

Going for a Stroll

A Comprehensive Study on Perceptions of Parents with Baby Carriages on Sidewalk Quality of Service in the City Center of Groningen



Source: vecteezy.com (2024)

Ignacio Enrique Ricci Capredoni – S4419626

University of Groningen – Faculty of Spatial Sciences
Bachelor Thesis Project Spatial Planning and Design

Supervisor: Charlotte Miller

16/02/2024

Abstract

This study explores the walking perceptions of parents with toddlers in the city center of Groningen. The respondents predominantly walk on key areas around the Vismarkt, Grote Markt, and Forum, engaging in recreational activities with toddlers primarily transported in baby carriages. The study builds on a tailored sidewalk quality of service model to evaluate the perceptions of parents with baby carriages on quality of service of sidewalks, characterized by the compact city urban form. Quantitative and qualitative insights from cross sectional survey data collection support the positive impact of favorable compact city sidewalk characteristics but reveal dissatisfaction with obstructive elements linked to high concentration of pedestrians, parked bicycles, cyclists on the sidewalk, and roadwork. Examining various parental concerns on safety and comfort that compose the quality-of-service model to evaluate the sidewalk, "lighting" emerged as the most positively perceived while "obstacles" presented significant challenges to the mobility of parents with baby carriages. The study results show an overall perceived good safety and sidewalk quality of service in the city center of Groningen. The study recommends these findings for broader exploration by academics and entities interested in optimizing sidewalk infrastructure in Dutch compact cities.

Table of Contents

| | |
|---|-----------|
| 1. INTRODUCTION..... | 4 |
| 1.1. BABY CARRIAGES ON SIDEWALKS OF THE DUTCH COMPACT CITY..... | 4 |
| 1.2. RESEARCH PROBLEM AND MOTIVATION..... | 4 |
| 1.3. RESEARCH STRUCTURE | 5 |
| 2. THEORETICAL FRAMEWORK | 5 |
| 2.1. THE DUTCH COMPACT CITY; DENSIFICATION ON SIDEWALKS..... | 5 |
| 2.2. QUALITY OF SERVICE - SIDEWALKS..... | 7 |
| 2.3. WALKING CONCERNS OF PARENTS WITH BABY CARRIAGES..... | 7 |
| 2.3.1. Weather | 7 |
| 2.3.2. Obstacles..... | 8 |
| 2.3.3. Pedestrian Concentration | 8 |
| 2.3.4. Pollution..... | 8 |
| 2.3.5. Lighting | 8 |
| 2.4. SIDEWALK QUALITY OF SERVICE MODEL..... | 9 |
| 2.5. EXPECTATIONS | 9 |
| 2.5.1. Answer to research sub-question 1 | 9 |
| 3. METHODOLOGY..... | 10 |
| 3.1. METHODOLOGICAL ROUTE TO ANSWER MAIN RESEARCH QUESTION | 10 |
| 3.2. DATA COLLECTION..... | 12 |
| 3.3. VALIDITY OF DATA..... | 13 |
| 3.4. DATA ANALYSIS..... | 13 |
| 3.4.1. Quantitative data..... | 13 |
| 3.4.2. Qualitative data..... | 13 |
| 3.5. ETHICAL CONSIDERATIONS | 14 |
| 4. RESULTS AND DISCUSSION | 14 |
| 4.1.1. Study area..... | 15 |
| Obstacle perception results..... | 17 |
| Pedestrian concentration perception results..... | 20 |
| Pollution perception results | 21 |
| Lighting perception results..... | 23 |
| Resulting Perceived Safety and Sidewalk Quality of Service | 24 |
| 5. CONCLUSIONS AND ANSWERS TO THE RESEARCH QUESTIONS | 25 |
| 5.1. REFLECTION ON THE RESEARCH PROCESS..... | 26 |
| 6. REFERENCES | 27 |
| BREMER, S., 2022. THE NEW BICYCLE SHED ON THE GROTE MARKT IS OPEN. INDEBUURT, MARCH 21, PP. 1..... | 27 |
| 7. APPENDICES | 30 |
| 7.1. APPENDIX A. QUESTIONNAIRE | 30 |

1. Introduction

1.1. *Baby Carriages on Sidewalks of the Dutch Compact City*

The "compact city" emerged in the Netherlands during the mid-1980s as a concept and spatial planning strategy aimed at creating dense, mixed-use, and walkable urban areas (de Roo, 1998). After decades of spatial planning projects implementing the concept, cities in The Netherlands are now renowned for their well performing compact nature (de Roo & Miller, 2019).

Despite the above, densification is placing significant strain on pedestrian infrastructure (Honey-Rosés & Zapata, 2021). Recent studies have recorded and analyzed the perceptions of pedestrians to measure the impact of the strain on sidewalk service (Ibid.). This strain manifests in the form of high pedestrian concentrations and obstacles that constrain walking space, hindering pedestrian flow, which gets perceived by pedestrians as a decrease in quality of service of sidewalks (Alfonzo et al., 2008; Krishnamurthy et al., 2018; Coppola & Marshall, 2021; Honey-Rosés & Zapata, 2021; Swain et al., 2023). Most studies on pedestrian quality of service focus on assessing pedestrian flow and level of satisfaction on pedestrian infrastructure, to understand the concerns behind mobility of pedestrians (Yadav & Rastogi, 2022). Pedestrians using wheeled devices, such as parents with baby carriages, require enhanced pedestrian service due to specific safety and comfort concerns regarding weather, obstacles, pedestrian concentrations, pollution, and lighting (Jiménez, de la Fuente, & Hernández-Galán, 2018; Evers et al., 2014; Ataol et al., 2022).

There is a lack of research that particularly examines sidewalk service as perceived by parents with baby carriages on sidewalks of Dutch compact cities. To further investigate this, the city center of Groningen was selected as the study area due to its location in The Netherlands as well as its "compact city" characteristics, which have resulted in a dense urban area with a high load on pedestrian infrastructure (de Roo & Miller, 2019).

1.2. *Research Problem and Motivation*

The aim of this research is to comprehend how Parents with baby carriages perceive sidewalk quality of service in the Dutch compact city sidewalk. This research is Motivated by the latest mobility plan of the municipality of Groningen (2021), stating the dire need to design public spaces to ensure that pedestrians are not crowded out and to prevent excesses on sidewalks. The study first develops a sidewalk quality-of-service model to address the specific concerns to safety and comfort of parents with baby carriages, in navigating densely populated "compact city" urban environments. Then uses this model as the basis to collect data. The results and conclusions of this study are beneficial for spatial planners and policymakers to develop effective strategies to optimize pedestrian infrastructure for parents with baby carriages and improve the overall sidewalk quality of service in compact cities (with emphasis on Groningen).

To reach the research aim, the following research question emerges:

What are the perceptions of parents with baby carriages on sidewalk quality of service in the compact city center of Groningen?

The sub-questions are:

1. How do the compact city sidewalk characteristics clash with walking concerns of parents that walk with baby carriages?
2. What are the specific challenges that parents with baby carriages encounter when walking along sidewalks?
3. How do these challenges influence the overall perceived sidewalk quality of service?

1.3. Research Structure

The following chapter, [chapter 2](#), presents the theoretical framework. [Chapter 3](#) discusses the methodology of the research. [Chapter 4](#) presents the results of the methodology. And finally, [Chapter 5](#) discusses the findings, reconnects to the research questions and states the conclusions drawn from this study.

2. Theoretical framework

2.1. The Dutch Compact City; Densification on Sidewalks

The compact city is an urban planning concept that advocates for the development of dense, mixed-use urban areas with a focus on minimizing urban sprawl and promoting sustainable, walkable neighborhoods (de Roo, 1998). The theory was first introduced in The Netherlands during the eighties as a response to the challenges associated with urbanization, including traffic congestion, environmental degradation, and social inequities (Ibid.).

After decades of compact city practice and policy implementations, Dutch cities are now characterized by their high population density, with buildings and infrastructure concentrated in a limited geographic area (de Roo & Miller, 2019). This density has encouraged efficient land use and reduced the need for sprawling development (de Roo, 1998). Their dense nature has facilitated pedestrian-friendly environments, with well-connected street networks, good cycling and pedestrian infrastructure, short walking distances, wide sidewalks, and good accessibility of parks, plazas, and public transit stops (Ibid.). These walkable urban areas have been proven to improve mobility of pedestrians and encourage physical activity, social interaction, and a sense of community (El Messeidy, 2019).

Past criticism of the compact city has revolved around safety, comfort, and pollution concerns due to overcrowding (Burton, Jenks, & Williams, 2003), however, these concerns are mitigated if spaces are efficiently used (de Roo & Miller, 2019). This debate regarding the compact city has to do with the dilemma of space scarcity, which is still affecting infrastructure across the country in modern times (Ibid.). This dilemma occurs when demand for space surpasses current supply, mostly affecting public spaces (Ibid.).

A recent study by Honey-Rosés and Zapata (2021) found that Densification of urban areas places a significant load on the pedestrian infrastructure due to pedestrian congestion,

which in return decreases perceived pedestrian quality of service. Furthermore, Dutch compact city sidewalks are characterized for having a high concentration of benches, trees, signs, bicycle parking and other objects which are obstructions to walkability (Verhoeven, 2019.). These static obstructions imply a “significant decrease in the average clear width of sidewalks for walking” (Coppola & Marshall, pg. 200, 2021). They may influence a route choice, force pedestrians to walk on the street, end their trip altogether, or impede sidewalk accessibility, which emphasizes a safety concern (Ibid.; see also Gath-Morad, Plaut & Kalay, pg. 10, 2023).

Figure 1 is an example of a person in a wheelchair who is getting their access obstructed on the sidewalk due to a utility pole. This specific case and example “may similarly impede others from using the sidewalk such as a parent with a stroller” (Coppola & Marshall, pg. 201, 2021).

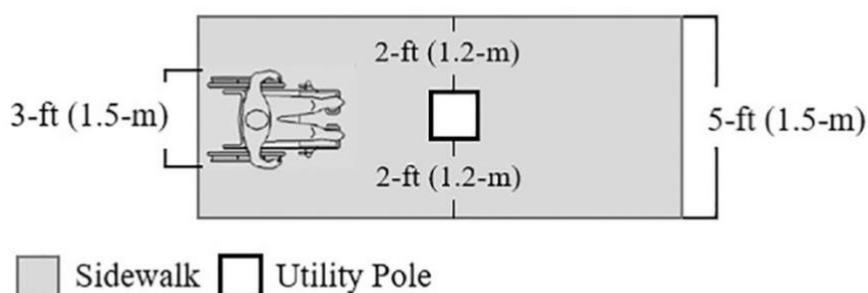


Figure 1. “Sidewalk clear width (plan view)” (Coppola & Marshall, pg. 201, 2021). Source: Coppola & Marshall, pg. 201, 2021.

In this context, spatial planners in The Netherlands have found that a viable strategy to deal with the space shortage dilemma is to optimize the space that is already in use (de Roo & Miller, 2019). In the case of Groningen, authorities have opted for space optimization as well as expansion strategies (Pirart, F.B.C., 2008).

