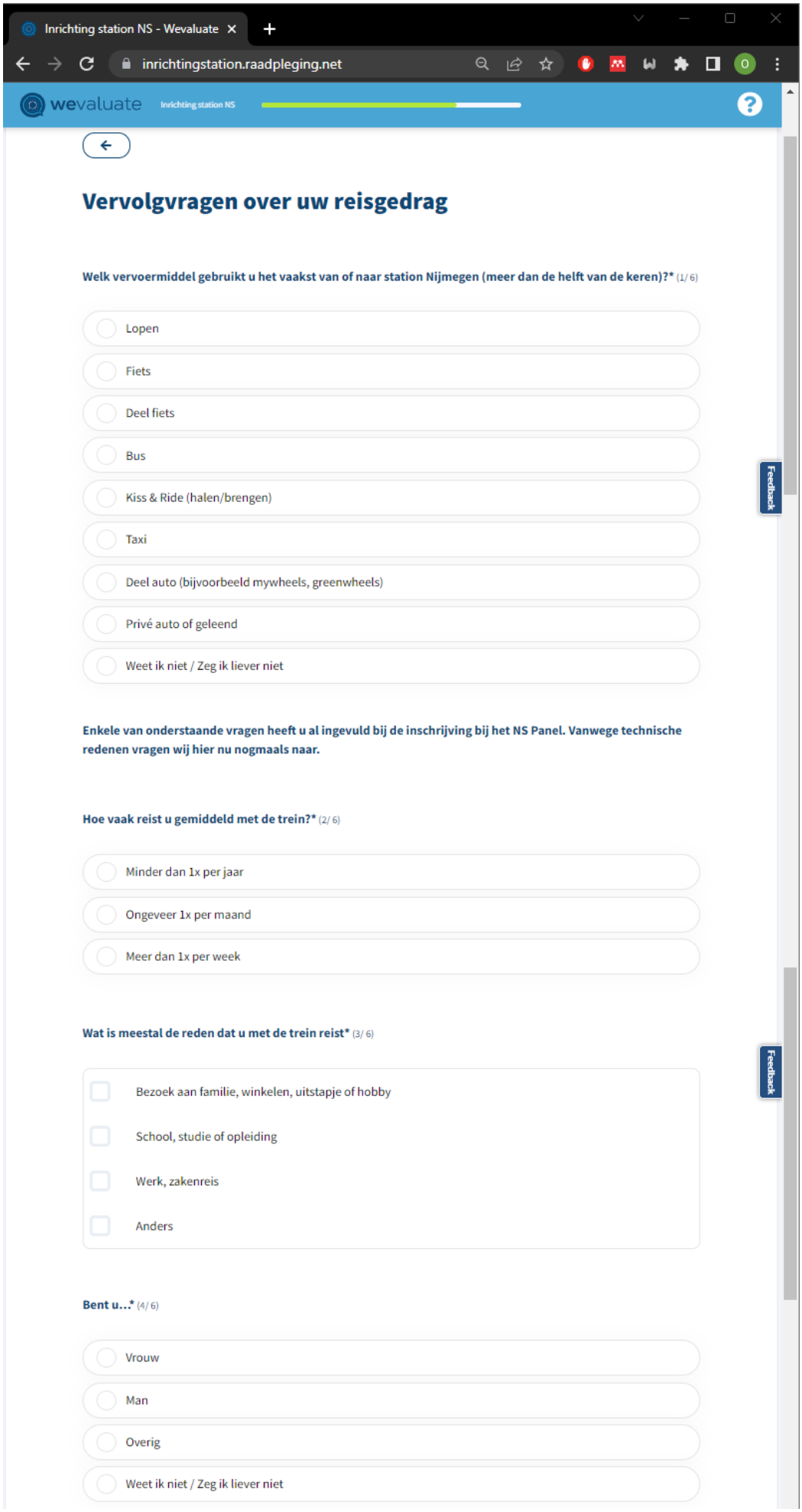

Figure D.7: Page 7.1

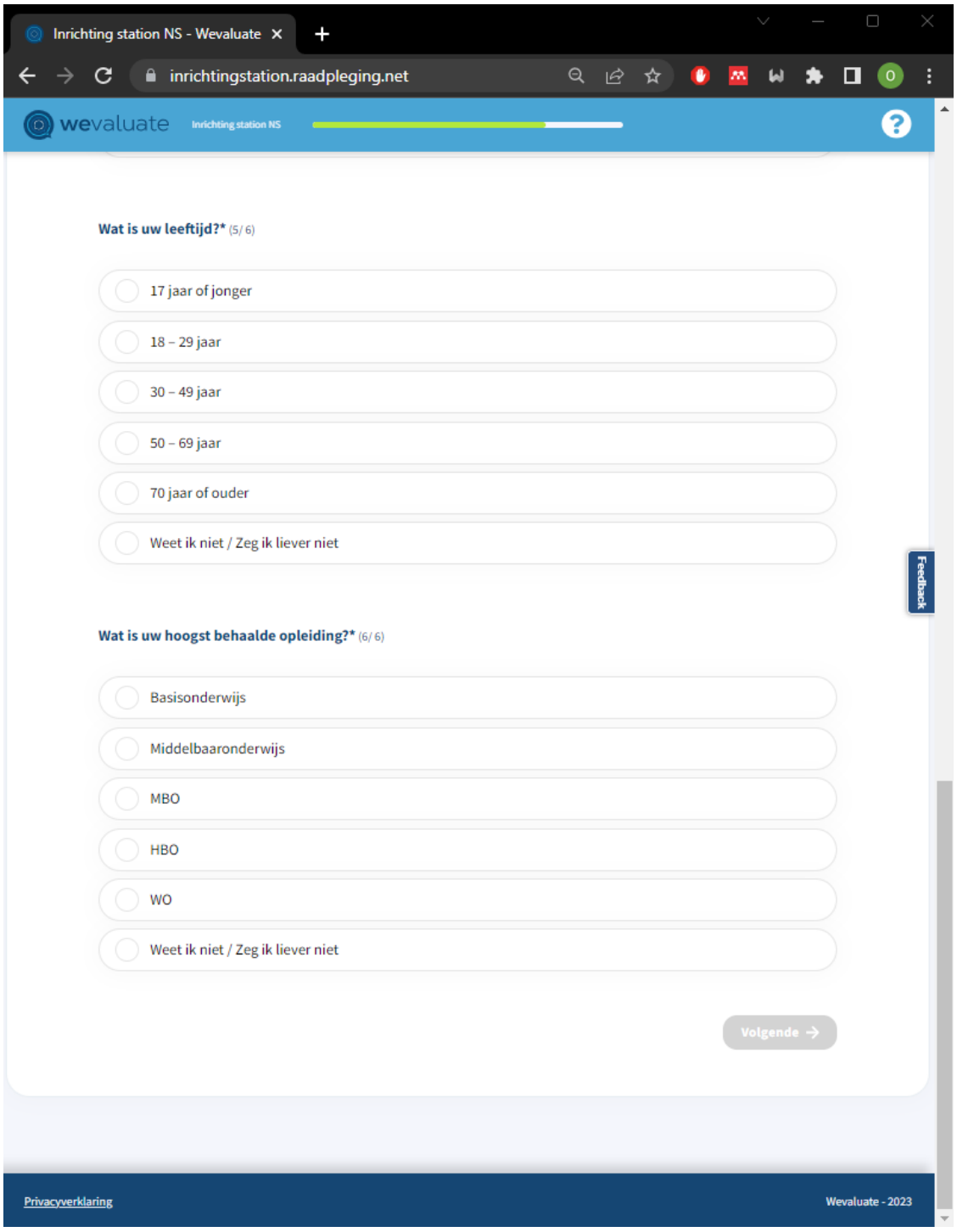

Figure D.8: Page 7.2

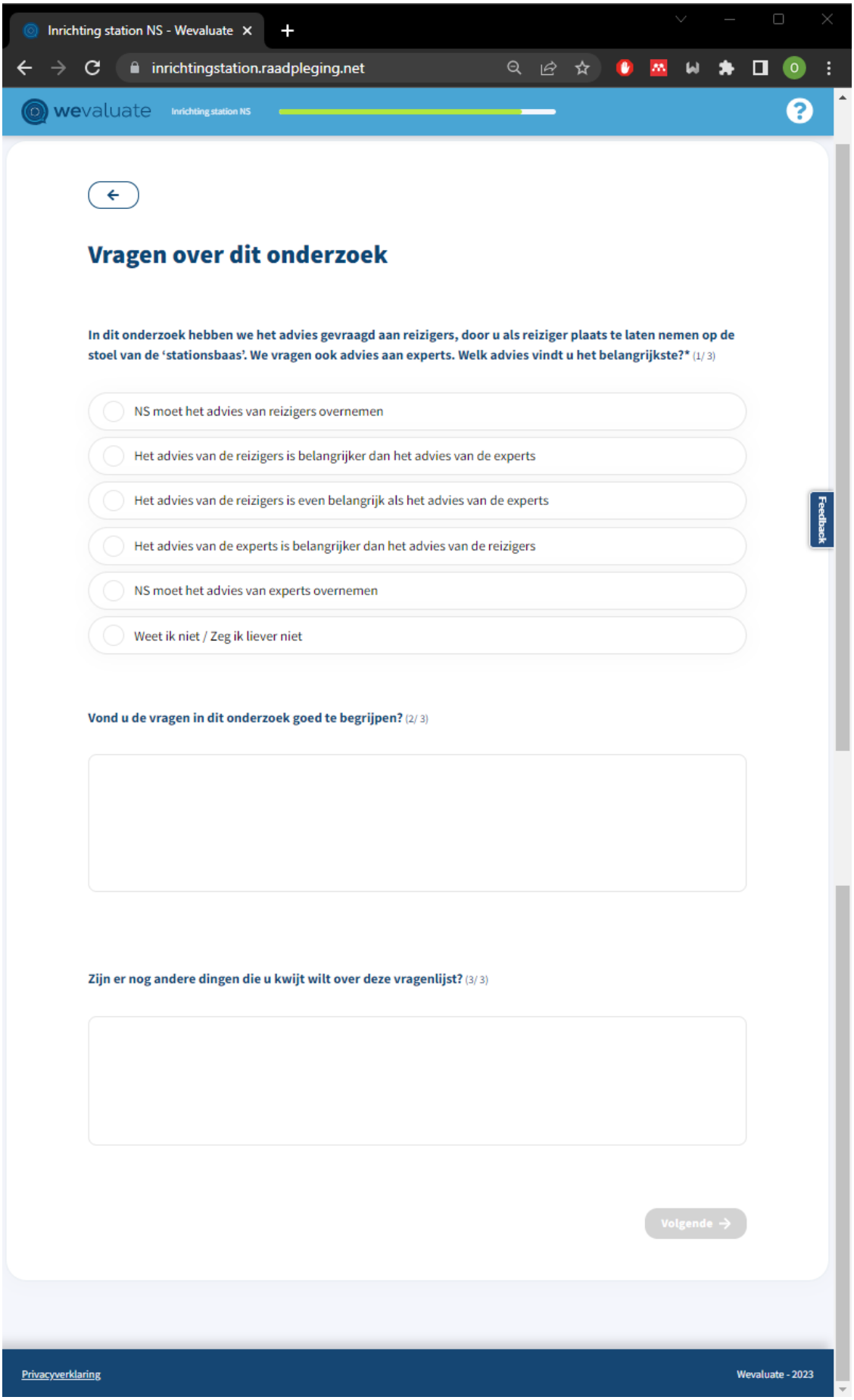

Figure D.9: Page 8

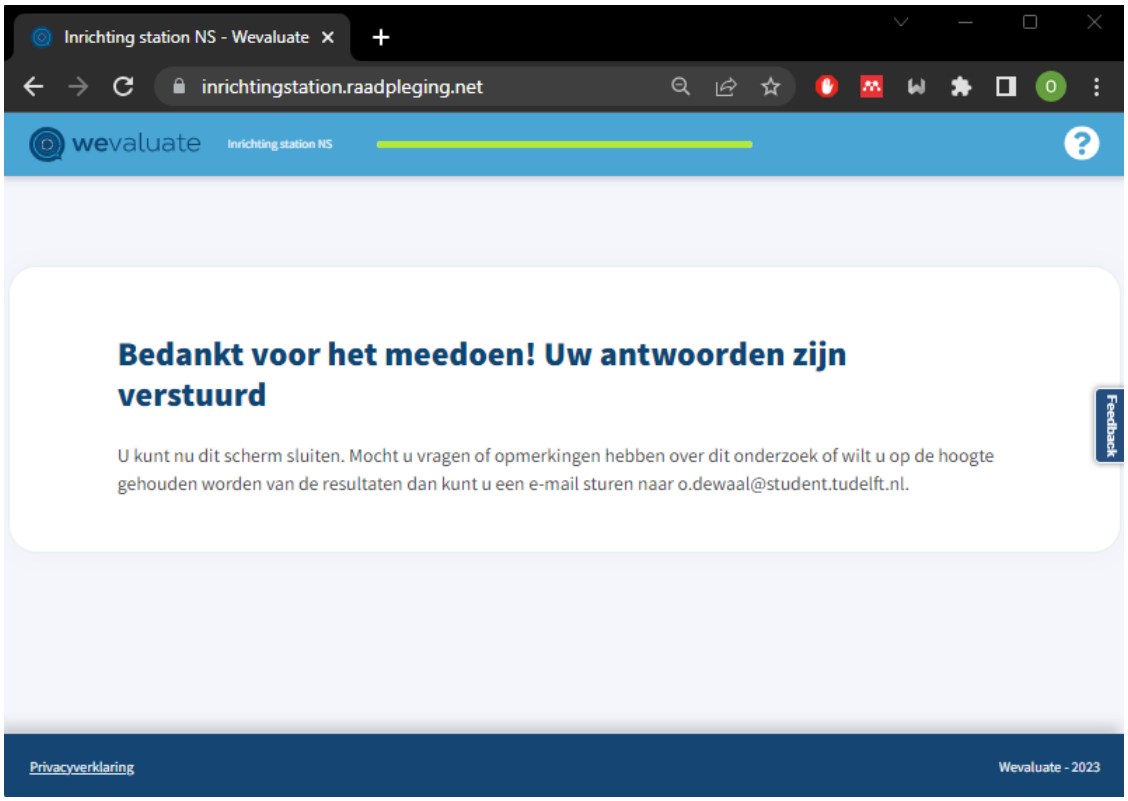

Figure D.10: Page 9

E

Data Analysis

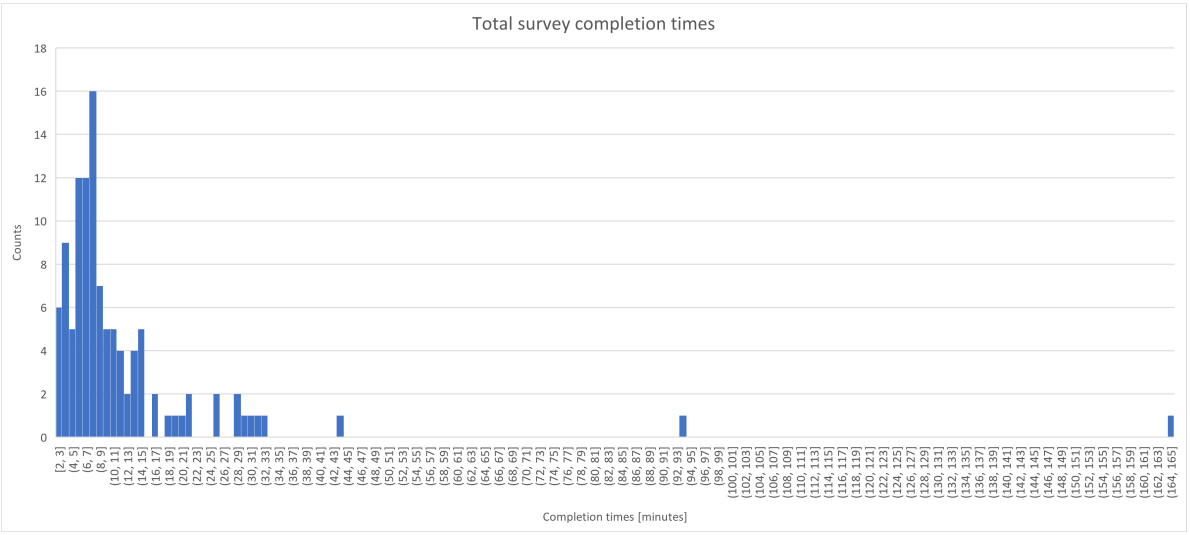

Figure E.1: Total survey completion times

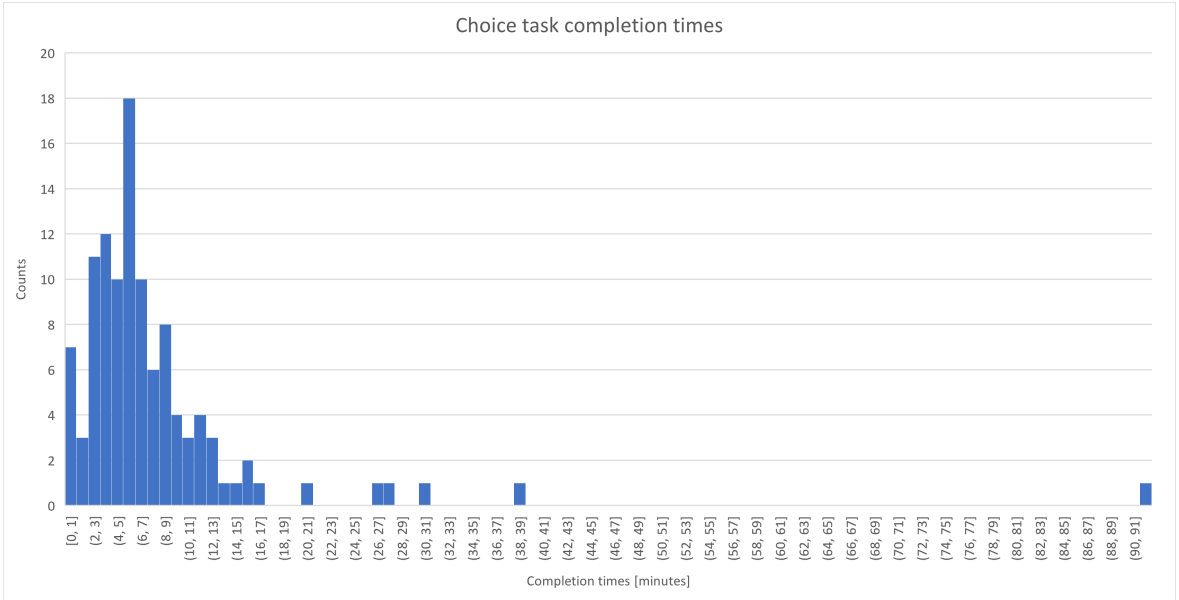

Figure E.2: Choice task completion times

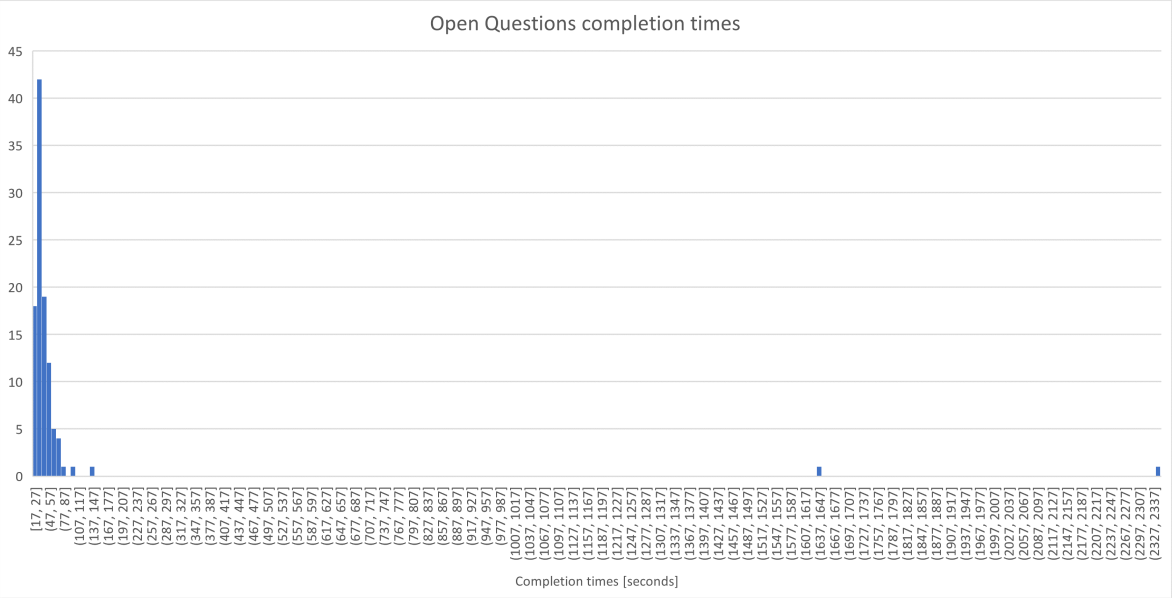

Figure E.3: Open questions completion times

		Sample size	Walking	Bike parking	Shared bike parking	Bus stop	Kiss & Ride	Taxi	Shared car parking	Private car parking