In 2021, the municipality of Groningen issued a sustainable urban mobility plan, addressing the specific need to alleviate space in the city for pedestrians in general, including baby carriages (Municipality of Groningen, 2021, p. 51). The municipality aims to make public spaces accessible to all pedestrians in future years, including baby carriages, by keeping the pedestrian space as “clear and open” as possible (Ibid.). Examples of projects proposed in the mobility plan of Groningen that have the purpose of allocating more pedestrian space have already started to take into effect. This is seen in the recent conversion of the Grote Markt from bicycle parking to pedestrian / sidewalk space by allocating underground bicycle parking (Bremer, 2022), as well as the road work to get rid of the bus lane also in Grote Markt to allocate more pedestrian / sidewalk space by strengthening the public transport outer ring of the city center (Veenstra, 2022.). The municipality also states that sidewalks in the city of Groningen are subject to shared use of pedestrians with terraces, retail displays, bicycle parking and street furniture (Ibid.), where “the busier the area, the less space usually remains for pedestrians”, putting accessibility under pressure (Ibid.). Highlighting the need to design public spaces to ensure that pedestrians are not crowded out, “and to prevent excesses” (Ibid.). This is an optimal opportunity for academic research to fill in the identified gap and specifically address and study the perceptions of parents with baby carriages on sidewalk quality of service in Groningen.

2.2. *Quality of Service - Sidewalks*

The Pedestrian Quality of Service (PQoS) or Pedestrian Level of Service (PLOS) model is an index used in urban planning and transportation engineering to evaluate and enhance the walking experience in urban environments (Vallejo-Borda, Cantillo, & Rodriguez-Valencia, 2020). This model is then understood as a “qualitative or quantitative measure of the operation condition of a facility” (Yadav & Rastogi, 2022, pg. 1) The model indicates flow condition of the infrastructure, as well as satisfaction level of its users (Ibid.). It aims to assess the quality of pedestrian infrastructure and amenities, such as sidewalks, crosswalks, pedestrian signals, lighting, or street furniture (Ibid.). This assessment model is more comprehensive of pedestrian infrastructure than its walkability index counterpart because it can assess micro scale urban design elements, as well as analyzing subjective opinions, experiences, and perceptions of infrastructure users to better understand what walking entails (Macdonald, 2018; Vallejo-Borda, Cantillo, & Rodriguez-Valencia, 2020). SQOS models have a new outlook on how pedestrian infrastructure should be evaluated, these models establish that perceptions can grant a better understanding of the specific concerns that affect users of the service in question, arguing that this is better for assessing quality of service than objective pedestrian infrastructure studies (Vallejo-Borda, Cantillo, & Rodriguez-Valencia, 2020). Moreover, the perceived pedestrian level of service (PLOS) is influenced by various built environment measures, which can significantly impact pedestrian comfort and safety (Bivina & Parida, 2019).

To reiterate, the aim of this research is to shed light on how Parents with baby carriages perceive sidewalk quality of service in the Dutch compact city sidewalk (using Groningen as the case study). The Factors used to build the sidewalk quality of service assessment model are drawn from the specific walking concerns of parents with baby carriages when walking on sidewalks, which will be discussed in the subsequent paragraphs. This study’s sidewalk quality of service model can be found at the end of this section representing the conceptual model of the research.

2.3. *Walking Concerns of Parents with Baby Carriages*

A study by Lepistö et al. (2022) established that, among other things, parents worry about the health of their baby the most. In this regard, when on the sidewalk, parents put emphasis on the protection of their babies when walking (Evers et al., 2014). The safety and comfort of walking in urban environments significantly impact the experiences of parents with baby carriages, where safer and comfortable sidewalks are perceived better (Ataol et al., 2022). The following paragraphs are meant to describe the elements that shape walking concerns (conditioned by perceived safety and comfort) among parents when walking with baby carriages:

2.3.1. *Weather*

A study by Carlson et al. (2021) found that pedestrians have a preference to go on ‘comfortable’ leisure walks when in presence of good weather and decide to evade walking if in presence of bad weather (See also: Aultman-Hall, Lane, & Lambert, 2009, pg. 35). Good weather also leads to increased walking among parents with toddlers and babies, specifying the positive effects on the babies’ health (Coyl-Shepherd et al., 2013). The safety of outdoor terrains is of particular interest to parents due to the difficulties and dangers related to pushing strollers in harsh weather conditions, such as the presence of snow and ice accumulation on sidewalks in winter (McCormack et al., 2009).

2.3.2. Obstacles

Obstacles such as utility poles, sidewalk debris, street furniture, parked bicycles, damaged surface, cyclists on the sidewalk, road work, and outdoor seating can obstruct the path of pedestrians and hinder mobility (Aultman-Hall & Adams Jr, 1998; Haworth, Schramm, and Debnath, 2014; Ferrer et al., 2015; Coppola & Marshall, pg. 201, 2021; Moricca & Ikalovic, 2022, p. 66). As stated in the compact city theory section, high presence of obstacles on sidewalks reduces the clear pathway for parents with baby carriages, requiring navigating around them to get to their destination, leading to inconvenience and safety concerns (Alfonzo et al., 2008; Evers et al., 2014). Pathways free of obstacles have the opposite effect (Alfonzo et al., 2008).

2.3.3. Pedestrian Concentration

High pedestrian volumes and congestion on sidewalks make pedestrians perceive a lower quality of service of sidewalks (Honey-Rosés and Zapata (2021) and make it difficult for parents to navigate with their toddlers through crowded areas (Alfonzo et al., 2008). As also discussed in the compact city theory section, when moving in crowded sidewalks, parents with carriages clash against the average pedestrian (Jiménez, de la Fuente, & Hernández-Galán, 2018), which results in them perceiving increased danger and discomfort (Alfonzo et al., 2008; Krishnamurthy et al., 2018; Feliciani & Nishinari, 2018; Swain et al., 2023).

2.3.4. Pollution

Vehicle noise coming from road traffic is one of the main sources of pollution affecting the pedestrians' perceived comfort and well-being on sidewalks (Morillas et al., 2018; de Paiva Vianna, Cardoso & Rodrigues, 2015). This is particularly true for babies, who have an enhanced hearing capability than adults due to their young age, therefore perceiving loud noises stronger (Gupta, A., Gupta, A., Jain, K. & Gupta, S., 2018). Exposure to unpleasant odors, as another form of pollution, also creates perception of discomfort and stress among pedestrians, impacting their willingness to use sidewalks, and associating odors to health risks coming from air pollution (Tanzil & Gamal, 2021, pg. 4; Vallejo-Borda et al. 2023), which has a stronger effect on babies inside strollers (Sharma & Kumar, 2020).

2.3.5. Lighting

Adequate lighting along sidewalks is essential for ensuring comfortable visibility and safety for parents with baby carriages, especially during low-light conditions or nighttime (Saelens & Handy, 2008). The presence of lighting in sidewalks is also proved to incentivize walking among all pedestrians (Vallejo-Borda et al. 2023). Lighting is linked to the perception of reassurance in terms of safety, "higher illuminance leads to higher reassurance" (Fotios, Unwin, & Farrall, 2015, pg. 465).

2.4. Sidewalk Quality of Service Model

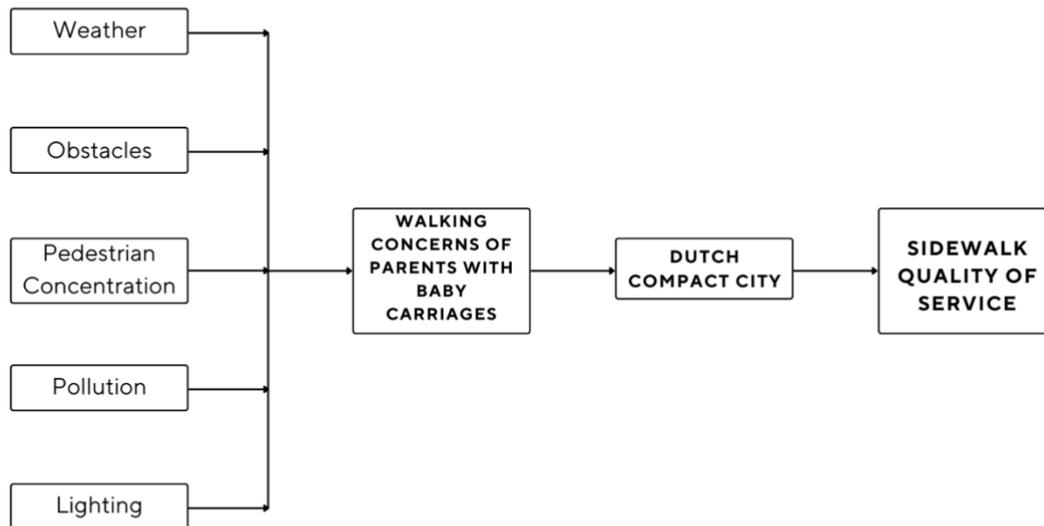


Figure 1. Conceptual model of sidewalk quality of service (SQOS). Source: Author, 2024.

A Sidewalk Quality of Service Model (conceptual model) has been created based on the theoretical framework (Figure 1). This model proposes to measure the sidewalk quality of service of the Dutch compact city (case: city center of Groningen), using as measuring indicators the safety and comfort concerns that shape walking for parents with baby carriages in relation to weather, obstacles, pedestrian concentration, pollution, and lighting.

2.5. Expectations

2.5.1. Answer to research sub-question 1

- How do the compact city sidewalk characteristics clash with walking concerns of parents that walk with baby carriages?

The Municipality of Groningen explicitly states that there is a need to optimize sidewalks along the city to accommodate more space for pedestrians, specifically acclaiming that each pedestrian should have an availability of two meters squared of space for walking (Municipality of Groningen, 2021). This is related to the lack of space dilemma (de Roo and miller, 2019), implying that densification produces sidewalk congestion of obstacles (Honey-Rosés & Zapata, 2021) and pedestrian overcrowding (Jiménez, de la Fuente, & Hernández-Galán, 2018), which in return decreases safety and comfort perceptions among pedestrians (Alfonzo et al., 2008; Evers et al., 2014; Krishnamurthy et al., 2018; Feliciani & Nishinari, 2018; Swain et al., 2023). potentially signifying a major challenge to mobility of parents with baby carriages in the city center of Groningen, who perceive comfort and safety as primary needs on sidewalks (Ataol et al., 2022).

The municipality of Groningen states that they are ahead of the rest of the compact cities in the Netherlands because of the environmentally friendly living environment of the city (Municipality of Groningen, 2021). This way, the concerns for safety and comfort of walking

for parents with baby carriages regarding weather, pollution, and lighting should be potentially well perceived elements among parents on the sidewalks of the city center of Groningen, reinforcing the notion that Dutch compact cities are environmentally sustainable living environments (El Messeidy, 2019).

3. Methodology

3.1. *Methodological route to answer main research question*

The sidewalk quality of service model proposed in the previous section serves as the introduction to the strategy to reach the research objectives, derived from the main research question and its sub-questions in Chapter 1. The SQOS model for this research proposes to measure the pedestrian flow condition of the Dutch compact city (case: city center of Groningen), using as measuring indicators the safety and comfort concerns that shape the comfort level of walking for parents with baby carriages in relation to weather, obstacles, pedestrian concentration, pollution, and lighting.

Thus, to answer the main research question: “What are the perceptions of parents with baby carriages on sidewalk quality of service in the compact city center of Groningen?”, I have designed a mixed methods cross sectional survey to measure the quality of the service provided by the sidewalks to parents walking with baby carriages. The survey ([Appendix A](#)) was developed using Qualtrics, a platform for conducting online surveys offered by the University of Groningen. It was created so that it could be completed in between 10 to 15 minutes at a single point in time. The indicators used to make the questions in this survey are, as stated in the previous paragraph, drawn from the walking concerns by parents with baby carriages listed in the sidewalk quality of service model constructed in Chapter 2. The questions were selected with conscious consideration of the characteristics of the Dutch compact city.

The survey consists of 26 questions measured in 5-point Likert scale, yes/sometimes/no, yes/no answers, with a first section of the survey asking the individual if they are a parent of a toddler or baby (Q1), if they go on walks with them on the city center of Groningen (Q2) and their preferred method of carrying their child while walking (Q3). Only individuals who are parents of toddlers or babies, who walk with them in the city center of Groningen, and who give consent by the end of the survey are considered for the study.

There are two open ended question to understand the reason and location of walking inside the city center of Groningen (Q4, 5), two open ended questions to measure the effect of cars and lighting (Q10, 14), and finally, two open questions (Q24, 25) for respondents to justify their perception on the question on overall sidewalk quality of service (Q23), and the most relevant aspect of the perceived sidewalk quality of service for them.

Table 1 shows the rest of the questions, which are quantitative variables that conform perceived sidewalk quality of service for this study, where Q23 is the question that measures overall perceived sidewalk quality of service in relation to all the previous questions in the table. **Figure 2** is meant to show a representation of the sidewalks surveyed, where obstacles and pedestrian concentration are seen at plain sight; the pictures were taken at 5PM during nighttime, to observe lighting. Pollution and weather were not observable indicators.

| Variable | Variable label & Measurement | Measurement type |
|----------|--|------------------|
| Q6 | Sufficient Sidewalk width (yes:1/no:2) | Nominal |
| Q7 | Sidewalk physical condition (1(very good)-5(very bad) scale) | Ordinal |
| Q8 | Obstruction by trees (yes:1/no:2) | Nominal |
| Q9 | Presence of cars (yes(affects:1/does not:2)/no(affects:3/does not:4) | Nominal |
| Q11 | Street noise (1(least)-5(most) scale) | Ordinal |
| Q12 | Influence of bad weather (1(least)-5(most) scale) | Ordinal |
| Q13 | Presence of lighting (yes(affects:1/does not:2)/no(affects:3/does not:4) | Nominal |
| Q15 | Odor rating (1(very good)-5(very bad) scale) | Ordinal |
| Q16 | Sidewalk cleanliness (yes:1/no:2) | Nominal |
| Q17 | High pedestrian concentration (yes:1/sometimes:2/no:3) | Nominal |
| Q18 | Objects in the way (yes:1/sometimes:2/no:3) | Nominal |
| Q19 | Roadwork (yes:1/sometimes:2/no:3) | Nominal |
| Q20 | Parked bikes (yes:1/sometimes:2/no:3) | Nominal |
| Q21 | Cyclists in the way (yes:1/sometimes:2/no:3) | Nominal |
| Q22 | Sidewalk safety (yes:1/sometimes:2/no:3) | Nominal |
| Q23 | Quality of service rating (1(very good)-5(very bad) scale) | Ordinal |

Table 1. Quantitative variables (Conducted by author, 2024).

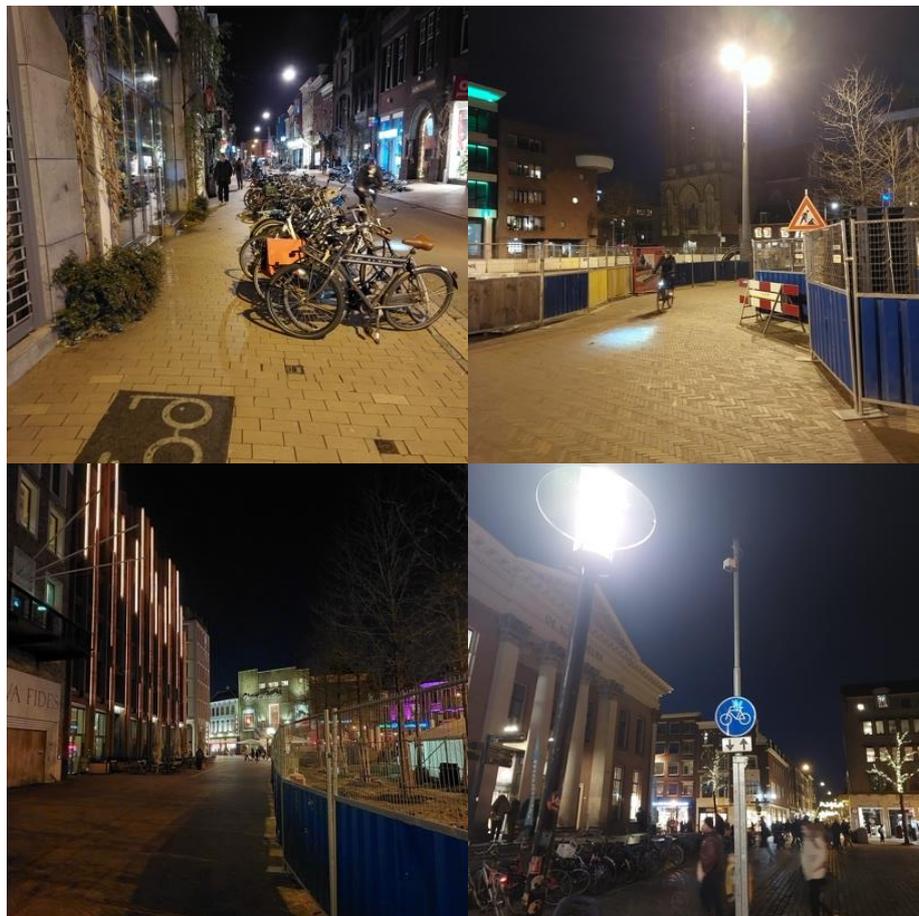


Figure 2. Examples of sidewalks surveyed. Source: Author, 2024.

3.2. Data collection

Purposive sampling was the method of sampling chosen for this study. Any Parents of toddlers or babies not in age of independent walking, that take these latter ones on walks in the city center of Groningen were invited to participate in this research. The online survey was advertised in the scope of three months (October, November, and December) via social media (Facebook and Reddit) and in-person. The social media advertisement took place only through specific social media groups related to Groningen. Such as “r/Groningen” for reddit and many different neighborhood and parenting groups on Facebook. The in-person advertisement was sought for via the cooperation of local Neighborhood associations, including the “Buurtcentrum Sonde 2000”, “Buurtcentrum TuinPad” and “Buurt Selwerd”, where representatives helped in the search for parents to survey, as well as allowing for flyers with QR codes to be attached to the “info” booths of the community centers (**Figure 3**). When scanning the QR codes, individuals could access the online survey. Moreover, the Forum, Grote Markt and Vismarkt were places used as static points on the street to intersect people with strollers and distribute the QR code flyers. A total of 56 flyers were distributed. Two parents also filled in the survey via links sent to them by email.



Figure 3. Photo of flyer with QR code attached to info booth of Buurtcentrum Sonde 2000. Source: Author, 2024.

3.3. *Validity of Data*

This research studies perceptions, therefore resulting in analyzing subjective data. Subjective perceptions are inherently based on individual interpretations, opinions, and experiences, which may not lend themselves well to quantitative analysis using statistical tests. Statistical tests are designed to analyze objective data that can be reliably measured and quantified, whereas subjective perceptions may vary greatly among individuals and may not be easily quantifiable. Also, Subjective perceptions often lack standardization and may be influenced by a wide range of factors, including personal biases, cultural backgrounds, and contextual influences. This is seen in the study by Vallejo-Borda (2020) where the authors needed to standardize the data gathered from the perceptions, so that they could conduct statistical tests.

Despite the above, standardization of data may result in statistical tests oversimplifying or overlooking the nuances and contextual intricacies of the subjective perceptions of parents with baby carriages, leading to potentially misleading conclusions. They are typically used to draw generalizable conclusions about relationships among variables. However, subjective perceptions are highly individualized and may not be representative of broader populations or applicable across different contexts. Because of this, comparing the sample population against the general pedestrian population is not a conscious choice for this study. Attempting to compare perceptions between two groups of a population, or more, using statistical tests may result in inaccurate or misleading findings, which strive away from the purpose of this observational study. If the study would have been focused on objective data gathering, then performing statistical analysis and comparing sampled populations would have resulted in reliable generable findings.

Instead, the qualitative questions proposed in the survey design will be used to address the causality of data to understand the quantitative results, having primary purpose in answering the third research sub question, which will be discussed in the next section.

3.4. *Data Analysis*

3.4.1. *Quantitative data*

Graphs were made to visualize the categorical data collected on perceptions of sidewalk quality of service questions. These graphs were made in Canva, formulas were used to count the categorical data variables, these counts were then used to create percentages of respondents per group. The colors of the graphs were purposely edited to symbolize the positive and negative perceptions. Red is symbolized as the negative value, while green is the positive one. The gradient in between these two colors is meant to show the less frequent perceptions. Causation of the quantitative data will be explained by the qualitative data.

3.4.2. *Qualitative data*

The qualitative data is analyzed using a thematic approach. The codes developed to analyze the data are deductive thematic codes. The deductive codes created for this research were obtained from the theoretical framework. In particular, the themes chosen are the same indicators used to create the quantitative questions in the questionnaire. Therefore, this research uses obstacles, pedestrian concentration, pollution, weather, and lighting as the themes to code qualitative data.

The open-answer questions of the survey have been transferred to ATLAS.ti. This program was used to code the data thematically. In ATLAS.ti the data was put in per question to keep the data manageable. The coding process continued once the data was put in. The deductive codes were mainly used as code groups, to keep a more organized coding system.

Inductive codes were created during the coding process. To answer the research questions, the codes and the quotes that have been highlighted in ATLAS.ti are used. These quotes are published in the results section along the quantitative data graphs, with the aim to support the graphs with causation.

3.5. *Ethical considerations*

Ethical considerations for the survey were in line with the University of Groningen guidelines, which were carefully studied and are both stated and accounted for. Voluntary participation, informed consent, anonymity, storage of personal data, confidentiality, potential for harm at absolute minimum, communication of results are all the ethical concerns that are addressed by the information, data protection and consent sections inside the survey (see Appendix A), which the surveyed person had to sign to submit the responses. The survey could be stopped voluntarily at any moment. Name, age, gender data were not asked for nor used. However, location-specific data was. For which precaution was taken to keep data anonymous and confidential. All data was stored in the X drive of the university of Groningen database, no data was saved to personal devices. The data will be deleted three months after the publishing date of this research. See [appendix A](#) for in-detail ethical considerations inside the survey.

4. Results and Discussion

The survey received 119 responses. Out of all the responses registered in the survey, only 31 responses met the requirements to be considered for this research. This is due to the rest 88 respondents participating but not identifying as parents who go on walks with their toddlers/babies in the city center of Groningen, or that consent was not given for the usage of their data collected.