Sample group	Traveller	104	15%	26%	6%	26%	6%	3%	8%	9%
	NS	6	30%	28%	9%	16%	4%	2%	8%	5%
Access/egress	Walking	36	17%	23%	7%	25%	7%	3%	8%	8%
	Bike	40	13%	29%	5%	27%	5%	2%	8%	9%
	Shared bike	6	19%	23%	15%	19%	6%	5%	8%	5%
	Bus	20	16%	23%	15%	19%	6%	5%	8%	5%
	Kiss & Ride	3	9%	23%	4%	32%	5%	1%	13%	14%
	Taxi	0	-	-	-	-	-	-	-	-
	Shared car	0	-	-	-	-	-	-	-	-
	Private car	0	-	-	-	-	-	-	-	-
Gender	Woman	42	15%	26%	6%	27%	6%	2%	8%	9%
	Man	67	16%	26%	6%	25%	6%	3%	8%	9%
Age group	17 years or younger	0	-	-	-	-	-	-	-	-
	18 – 29 years	47	13%	27%	5%	28%	5%	2%	9%	11%
	30 – 49 years	46	16%	25%	8%	24%	8%	4%	7%	8%
	50 – 69 years	16	22%	23%	8%	23%	5%	4%	7%	6%
	70 years or older	0	-	-	-	-	-	-	-	-
Trip frequency	Less than once a year	0	-	-	-	-	-	-	-	-
	Approx. once a month	31	14%	24%	8%	28%	7%	3%	7%	9%
	More than once a month	79	16%	27%	6%	25%	6%	3%	8%	9%
Trip purpose	Family, leisure	50	12%	26%	7%	28%	6%	3%	7%	10%
	Study, school	17	15%	28%	6%	27%	5%	1%	7%	10%
	Work, business	74	17%	26%	7%	24%	6%	3%	8%	8%
Education	Basisonderwijs	0	-	-	-	-	-	-	-	-
	Middelbaaronderwijs	6	9%	26%	5%	32%	3%	1%	9%	16%
	MBO	2	38%	18%	7%	18%	4%	5%	7%	5%
	HBO	15	14%	28%	6%	23%	5%	3%	9%	9%
	WO	86	16%	26%	7%	26%	6%	3%	8%	9%

Figure E.4: Mean values of full dataset

		Sample size	Walking	Bike parking	Shared bike parking	Bus stop	Kiss & Ride	Taxi	Shared car parking	Private car parking