28 out of 31 parents stated that their reason for walking was linked to leisure (Q4). 30 out of 31 of the parents specified that their preferred mode of carrying their toddlers/babies were strollers, 9 of them also stated that they use baby slings, and 4 of them other forms of baby carriages (Q3). Half of the respondents specified that the perceived sidewalk quality of service impacted their choice of method for carrying their toddler on the sidewalk (Q26). The next sections visualize the results obtained from the quantitative questions that altogether make up the overall perceived sidewalk quality of service in the form of graphs, the cause for their proportions is to be supported by the qualitative insights given by the same respondents.

4.1.1. Study area



Figure 4. Tag cloud of responses regarding areas or streets that respondents walk on. Source: Author, 2024.

Figure 4 shows a tag cloud grouping the responses recorded from respondents when asked which streets or areas they would use sidewalks to walk on (Q5). The results indicate that the study is centered primarily in the inner city Vismarkt-Grote Markt-Forum area, with streets such as the Herestraat, Oosterstraat as connecting streets as well as the rest less frequent streets found in the figure, that also connect between each other towards the Vismarkt and Grote Markt. Almost all respondents overlap their answers among each other. In detail, all walking trips noted converge in the Grote Markt and Vismarkt areas. This is visualized in red color in figure 5. In conclusion, the perception of the city center revolves around the Vismarkt and Grote Markt, which results in the study area of this research.

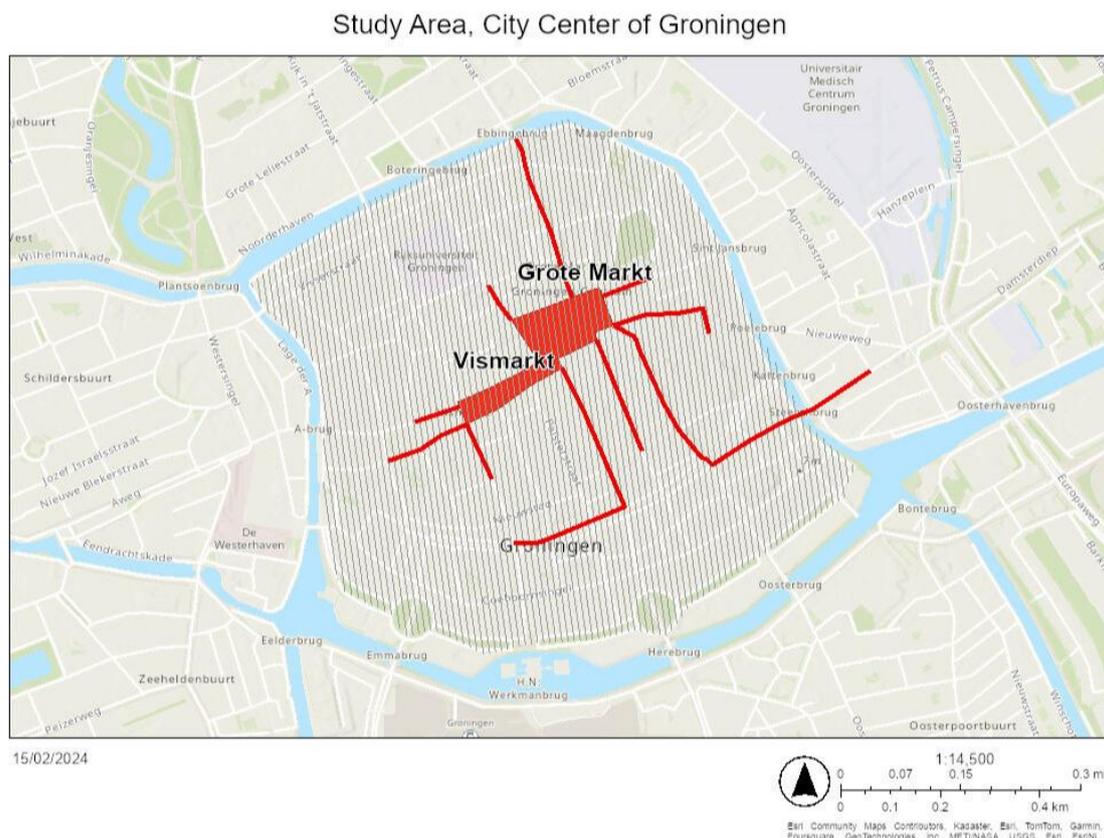


Figure 5. Resulting study area of recorded perceptions of parents with toddlers in baby carriages. Source: Author, 2024.

Weather perception results and discussion

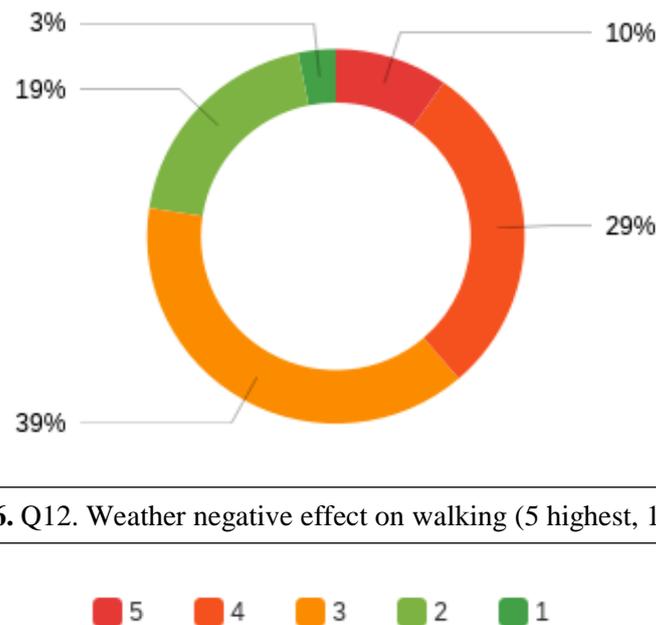


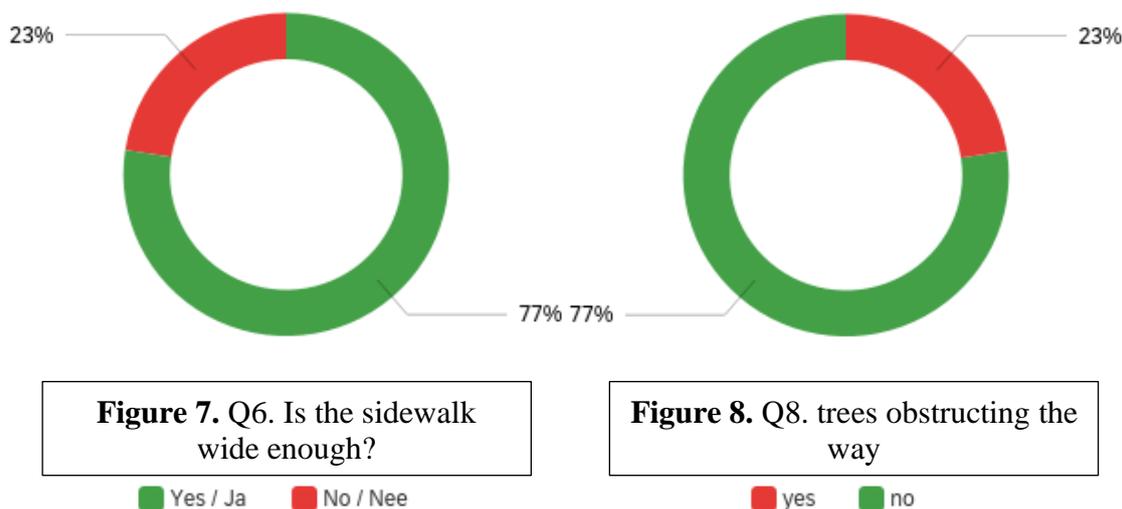
Figure 6. Q12. Weather negative effect on walking (5 highest, 1 lowest)

Figure 6 shows how many parents in proportion perceive weather to hinder their walking with baby carriages on the sidewalk. 39% of parents identify that weather plays a negative effect on their walking comfort. 22% of parents do not perceive weather to negatively influence their walking comfort, and finally 39% of parents do not have any opinion in this regard and don't particularly have much of a negative perception when walking with their babies in baby carriages. When asked to explain their decision on the overall perceived sidewalk quality of service, only one parent mentioned a weather relation to walking.

“I prefer not to go out when it gets dark. In wintertime this means no evening walks”

The Quote above shows a connection between weather and lighting. There is a causation for parents to not go out in what they consider to be “bad weather” but explained by shortened daylight hours. Weather proved not to be a challenge for parents to walk on the sidewalks of the city center of Groningen, in fact, as stated above, out of the 31 respondents only one of them mentioned weather as a negative influence on their walking. McCormack et al. (2009) States that weather mostly influences walking among parents with baby carriages when subject to harsh conditions. However, as observed from the sidewalk examples shown in Figure 2, in the methodology section, weather was not observed as an indicator. The rest of the respondents focused on other walking concerns, disregarding weather as a factor that affects sidewalk quality of service on the sidewalks of the city center of Groningen.

Obstacle perception results



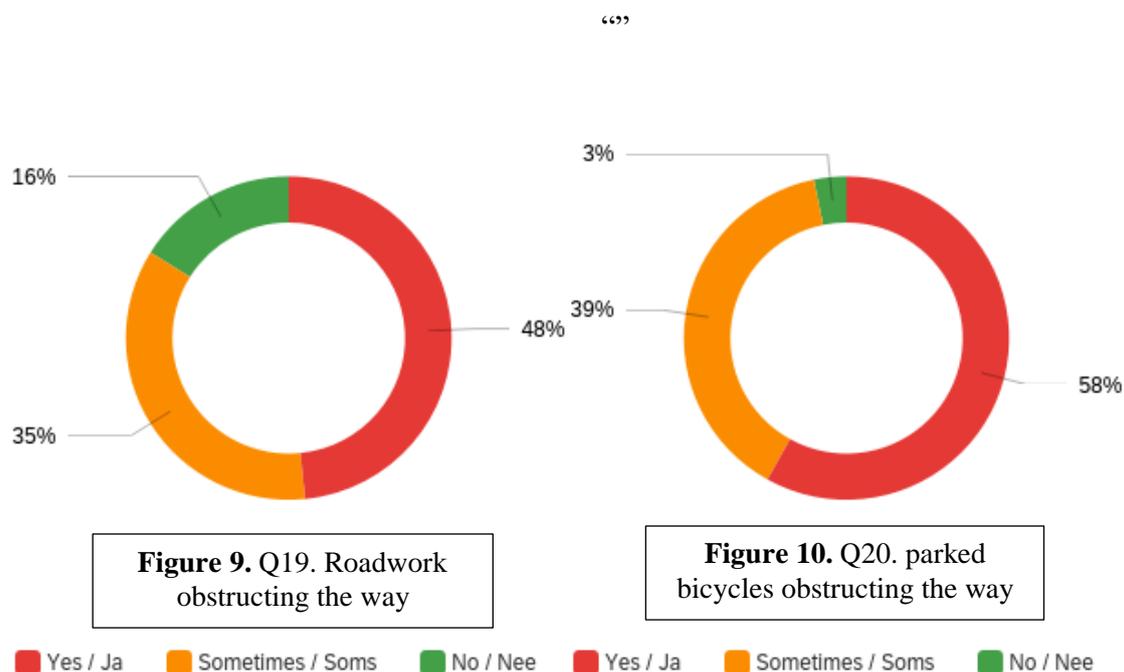
Figures 7 and 8 show the parental perceptions regarding sidewalk width and trees in their influence to block their walking path. 77% of parents perceive that sidewalks are both wide enough in terms of built characteristics and spacious enough so that trees are not presenting an obstruction to them. 22% of parents perceive that the sidewalk is not wide enough and that trees become a nuisance to their walking comfort as they impose an obstacle in the way. However, an interesting remark was given regarding sidewalks in the canal bridges.