Sample group	Traveller	104	51%	56%	20%	49%	27%	15%	25%	26%
	NS	6	29%	31%	11%	31%	10%	5%	13%	17%
Access/egress	Walking	36	51%	45%	20%	39%	27%	15%	24%	23%
	Bike	40	36%	47%	20%	36%	13%	10%	15%	26%
	Shared bike	6	21%	10%	14%	15%	9%	5%	6%	15%
	Bus	20	29%	26%	15%	42%	14%	7%	23%	26%
	Kiss & Ride	3	6%	4%	6%	15%	1%	2%	7%	7%
	Taxi	0	-	-	-	-	-	-	-	-
	Shared car	0	-	-	-	-	-	-	-	-
	Private car	0	-	-	-	-	-	-	-	-
Gender	Woman	42	50%	31%	18%	42%	27%	10%	14%	26%
	Man	67	30%	56%	20%	49%	14%	15%	25%	25%
Age group	17 years or younger	0	-	-	-	-	-	-	-	-
	18 – 29 years	47	26%	41%	20%	45%	13%	6%	25%	26%
	30 – 49 years	46	37%	45%	20%	35%	27%	15%	15%	25%
	50 – 69 years	16	50%	41%	18%	46%	10%	10%	12%	22%
	70 years or older	0	-	-	-	-	-	-	-	-
Trip frequency	Less than once a year	0	-	-	-	-	-	-	-	-
	Approx. once a month	31	51%	27%	20%	39%	14%	10%	15%	25%
	More than once a month	79	36%	56%	20%	45%	27%	15%	25%	26%
Trip purpose	Family, leisure	50	51%	46%	20%	38%	14%	10%	15%	26%
	Study, school	17	29%	21%	13%	45%	10%	5%	24%	26%
	Work, business	74	37%	56%	20%	41%	27%	15%	25%	25%
Education	Basisonderwijs	0	-	-	-	-	-	-	-	-
	Middelbaaronderwijs	6	21%	15%	8%	13%	6%	3%	12%	26%
	MBO	2	35%	5%	3%	14%	2%	1%	6%	10%
	HBO	15	36%	35%	20%	40%	11%	10%	25%	25%
	WO	86	37%	56%	20%	40%	27%	15%	25%	25%