“With a stroller it is quite a task to walk along the canal. Often loading and unloading and the sidewalk is very close to the cars that are driving hard”

The above quote establishes a perception connection of parental safety walking concern regarding their baby in the stroller, when in proximity of cars in the street. Considering sidewalk width specifically on a sidewalk in a canal bridge in the city center of Groningen. Further noting that:

“You often have to walk off the sidewalk for a bit, then over the road and then back onto the sidewalk. Not very pleasant. I also often think of people who are dependent on a wheelchair”

The concerned parent evaluates the overall sidewalk quality of service lower. This specific respondent argued this was his negative influenced factor regarding quality of service on sidewalks of the city center of Groningen. They make a special remark on disabled individuals who move with wheelchairs, sympathizing with them as a fellow affected individual. The Mobility Plan of the Municipality of Groningen (2021) states that there is increased emphasis on addressing lack of space for wheelchair and baby carriage users. This quote, above mentioned, alludes to this. However, this is a specific isolated case as the vast majority (77%) of parents do not perceive built sidewalk width narrow enough to concern them.



Figures 9 and 10 show the worst perceived sidewalk walking concerns when evaluating their influence on the perceived sidewalk quality of service. These two were the main reasons for parents not to give an optimum grade to the overall sidewalk quality of service question in the survey. 48% of parents perceive road work to obstruct their walking with baby carriages frequently when going on walks, while 35% more perceive to encounter road work obstacles with less frequency, with a minimal 16% of parents perceiving no obstruction at all in this regard. Stating that:

“There are a lot of roadworks obstructing the way”

This correlates to the observation remarks on Figure 3, the future road work projects noted in the policy document of the mobility plan of Groningen (2021) as well as the recent news on the Groningen Grote Markt sidewalk reconstruction projects (Bremer, 2022; Veenstra, 2022).

Figure 10 shows the most negatively influential walking concern on perceived sidewalk quality of service by parents with baby carriages. A whopping 97% of parents perceive obstructed walking regarding bicycle parking in the sidewalk, with 58% of them perceiving it frequently and 39% not so often, while a tiny 3% of parents do not perceive issues in this matter. This is seen in the quotes mentioned below.

“Lot of bike occupies sidewalks meant for walking”

“Presence of objects on the sidewalk such as bikes, made me evaluate sidewalk service worse”

Alfonzo et al. (2008) states that baby carriages are specially affected by obstructions in the sidewalk, in the compact city theory, public spaces are subject to the lack of space dilemma

(de Roo & miller, 2019). Both bicycle parking and roadwork obstructions are giving clear examples of specific sidewalk characteristics of the compact city where space needs to be optimized. The municipality of Groningen is highly advised to act upon the underlying need of parents to have a comfortable unobstructed walking flow on the sidewalks of the city center of Groningen.

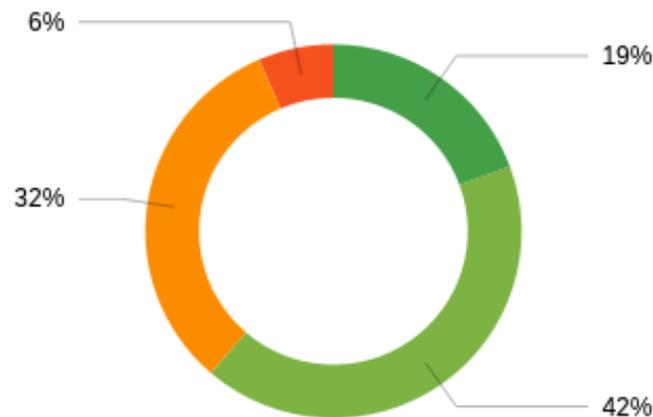


Figure 11. Q7. Sidewalk Surface Condition



Figure 12. Q21. Cyclists on the sidewalk obstructing the way



Figure 13. Q9. Café tables and chairs obstructing the way



Figure 11, 12 and 13 show proportions for perceived sidewalk surface condition, cyclists on the sidewalk obstructing the way, and café tables and chairs respectively. Sidewalk surface condition is well perceived by the combined 61% majority of parents; its influence on sidewalk quality of service is positive, as seen in the quote below.

“Smooth surface”, “The sidewalks are of good quality”

In terms of bicycle parking, cyclists on the way are perceived by 74% of parents as a walking concern that obstructs their pathway, 29% frequently perceive this, 45% sometimes, while 26% do not. An underlying cause for this has to do with parents with baby carriages crossing intersections, or when they need to go on the street. They perceive bicycles to be disruptive, not on the sidewalk, but regarding their behavior against parents with baby carriages when they move from the sidewalk to the street, as seen in the below quote:

“It’s harder to go onto the road when you need to, to avoid bikes”

Café tables and chairs obstructing the way were the third most influential perceived concern by parents. 48% of them perceived these obstructions frequently, while 35% did not do so often, and 16% not at all. These obstructive objects are perceived by parents in relation to terraces and bars, which are the sources of the cause. As seen in the quote below:

“Random terraces in the middle of the sidewalk”

Pedestrian concentration perception results

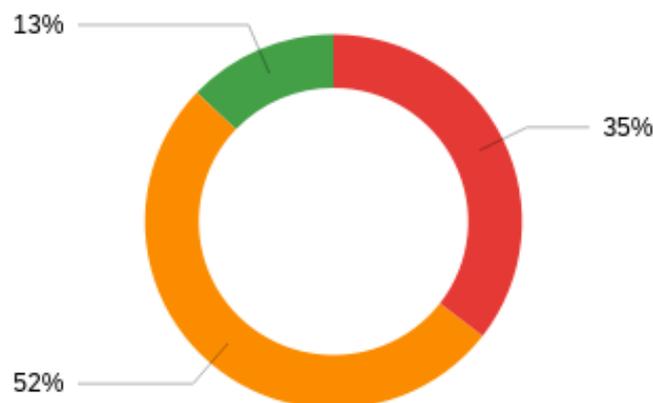


Figure 14. Q17. High pedestrian concentration obstructing the way

■ Yes / Ja ■ Sometimes / Soms ■ No / Nee

Figure 14 addresses the proportions of perceptions of parents’ pedestrian concentration sidewalk concerns. 87% of parents perceive obstructions to their walking path. Among them, 35% frequently perceive it, while 52% do not so often. There is a marginal 13% that has never perceived this when walking with baby carriages. However, despite these perceptions, qualitative insight reveals the underlying notion that parents with baby strollers do not feel any discomfort nor safety concern regarding overcrowding, going against one of the expectations of this study. Seen in the quotes below:

“Fun and get used to the hustle and bustle of the city and other people”

“Well-regulated for an old city center, people also behave very socially when you have a child with you”

Pollution perception results

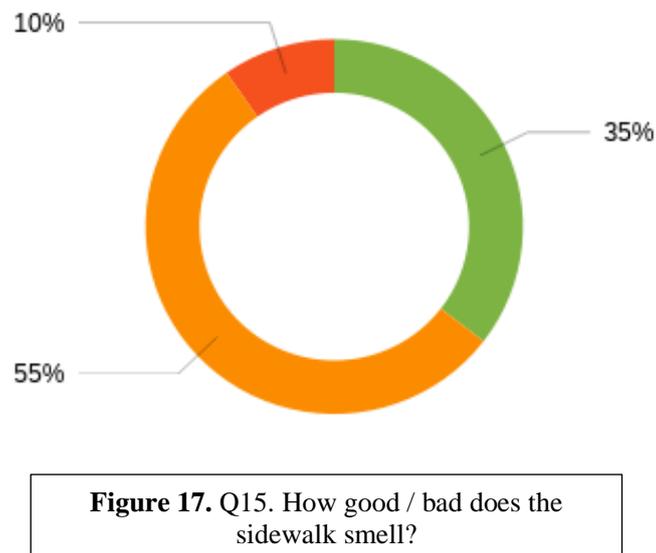
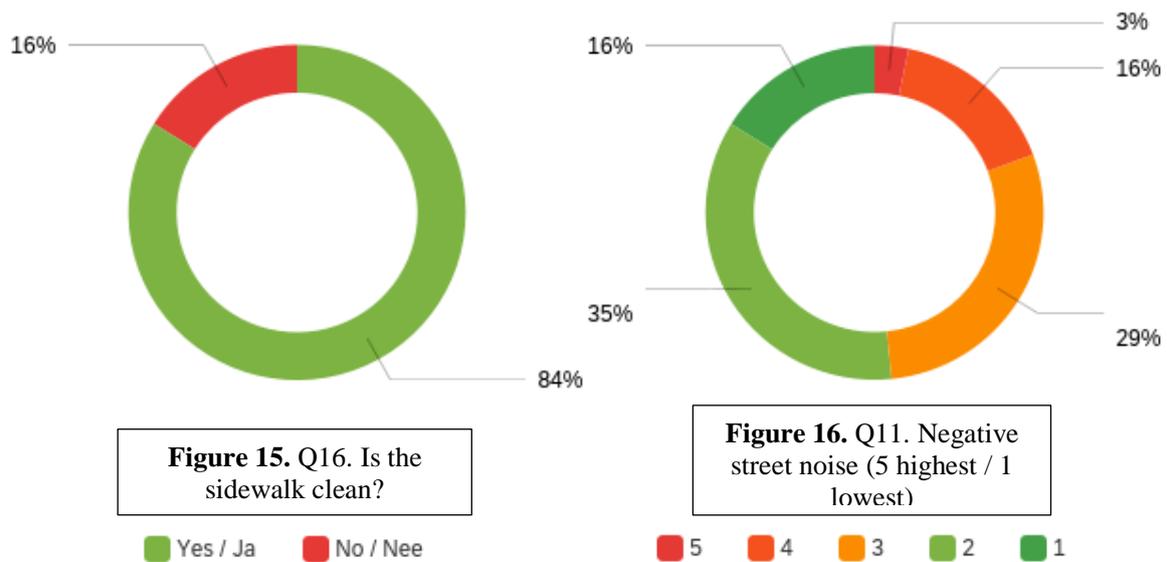


Figure 15, 16, and 17 show proportions of pollution related perceptions of sidewalk cleanliness, negative street noise and sidewalk odor. None of these concerns were deemed

influential, neither in the positive nor the negative sense. Negative street noise, however, was linked to the presence of cars, which is discussed below. Quote:

“Hard to sleep”

“Pay attention when crossing, cars are sometimes parked on the footpath, noise and exhaust fumes”