Figure E.5: Range values of full dataset

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means							
						Significance				95% Confidence Interval of the Difference	
		F	Sig.	t	df	One-Sided p	Two-Sided p	Mean Difference	Std. Error Difference	Lower	Upper
Lopen	Equal variances assumed	,422	,518	-4,042	108	<,001	<,001	-,15314	,03789	-,22824	-,07804
	Equal variances not assumed			-3,261	5,364	,010	,020	-,15314	,04696	-,27144	-,03484
Fiets parkeren	Equal variances assumed	,194	,661	-,438	108	,331	,662	-,01606	,03667	-,08874	,05662
	Equal variances not assumed			-,361	5,381	,366	,732	-,01606	,04453	-,12814	,09602
Deelfiets parkeren	Equal variances assumed	,714	,400	-1,075	108	,142	,285	-,02221	,02066	-,06316	,01874
	Equal variances not assumed			-1,323	5,956	,117	,234	-,02221	,01679	-,06338	,01895
Bushalte	Equal variances assumed	,885	,349	2,653	108	,005	,009	,09804	,03695	,02480	,17129
	Equal variances not assumed			2,059	5,333	,046	,091	,09804	,04762	-,02211	,21820
Kiss and Ride	Equal variances assumed	,413	,522	1,347	108	,090	,181	,02587	,01920	-,01219	,06392
	Equal variances not assumed			1,531	5,795	,089	,178	,02587	,01689	-,01582	,06756
Taxi	Equal variances assumed	2,337	,129	,943	108	,174	,348	,01141	,01210	-,01258	,03540
	Equal variances not assumed			1,481	6,733	,092	,184	,01141	,00770	-,00695	,02977
Deelauto parkeren	Equal variances assumed	,160	,690	,203	108	,420	,840	,00413	,02040	-,03630	,04457
	Equal variances not assumed			,206	5,618	,422	,844	,00413	,02003	-,04569	,05396
Privé auto parkeren	Equal variances assumed	,927	,338	1,251	108	,107	,214	,03878	,03101	-,02268	,10025
	Equal variances not assumed			1,422	5,795	,103	,207	,03878	,02728	-,02854	,10611

Figure E.6: Independent-Samples T-Test results

Table E.1: Categories within answers to open question 1

	Substantiation categories	Travellers	Station Developers
Q1: This question is about the mode of transportation you gave the highest percentages to. Can you explain why you gave the most percentages to this one?			
1	Sustainable mode (environment friendly, clean, efficient)	21	1
2	Space efficient	15	2
3	Impact/contribution to mobility system	15	1
4	City type (students, car free, green)	10	1
5	Most convenient / best way to access train station	10	0
6	Most people use this	9	2
7	Health	8	0
8	Impact on surroundings	7	1
9	Inclusiveness and accessibility (costs, physical ability)	7	0
10	Disabled people	6	0
11	High capacity	6	0
12	Futureproof	5	0
13	Station located near city centre	4	1
14	Alternatives available	4	0
15	(Traffic) safety	2	0
16	Personal preference	2	0
17	Modalshift from cycling to walking for people nearby the train station and from car to bus further away	1	1

Table E.2: Categories within answers to open question 2

	Substantiation categories	Travellers	Station Developers
Q2: This question is about the mode of transportation you gave the least percentages to. Can you explain why you gave the least percent to this one?			
1	Does not belong at a railway station	15	0
2	Efficiency (space, capacity)	15	0
3	Rarely used	15	0
4	Sufficient alternatives available	12	2
5	Can be located further away or on demand	9	0
6	Modern city	6	2
7	Not sustainable	8	0
8	City type (students, car free, green)	5	0
9	Only for disabled	4	0
10	Expensive (to use)	4	0
11	Impact on surroundings	3	0
12	Corresponds to current modal split	2	1
13	Too valuable/expensive land	3	0
14	Impact/contribution to mobility system	2	0

Table E.3: Categories within answers to open question 3

	Substantiation categories	Travellers	Station Developers
Q3: Which other things played a role into the distribution of points (e.g., what trade-offs did you make and what themes played a role)?			
1	Sustainable mode (environment friendly, clean, efficient)	22	2
2	Space efficient	8	3
3	Impact/contribution to mobility system	7	1
4	(Traffic) safety and livability (environmental quality)	8	0
5	City type (students, car free, green)	8	0
6	Inclusiveness and accessibility (costs, physical ability)	5	2
7	Corresponds to current modal split and situation	5	1
8	Personal preference / experience	5	0
9	Health	4	0
10	Does not belong at a railway station (priorities)	2	0
11	Shared mobility	3	0
12	Diabled people	3	0
13	High capacity	3	0
14	Futureproof	2	1
15	(Use) costs	2	0
16	Dutch weather	1	0
17	Space - service range efficiency	1	0
18	Sufficient alternatives available	1	0
19	Station close to city centre	1	1

Table E.4: Categories within answers to open question 4

	Substantiation categories	Travellers	Station Developers
Q4: When you would have preferred to use less than 100 points, could you explain your preferences?			
1	No	26	4
2	More	7	0
3	Yes, for greenery (parks, trees)	5	0
4	Yes, for housing and offices	1	0
5	Yes, for playing fields	1	0
6	Yes, for a nicer surrounding	1	0

F

Expert Discussion Group

0. Bespreken opgestelde voorafgaande verwachtingen.

Eerst de verwachting bespreken en wat de experts verwachten. Daarna de resultaten pas presenteren.