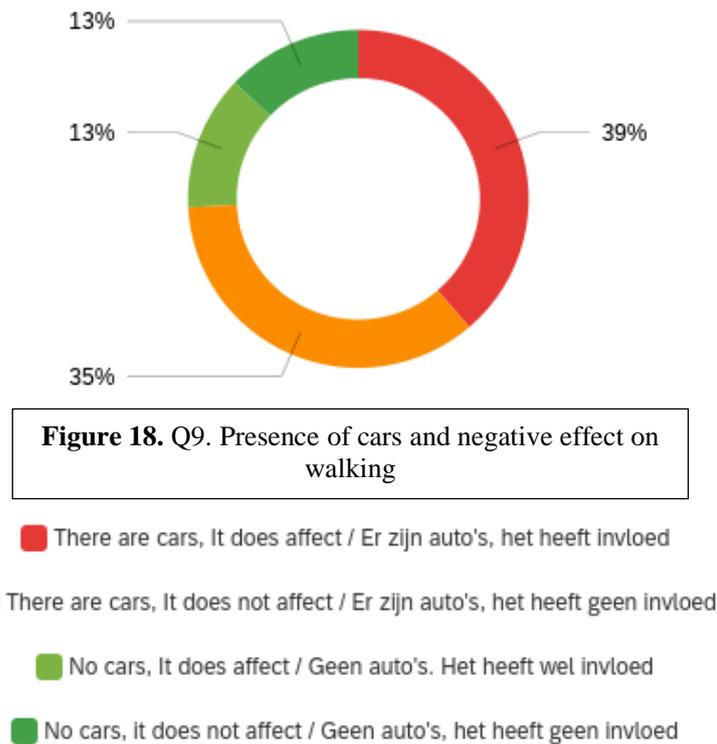


Figure 18 shows the proportions of perceived pollution nuisance. 39% of parents perceive a negative effect of cars on the walking experience. 35% do not. 13% do not perceive any sort of effect of cars on their walking, while the rest do not perceive any presence of cars but do regard them to have a negative effect on walking. Qualitative data shows that parents do not perceive any danger or discomfort on the sidewalk by having cars near them, but they do when they need to cross the street. This directly relates to the findings on **Figure 12**, “cyclists on the sidewalk”. Quote:

“It is hard to cross the street due to cars in Oosterstraat”

Lighting perception results

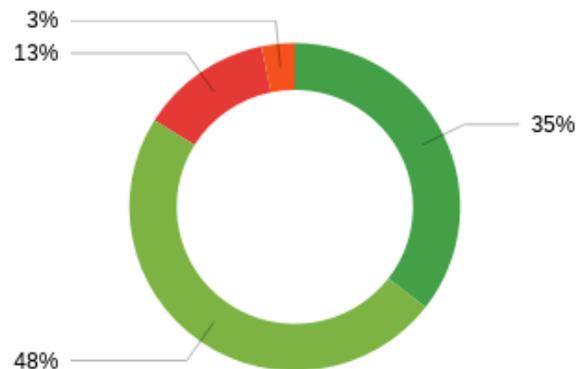


Figure 19. Q13. Presence of lighting on sidewalk and effect on walking decision

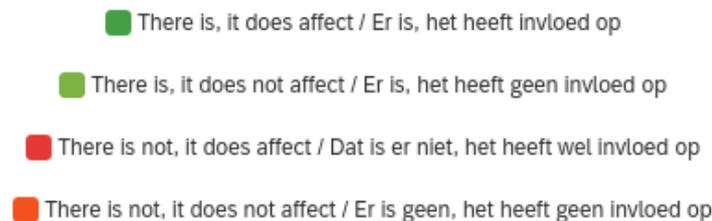


Figure 19 shows the perceptions recorded on concerns regarding lighting presence on sidewalks. 82% of parents perceive lighting on sidewalks. 35% perceive lighting to impact their decision to go on walks. 13% perceive a lack of lighting and an effect on their walking decisions. The rest 3% perceive a lack of lighting and no effect regarding this when walking. The causation behind this lies in self-reassurance and safety concerns, which also correlates to the expectations from literature (Fotios, Unwin, & Farrall, 2015, pg. 465). Parents with babies put extra care in lighting on sidewalks. Because of this, this is the fifth most influential concern that shapes sidewalk quality of service for parents on sidewalks of the city center of Groningen. Quotes:

“Better lighting feels safer”

“Good lighting gives a sense of security and makes that you can see where you walk”

“We don’t go walking when the light is not enough”

Resulting Perceived Safety and Sidewalk Quality of Service

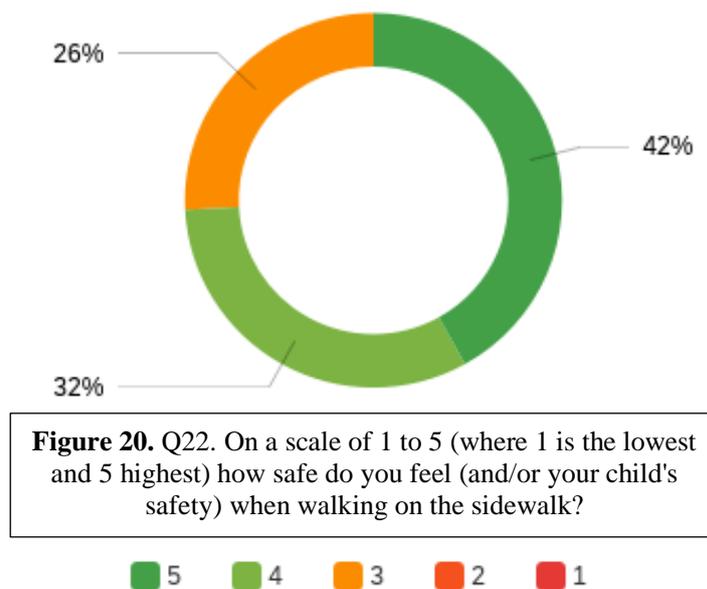


Figure 20 shows the overall perceived safety of parents with baby carriages in proportions. 74% of parents feel safe when walking in the city center of Groningen. 42% feels really safe, 32% feels sufficiently safe, and the last 26% feel moderately safe. This is a highly important notion for this study. The empirical research examined that the two main concerns of parents when walking on sidewalks were safety and comfort levels (Jiménez, de la Fuente, & Hernández-Galán, 2018; Evers et al., 2014; Ataol et al., 2022). Parents do not feel entirely safe on sidewalks only because of car obstacle concerns, specifically shedding light on the car obstacles perceived on sidewalks of canal bridges. Parents value lighting to be the most influential concern for safety perceptions in the city center of Groningen, specifically when in nighttime. The good perception in the presence of lighting influenced a higher perceived safety among parents with baby carriages.

5. Conclusions and Answers to the Research Questions

- The Main research question was: What are the perceptions of parents with baby carriages on sidewalk quality of service in the compact city center of Groningen?

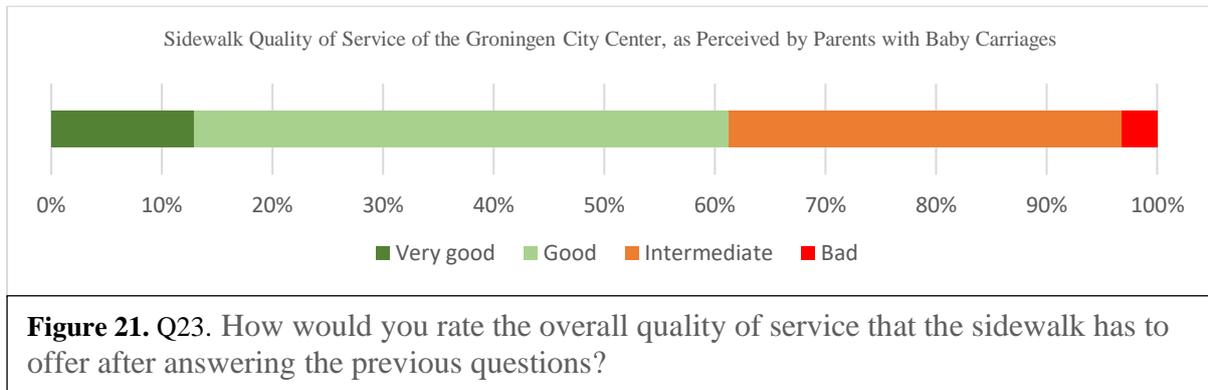


Figure 21 shows the results of the overall perceived sidewalk quality of service of the (inner) city center of Groningen, recorded from the walking perceptions of 31 parents who walk with their children in baby carriages. 61% of parents perceived an overall good sidewalk quality of service, 35% ranked it intermediate, and a final 3% evaluated it to be bad. The causes for this evaluation are listed hereafter.

The sub-questions were:

4. How do the compact city sidewalk characteristics clash with walking concerns of parents that walk with baby carriages?
5. What are the specific challenges that parents with baby carriages encounter when walking along sidewalks?
6. How do these challenges influence the overall perceived sidewalk quality of service?

Based on the Weather Perception, Obstacle Perception, Pedestrian Concentration Perception, Pollution Perception, and Lighting Perception results, the following conclusions were drawn:

Weather was not identified as a significant challenge for parents walking with baby carriages in the sidewalks of Groningen's city center. Only a minority of parents perceived weather conditions negatively affecting their walking comfort, with one parent citing concerns about walking in the dark during winter. This suggests that weather is not a prominent factor influencing parents' perceptions of sidewalk quality of service in Groningen.

Specific concerns were raised regarding sidewalks near canal bridges, where proximity to cars raised safety issues. Road work and bicycle parking were identified as significant obstacles, with most parents perceiving these as frequent hindrances to walking. Sidewalk width and trees' obstruction were not major concerns for most parents.

While many parents perceived obstructions on sidewalks, such as crowded pathways, it did not significantly affect their walking comfort or safety. Parents generally felt that the city center

of Groningen was well-regulated, and that people behaved socially, contributing to a positive walking experience despite pedestrian concentration.

Sidewalk cleanliness, negative street noise and sidewalk odor, were not considered influential factors by parents in evaluating sidewalk quality of service. Negative street noise was associated with the presence of cars, particularly in terms of cars causing noise.

Lighting presence on sidewalks was perceived as good lighting positively impacting most parents' decision to go on walks. A lack of lighting was noted as a concern for some parents, impacting their sense of safety and decision to go walking, particularly during darker hours. Lighting was identified as one of the top concerns shaping sidewalk quality of service for parents in Groningen's city center.

The following remarks were noted considering the original expectations of this research when the theoretical framework was formed:

1. The lack of space dilemma of the Dutch compact city (de Roo and miller, 2019) is present in the city center of Groningen and is affecting parents with baby carriages. The conclusions drawn from this research can be used by the Municipality of Groningen to create a space optimization strategy on sidewalks of the city center to accommodate more space for parents with baby carriages. This can be included in the sustainable mobility plan of Groningen (Municipality of Groningen, 2021).
2. This study addressed the hypothesis that the mobility plan of the Municipality of Groningen (2021) provides a head start, compared to other compact cities in The Netherlands, in matters of environmentally friendly living environments. Particularly, this considers the assumption that the results on the perceptions of parents with baby carriages regarding safety and comfort concerns on weather, pollution, and lighting would be positive. In this regard, lighting was deemed one of the most influential aspects for sidewalk quality of service evaluation, while weather and pollution proved to be non-influential, highlighting a high level of service in street lighting in the city center of Groningen.

5.1. Reflection on the research process

Major setbacks played a part in the delivery of the final version of this study. An initial thesis project was sought that focused solely on sidewalk quality of service, disregarding the development of a strong theoretical framework for the assessment of the level of service of the sidewalks of the city center of Groningen. The first version of this thesis was also weak at defining a qualitative data analysis method; it attempted to analyze the data through the conduction of statistical tests, which are not a proper choice for the analysis of subjective data. The first version of this study also considered commanding a qualitative focus group to validate the reliability of the results from the surveys. However, it was not possible to obtain enough registrations, for which a mixed methods survey was preferred. The language barrier, as well as the lack of time disposal of parents, hindered the extent to which the population could be reached. Future research can be done regarding parents of toddlers' availability for studies in an international context.

6. References

Aultman-Hall, L., Lane, D. and Lambert, R.R., 2009. Assessing impact of weather and season on pedestrian traffic volumes. *Transportation research record*, 2140(1), pp.35-43.

Aultman-Hall, L. and Adams Jr, M.F., 1998. Sidewalk bicycling safety issues. *Transportation Research Record*, 1636(1), pp.71-76.

Alfonzo, M., Boarnet, M.G., Day, K., Mcmillan, T. and Anderson, C.L., 2008. The relationship of neighbourhood built environment features and adult parents' walking. *Journal of Urban Design*, 13(1), pp.29-51.

Ataol, Ö., Krishnamurthy, S., Druta, O. and van Wesemael, P., 2022. Towards inclusive urban environments for infants and toddlers: Assessing four urban neighbourhoods in Istanbul with mothers. *Children & Society*, 36(6), pp.1177-1193.

Bivina, G.R. and Parida, M., 2019. Modelling perceived pedestrian level of service of sidewalks: A structural equation approach. *Transport*, 34(3), pp.339-350.

Bremer, S., 2022. The new bicycle shed on the Grote Markt is open. *Indebuurt*, March 21, pp. 1. <https://indebuurt.nl/groningen/gemeente/de-nieuwe-fietsenstalling-aan-de-grote-markt-is-open~157780/>

Burton, E., Jenks, M. and Williams, K. eds., 2003. *The compact city: a sustainable urban form?*. Routledge.

Carlson, S.A., Whitfield, G.P., Davis, R.T., Peterson, E.L., Fulton, J.E. and Berrigan, D., 2021. Associations between perceptions and measures of weather and walking, United States—2015. *International journal of environmental research and public health*, 18(16), p.8398.

Coyle-Shepherd, D.D. and Hanlon, C., 2013. Family play and leisure activities: Correlates of parents' and children's socio-emotional well-being. *International Journal of Play*, 2(3), pp.254-272.

Coppola, N.A. and Marshall, W.E., 2021. Sidewalk static obstructions and their impact on clear width. *Transportation research record*, 2675(6), pp.200-212.

de Paiva Vianna, K.M., Cardoso, M.R.A. and Rodrigues, R.M.C., 2015. Noise pollution and annoyance: An urban soundscapes study. *Noise & health*, 17(76), p.125.

De Roo, G., 1998. Environmental planning and the compact city a dutch perspective. *Studies in environmental science*, 72, pp.1027-1042.

De Roo, G. and Miller, D. eds., 2019. *Compact cities and sustainable urban development: A critical assessment of policies and plans from an international perspective*. Routledge.

Dols, J., Pons, V., Alcalá, E., Valles, B. and Martín, Á., 2013. Analysis of dynamic behavior and safety of baby carriages in public transportation buses. *Transportation Research Part A: Policy and Practice*, 49, pp.1-9.

El Messeidy, R., 2019. Towards Better Cities: Improving Walkability in Terms of Seven Principles. *Journal of Urban Research*, 33(1), pp.154-171.

Erturan, A. and van der Spek, S.C., 2022. Walkability analyses of Delft city centre by Go-Along walks and testing of different design scenarios for a more walkable environment. *Journal of Urban Design*, 27(3), pp.287-309.

Evers, C., Boles, S., Johnson-Shelton, D., Schlossberg, M. and Richey, D., 2014. Parent safety perceptions of child walking routes. *Journal of transport & health*, 1(2), pp.108-115.

- Ferrer, S., Ruíz, T., & Mars, L. (2015). A qualitative study on the role of the built environment for short walking trips. *Transportation Research Part F: Traffic Psychology and Behaviour*, 33, 141-160. <https://doi.org/10.1016/j.trf.2015.07.014>
- Florez, J., Muniz, J. and Portugal, L., 2014. Pedestrian quality of service: Lessons from Maracanã Stadium. *Procedia-Social and Behavioral Sciences*, 160, pp.130-139.
- Fotios, S., Unwin, J. and Farrall, S., 2015. Road lighting and pedestrian reassurance after dark: A review. *Lighting Research & Technology*, 47(4), pp.449-469.
- Feliciani, C. and Nishinari, K., 2018. Measurement of congestion and intrinsic risk in pedestrian crowds. *Transportation research part C: emerging technologies*, 91, pp.124-155.
- Municipality of Groningen, 2021. Groningen well on the way: Sustainable Urban Mobility Plan Towards a liveable, clean and healthy municipality. (Established: December 2021). Available at: <https://gemeente.groningen.nl/groningen-goed-op-weg>
- Galanis, A. and Eliou, N., 2011. Evaluation of the pedestrian infrastructure using walkability indicators. *WSEAS Transactions on Environment and Development*, 7(12), pp.385-394.
- Gath-Morad, M., O. Plaut, P. and Kalay, Y.E., 2023. Attract or repel: how street features shape pedestrians' leisure walks in cities. *Journal of Urban Design*, pp.1-21.
- Gupta, A., Gupta, A., Jain, K. and Gupta, S., 2018. Noise pollution and impact on children health. *The Indian Journal of Pediatrics*, 85(4), pp.300-306.
- Haworth, N., Schramm, A. and Debnath, A.K., 2014. An observational study of conflicts between cyclists and pedestrians in the city centre. *Journal of the Australasian College of Road Safety*, 25(4), pp.31-40.
- Hillnhütter, H., 2022. Stimulating urban walking environments—Can we measure the effect?. *Environment and Planning B: Urban Analytics and City Science*, 49(1), pp.275-289.
- Honey-Rosés, J. and Zapata, O., 2021. The impact of residential densification on perceptions of public space: A field experiment. *Journal of the American Planning Association*, 87(2), pp.282-295.
- Jahan, M.I., Mazumdar, A.A.B., Hadiuzzaman, M., Mashrur, S.M. and Murshed, M.N., 2020. Analyzing service quality of pedestrian sidewalks under mixed traffic condition considering latent variables. *Journal of Urban Planning and Development*, 146(2), p.04020011.
- Jaskiewicz, F., 2000. Pedestrian level of service based on trip quality. *Transportation Research Circular, TRB*.
- Jiménez, D., de la Fuente, Y. and Hernández-Galán, J., 2018. Diversity of "pedestrians on wheels", new challenges for cities in 21st century. *Stud Health Technol Inform*, 256, pp.357-66.
- Karsten, L. and Van Vliet, W., 2006. Children in the city: Reclaiming the street. *Children Youth and Environments*, 16(1), pp.151-167.
- Kesmodel, U.S., 2018. Cross-sectional studies—what are they good for?. *Acta obstetricia et gynecologica Scandinavica*, 97(4), pp.388-393.
- Krishnamurthy, S., Steenhuis, C., Reijnders, D.A.H. and Stav, T., 2018. Child-friendly urban design: observations on public space from Eindhoven (NL) and Jerusalem (IL).
- Lee, S., Han, M., Rhee, K. and Bae, B., 2021. Identification of factors affecting pedestrian satisfaction toward land use and street type. *Sustainability*, 13(19), p.10725.
- Lepistö, S., Raunima, M. and Paavilainen, E., 2022. Families expecting and living with a baby: A perspective on parental worries. *Childhood Vulnerability Journal*, 4(1-3), pp.83-97.
- Matthews, H., 2003. Coming of age for children's geographies. *Childrens Geographies*, 1, pp.3-6.

- MORICCA, A. and IKALOVIC, V., 2022. PEDESTRIAN MOBILITY IN THE PROXIMITY OF CONSTRUCTION SITES: AN APPROACH TO ANALYSE AND IMPROVE THE PEDESTRIAN EXPERIENCE. *Risk Analysis, Hazard Mitigation and Safety and Security Engineering XIII*, 214, p.59.
- Morillas, J.M.B., Gozalo, G.R., González, D.M., Moraga, P.A. and Vílchez-Gómez, R., 2018. Noise pollution and urban planning. *Current Pollution Reports*, 4(3), pp.208-219.
- Macdonald, E., Szibbo, N., Eisenstein, W. and Mazingo, L., 2018. Quality-of-service: toward a standardized rating tool for pedestrian quality of urban streets. *Journal of Urban Design*, 23(1), pp.71-93.
- Ortega, E., Martín, B., De Isidro, Á. and Cuevas-Wizner, R., 2020. Street walking quality of the ‘Centro’ district, Madrid. *Journal of Maps*, 16(1), pp.184-194.
- Pirart, F.B.C., 2008. *Policies against urban sprawl in the changing Dutch planning context. Groningen case: from a monocentric compact city policy towards a new urbanisation path between intensification and expansion* (Doctoral dissertation).
- Rodriguez-Valencia, A., Barrero, G.A., Ortiz-Ramirez, H.A. and Vallejo-Borda, J.A., 2020. Power of user perception on pedestrian quality of service. *Transportation research record*, 2674(5), pp.250-258.
- Rodriguez-Valencia, A., Vallejo-Borda, J.A., Barrero, G.A. and Ortiz-Ramirez, H.A., 2022. Towards an enriched framework of service evaluation for pedestrian and bicyclist infrastructure: acknowledging the power of users’ perceptions. *Transportation*, 49(3), pp.791-814.
- Sharma, A. and Kumar, P., 2020. Quantification of air pollution exposure to in-pram babies and mitigation strategies. *Environment international*, 139, p.105671.
- Swain, R., Oswin, P., Truelove, V. and Larue, G.S., 2023. Children’s and parents’ perceptions on safe routes to schools: a mixed-methods study investigating factors influencing active school travel. *Journal of Urban Design*, pp.1-23.
- Tanzil, Y.T. and Gamal, A., 2021, February. Elements identification for pedestrian comfort. In *IOP Conference Series: Earth and Environmental Science* (Vol. 673, No. 1, p. 012026). IOP Publishing.
- Ujjwal, J. and Bandyopadhyaya, R., 2023. Development of comprehensive service quality assessment framework for sidewalks considering desired and actual conditions. *Transportation letters*, 15(3), pp.227-241.
- Vallejo-Borda, J.A., Cantillo, V. and Rodriguez-Valencia, A., 2020. A perception-based cognitive map of the pedestrian perceived quality of service on urban sidewalks. *Transportation research part F: traffic psychology and behaviour*, 73, pp.107-118.
- Vallejo-Borda, J.A., Barchelot-Aceros, L.J., Barrero, G.A., Ortiz-Ramirez, H.A., Pabón-Poches, D.K. and Silva-Fernández, C.S., 2023. Addressing pedestrian perceived externalities influenced by motor vehicles: A perspective from curb space typologies. *Transportation research part A: policy and practice*, 178, p.103876.
- Verhoeven, M., 2019. Walkability of Large Dutch Cities: A Comparison Between Scientific Walkability Trends and Planning Policy & Practice of the Cities Amsterdam and Utrecht (MSc Thesis, Spatial Planning). *Wageningen University*.
- Veenstra, T., 2022. The last buses disappear from Grote Markt. *OOGTV*, February 8, pp. 1. <https://www.oogtv.nl/2022/02/laatste-bussen-verdwijnen-half-juli-van-grote-markt/>
- Vecteezy (2024). *Mom and Dad are walking down the street pushing a stroller*. *Pro Vector*. Retrieved on January 23, 2024 from <https://www.vecteezy.com/vector-art/2176097-mom-and-dad-are-walking-down-the-street-pushing-a-stroller>

Yadav, V. and Rastogi, R., 2022, November. Pedestrian Level of Service: A Review of Factors and Methodology. In *National Conference on Recent Advances in Traffic Engineering* (pp. 1-18). Singapore: Springer Nature Singapore.