Reizigers en NS'ers maken andere keuzes met andere onderbouwingen

"Denk dat het klopt. Maar wij zijn denk ik wel slechter in staat dit objectief te doen dan we zouden moeten zijn. Reizigers t.o.v. NS minder goed in staat inschatting te maken van ruimtegebruik. Zij kunnen de onderdelen vast noemen, maar hoe groot iets is, dat minder goed."

Vergeleken met reizigers zijn NS'ers consistenter met het verdelen van de ruimte

"Als het goed is hebben wij allemaal STOMP in ons hoofd zitten. Dus de hiërarchie tussen de modaliteiten zou hetzelfde moeten zijn."

De verdeling van punten van NS'ers komt overeen met het STOMP principe

"Gek dat bus minder ruimte krijgt. Want bus wordt alleen maar belangrijker, maar tegelijkertijd krijgt het in beleid steeds minder ruimte. Het busgebruik is aan het afnemen. Bussen hebben ook heel veel ruimte nodig en krijgen dat ook op veel plekken. Dus we worstelen heel erg met de bus. Het zit hem met name in de remises, opstelplaatsen en oplaadplekken.

De vraag is of NS'ers ruimte geven aan iets wat wordt afgeschaald. Over het ruimtegebruik klopt STOMP niet helemaal in deze context, want het ruimtegebruik per modaliteit is anders. Het klopt wel voor locaties t.o.v. het station. Het verschilt ook erg per locatie."

Afwijking naar demografische kenmerken

"Hangt erg af van je sample waarschijnlijk. Er is waarschijnlijk een afwijking in een combinatie tussen demografische en reizigerskenmerken. Kijk vooral naar welke modaliteiten heb je tot je beschikking, bij bijvoorbeeld hoog opgeleid waarschijnlijk meer inkomen en dus meer modaliteiten. Als je allemaal studenten in je sample hebt is dat echt anders dan wanneer je ook laag opgeleiden hebt."

Afwijking naar reizigerskenmerken

"Mensen zijn waarschijnlijk biased door het vervoermiddel dat zij zelf gebruiken. NS'ers worden waarschi-

jnlijk beïnvloedt door hun persoonlijke voorkeur, met waarschijnlijk een voorkeur voor lopen en fietsen. Dus benieuwd wat daar uit komt."

1. Resultaten Case Study

Waar zouden deze resultaten aan kunnen bijdragen? Bijvoorbeeld inspiratie of validatie van de afwegingen die al gemaakt worden?

"Als jouw bevindingen aansluiten bij de huidige voor- en natransport verdelingen (modal split), dan heb je niks nieuws gevonden. Als je sample representatief is t.o.v. huidige gebruikers, dan krijg je de huidige verdeling te zien in je antwoorden denk ik. Dan levert het weinig nieuws op. Als het anders is dan huidige verdeling, hoe ziet je populatie er dan uit?

Als wij een station gaan ontwerpen, dan kijken we naar de verdeling van voor- en natransport. Welke groep is het belangrijkst. Dan hebben we al genoeg data waar we naartoe moeten. Maar als deze methode laat zien dat mensen nóg meer gewicht toekennen aan iets anders, dan levert dat een nieuwe bijdrage.

Mensen geven waarschijnlijk het zwaarste gewicht aan de modaliteit die ze zelf gebruiken, dat is dan niks nieuws. Maar ze geven ook gewicht aan de andere 7 modaliteiten en dat is nieuwe informatie. Het is belangrijk om te weten wat de 'tweede' voorkeur is. Je kan dit gebruiken bij het maken van keuzes. Bijvoorbeeld met als je nu zo'n beetje bij het perron kan parkeren, dan kun je zeggen dat er veel mensen het belangrijkste vinden om te parkeren bij het station. Maar je weet nu met deze methode dat ze, bijvoorbeeld lopen en fietsen ook belangrijk vinden. Dan kun je natuurlijk gaan kijken of je die auto parkeerplekken niet weg moet gaan halen. Dit is dan een sterke onderbouwing in gesprekken met gemeenten. Want die zeggen dat veel mensen met de auto komen en dat dat dus het belangrijkst is, maar dat komt ook omdat auto goed gefaciliteerd wordt. Alleen die eerste voorkeur halen we uit de modal split. Deze methode geeft dus ook inzicht in de tweede voorkeur.

Het kan ook zo zijn dat mensen met een andere modaliteit naar het station zouden willen komen maar dat dat niet kan om wat voor reden dan ook. Die echte voorkeur kan je hiermee ook vinden. Tool om bij discussies te kunnen zeggen waar de modalshift heen zou moeten als je bijv. parkeerplekken weghaalt! Je kan zo kunnen sturen op een modalshift. Ook kun je voorspellen welke tweede / nieuwe keuze de reiziger maakt."

2. Toepassing op andere stations

"Het verschilt heel erg wie het station gebruikt. In Meppel wonen mensen een stuk verder van het station. En het ruimtetekort is er misschien anders. De STOMP hiërarchie die we hier vinden op Nijmegen, is misschien heel anders op andere locaties. Daar kan de auto nog best ruimte krijgen. Deze methode is dus goed in te zetten om per type station een hiërarchie of prioriteiten op te stellen. Want daarvoor heb je de lokale en type gebruikers voor nodig. Die inzichten van die mensen zijn erg nuttig. Dit zou je bijvoorbeeld op basis van KIS types kunnen insteken. De populatie in Nijmegen denkt misschien heel anders over modal shift dan een populatie op een Type 6 station (die wonen en werken anders en verplaatsen zich anders)."

3. Toepassing op andere keuzes/afwegingen

"Voor reizigers moeilijker dan sec de ruimte. Mensen vinden het lastig om bijvoorbeeld in te schatten

wat de afstand tot iets betekent in tijd. Het lopen door een rechte hal is anders dan door allemaal trappetjes en tunnels die misschien wel even lang of sneller is, voelt het langzamer. Ander voorbeeld, de afweging van locatie van faciliteiten is meer afhankelijk van interpretatie en ervaring.

Je zou het wel kunnen toepassen op brancheringsvraagstukken. Welke winkels zou je tegen moeten komen en op welke locaties. Stel je hebt ruimte over, wat moet daar dan komen? Of, welke functies zou je toevoegen aan het station?

Vergeleken met bewonersavonden levert concretere antwoorden op. Want mensen stellen valet parking voor de fiets voor en andere onhaalbare dingen. Hier zeg je: je hebt zoveel euro's en zoveel ruimte. Vind je de valet parking dan wel echt zo belangrijk?

Je kan dit goed inzetten als participatie tool. Door de afweging en dilemma te ervaren creëer je wel begrip. Als je ziet dat je niet voor alles ruimte hebt dan begrijpen mensen het. Ruimtegebruik is een puzzel die je heel moeilijk kunt uitleggen aan omwonenden.

Verdelen van geld is ook een goede toepassing. Binnen de gemeente zegt iedereen wat anders."

4. Toepassing op andere stakeholders

"Met gemeenten is dit een goede tool. Dit hebben we al gedaan met blokjes op schaal. Dat is heel inzichtelijk. Dus kan me heel goed voorstellen dat wij dit meenemen naar de gemeente deze tool.

Bewonersparticipatie! Goede invulling van de participatiewet. Deze tool levert dan bruikbare inzichten.

Bij de sessie in Zuilen was dit leuk geweest. Veel ambities daar vanuit gemeente (retail, woning, kantoren, maar ook voor- en natransport). Hiermee geef je een heel concrete discussietool. Nu hebben we gewoon op geeltjes wat ideeën opgeschreven. Het is daar ook nogal wat getouwtrek, iedereen wil veel ruimte. Zo'n tool is dan wel boeiend.

Dit is een goede bijdrage aan het handelingsperspectief. Daarin is stap 1 het in kaart brengen van de huidige situatie. Stap 2 is het bepalen van de gewenste situatie. Om dat in kaart te brengen zou je deze tool kunnen gebruiken. Dan zie je ieders ambities: wat wil je nou eigenlijk echt? De ene wethouder / ambtenaar zegt wat anders dan de ander." Kan heel waardevol zijn dit! Vaak van te voren niet goed afgesproken wat de prioriteiten zijn. Daar kan deze tool bij helpen. We kunnen deze methode meenemen bij het handelingsperspectief. Eerst bedenken we al de richting maar de specifiekere invulling kunnen we informatie bij de reiziger ophalen.

Ook op de stations waar we geen handelingsperspectief hebben is dit nuttig. Iedere organisatie moet dan even voor zichzelf gaan bedenken hoe ze het willen en daarna kom je weer bij elkaar. Het is ook een tool waarmee je elkaar beter gaat leren kennen. Want het zit vaak in het hoofd van de mensen, maar zo wordt het concreet. Dat doe je wel bij het handelingsperspectief, maar dat doen we niet op elk station. En dat is in de voorfase, dus de mensen die er later bij komen zzijn niet altijd allemaal betrokken geweest bij die voorfase, maar moeten wel die puzzel gaan leggen. Dan kun je dit goed gebruiken.

Voor veel mensen is het lastig een vertaalslag / interpretatie te maken van ruimtegebruik. Het gebruik van 100 punten voor puur ruimte verdelen doet iedereen op dezelfde manier. Dus een blokkendoos met 100 blokken is goed te doen."

Afsluiting

Generaliseerbaar naar andere stations zeker als je daar de lokale modal split in stopt voor de startwaarden in de keuzetaak. Je kan het toepassen als je gaat ontwikkelen from scratch, dan zet je alle waarden op nul. Je kan het ook toepassen als je gaat herontwikkelen op basis van huidige modal split.

Interessant om te doen met meerdere stakeholders. Want veel tegenstelde belangen. Je kan het dus ook gebruiken om niet alleen informatie en ideeën op te halen, maar ook om te sturen bij overleggen met stakeholders: “zorg maar dat het past in de 100 punten”. Toepassen bij het handelingsperspectief!

Ander advies: onderzoeken hoe je dit kunt toepassen als participatie. Dat kan natuurlijk in je aanbevelingen van je onderzoek.

En ja: we moeten reizigers vaker betrekken bij het ontwikkelen van stations. Op sommige vlakken zijn ze inderdaad de experts, de reizigers. Maar andere aspecten weer niet, zoals inschatten van haalbaarheid.”