¹ European Charter of Pedestrian Rights, 1988

https://www.diba.cat/c/document_library/get_file?uuid=246cdcd3-0c1b-4056-9573-115f2eb986b3&groupId=7294824

² Central Bureau of Statistics of the Kingdom of the Netherlands, 2023

<https://www.cbs.nl/en-gb/visualisations/dashboard-population/population-counter#:~:text=As%20of%20end%20of%20November,men%20and%20women%20by%20age.>

7. Appendices

7.1. Appendix A. Questionnaire

Going for a Stroll

A Comprehensive Study on Parental Walking Perceptions on Sidewalks in the Inner-city Center of Groningen

Start of Block: Block 1

info1 (Nederlandse versie hieronder) (Dutch below)

Survey Information

Name of Researcher: Ignacio Ricci (Bachelor Student, Spatial Planning and Design)

E-mail: i.e.ricci.capredoni@student.rug.nl

The survey is meant to draw input for finding deficiencies (if any) in, and explaining the quality of service of sidewalks in the Binnenstad of Groningen from the perception of parents who walk these sidewalks with their toddlers or babies (not in independent walking age).

Enquête-informatie

Naam onderzoeker: Ignacio Ricci (Bachelorstudent Ruimtelijke Ordening en Ontwerp)

E-mail: i.e.ricci.capredoni@student.rug.nl

Het onderzoek is bedoeld om input te verkrijgen voor het vinden van tekortkomingen (indien aanwezig) in en het verklaren van de kwaliteit van de dienstverlening van trottoirs in de Binnenstad van Groningen vanuit de perceptie van ouders die over deze trottoirs lopen met hun peuters of baby's (niet in de leeftijd waarop ze zelfstandig kunnen lopen).

Pressing next will mean you understand the information provided to you.

Als u op Volgende drukt, betekent dit dat u de verstrekte informatie begrijpt.

End of Block: Block 1

Start of Block: Block 2

Q1 Are you a parent of a toddler or baby?

Bent u ouder van een peuter of baby?

Yes / Ja (1)

No / Nee (2)

Q2 Do you go on walks with your toddler / baby on the city centre of Groningen?

Maak jij een wandeling met je peuter / baby door de binnenstad van Groningen?

Yes / Ja (1)

No / Nee (2)

Q3 How do you walk with your toddler / baby on the city center?

Hoe loop je met je peuter/baby door de binnenstad?

Stroller / Kinderwagen (1)

Baby carrier / Draagzakken (2)

Other / Ander: (3) _____

Q4 What is your reason to go on walks with your child?

Wat is voor u de reden om met uw kind te gaan wandelen?

End of Block: Block 2

Start of Block: Block 3

info2 The following block of questions have to do with Sidewalk Quality of Service. Which, for purposes of this research, is explained by the emotional perceptions of parents (you) towards the following factors: sidewalk characteristics, externalities, surrounding, discomfort, bike hassles and protection.

Het volgende blok vragen heeft te maken met Sidewalk Quality of Service. Wat voor de doeleinden van dit onderzoek wordt verklaard door de emotionele percepties van ouders (jij) ten aanzien van de volgende factoren: kenmerken van het trottoir, externe factoren, omgeving, ongemak, fietsproblemen en bescherming.

End of Block: Block 3

Start of Block: Block 4

Q5 Which sidewalk, street or place of the City centre do you walk on with your baby / toddler?

Op welke stoep, straat of plek in de binnenstad loop jij met je baby/peuter?

Q6 Is the sidewalk wide enough for walking with your child?

Is het trottoir breed genoeg om met uw kind te lopen?

Yes / Ja (1)

No / Nee (2)

Q7 how would you describe the physical condition of the sidewalk for walking with your child?

Hoe zou u de fysieke conditie van het trottoir omschrijven als u met uw kind loopt?

- Very Good / Erg Goed (1)
 - Good / Goed (2)
 - Intermediate / Tussenliggend (3)
 - Bad / Slecht (4)
 - Very Bad / Heel slecht (5)
-

Q8 Are there trees in the sidewalk that take up space, dificulting your walking with your child?

Staan er bomen op het trottoir die ruimte in beslag nemen, waardoor u moeilijk met uw kind kunt lopen?

- yes (1)
 - no (2)
-

Page Break

Q9 Is there presence of cars in the street? If so, does it affect your walking with your child negatively?

Is er sprake van auto's op straat? Zo ja, heeft dit een negatieve invloed op het wandelen met uw kind?

- There are cars, It does affect / Er zijn auto's, het heeft invloed (1)
 - There are cars, It does not affect / Er zijn auto's, het heeft geen invloed (2)
 - No cars, It does affect / Geen auto's. Het heeft wel invloed (3)
 - No cars, it does not affect / Geen auto's, het heeft geen invloed (4)
-

Display This Question:

If Is there presence of cars in the street? If so, does it affect your walking with your child negat... = There are cars, It does affect / Er zijn auto's, het heeft invloed

Or Is there presence of cars in the street? If so, does it affect your walking with your child negat... = No cars, It does affect / Geen auto's. Het heeft wel invloed

Q10 How does it affect?

Welke invloed heeft dit?

Q11 On a scale of 1 to 5 (where 1 is the lowest, and 5 highest) how much negative street noise is there on the sidewalk when walking with your child?

Hoeveel negatief straatgeluid is er op een schaal van 1 tot 5 (waarbij 1 het laagste en 5 het hoogste is) op de stoep als u met uw kind loopt?

5 (1)

4 (2)

3 (3)

2 (4)

1 (5)

Page Break

Q12 on a scale of 1 to 5 (where 1 is the least, 5 the most), how much Does weather negatively affect your walk with your child?
op een schaal van 1 tot 5 (waarbij 1 het minst is, 5 het meest), hoeveel heeft het weer een negatieve invloed op uw wandeling met uw kind?

5 (1)

4 (2)

3 (3)

2 (4)

1 (5)

Q13 Is there good lighting in the sidewalk? does it affect your decision to walk there with your child?

Is er goede verlichting op de stoep? Heeft het invloed op uw beslissing om daar met uw kind naartoe te lopen?

There is, it does affect / Er is, het heeft invloed op (1)

There is, it does not affect / Er is, het heeft geen invloed op (2)

There is not, it does affect / Dat is er niet, het heeft wel invloed op (3)

There is not, it does not affect / Er is geen, het heeft geen invloed op (4)

Display This Question:

If Is there good lighting in the sidewalk? does it affect your decision to walk there with your chil... = There is, it does affect / Er is, het heeft invloed op

Or Is there good lighting in the sidewalk? does it affect your decision to walk there with your chil... = There is not, it does affect / Dat is er niet, het heeft wel invloed op

Q14 How does it affect?

Welke invloed heeft dit?

Q15 How do you perceive odour in the sidewalk?
Hoe 'stinkt' het trottoir?

- Very good odour / Zeer goede geur (1)
- Good odour / Goede geur (2)
- Moderate / Gematigd (3)
- Bad odour / Slechte geur (4)
- Very bad odour / Zeer slechte geur (5)

Q16 Is the sidewalk clean?

Is het trottoir schoon?

- Yes / Ja (1)
- No / Nee (2)

Page Break

Q17 Do you usually encounter big concentrations of people in the sidewalk that difficult your mobility with your child?

Komt u gewoonlijk grote concentraties mensen op de stoep tegen die uw mobiliteit met uw kind bemoeilijken?

- Yes / Ja (1)
- Sometimes / Soms (2)
- No / Nee (3)

Q18 Do you usually encounter objects (such as café tables or chairs) on the sidewalk that difficult your walking with your child?

Komt u regelmatig voorwerpen (zoals café tafels of stoelen) op de stoep tegen die het lopen met uw kind bemoeilijken?

- Yes / Ja (1)
- Sometimes / Soms (2)
- No / Nee (3)

Q19 Do you usually encounter road work that impedes you from walking on the sidewalk with your child?

Heeft u regelmatig te maken met wegwerkzaamheden waardoor u niet met uw kind op de stoep kunt lopen?

Yes / Ja (1)

Sometimes / Soms (2)

No / Nee (3)

Page Break

Q20 Do you usually encounter parked bikes in the sidewalk that difficult your walking with your child?

Komt u regelmatig geparkeerde fietsen tegen op de stoep waardoor u moeilijk met uw kind kunt lopen?

Yes / Ja (1)

Sometimes / Soms (2)

No / Nee (3)

Q21 Do you usually encounter cyclists in the sidewalk that difficult your walking with your child?

Komt u vaak fietsers tegen op de stoep die het lopen met uw kind lastig maken?

Yes / Ja (1)

Sometimes / Soms (2)

No / Nee (3)

Page Break

Q22 on a scale of 1 to 5 (where 1 is the lowest and 5 highest) how safe do you feel (and/or your child's safety) when walking on the sidewalk?

op een schaal van 1 tot 5 (waarbij 1 het laagste en 5 het hoogste is) hoe veilig voelt u zich (en/of de veiligheid van uw kind) als u op de stoep loopt?

5 (1)

4 (2)

3 (3)

2 (4)

1 (5)

End of Block: Block 4

Start of Block: Block 3

Q23 How would you rate the quality of service that the sidewalk has to offer after answering the previous questions?

Hoe beoordeelt u de kwaliteit van de dienstverlening die het trottoir te bieden heeft na het beantwoorden van de voorgaande vragen?

Very good / Erg goed (1)

Good / Goed (2)

Intermediate / Tussenliggend (3)

Bad / Slecht (4)

Very bad / Heel slecht (5)

Q24 Can you name positive and / or negative factors that shaped your answer?

Kunt u positieve en/of negatieve factoren noemen die uw antwoord hebben bepaald?

Positive / Positief (1) _____

Negative / Negatief (2) _____

Q25 From the previous factors mentioned, which one is the most important for you?

Welke van de eerder genoemde factoren is voor u het belangrijkste?

Q26 Does the quality of service of the sidewalk impact the decision to choose which stroller / baby carrier / or other to use?

Heeft de kwaliteit van de dienstverlening van het trottoir invloed op de beslissing om te kiezen welke kinderwagen / draagzak / of iets anders u wilt

gebruiken?

Yes / Ja (1)

No / Nee (2)

End of Block: Block 3

Start of Block: Block 5

info3 [Researcher's email: i.e.ricci.capredoni@student.rug.nl](mailto:i.e.ricci.capredoni@student.rug.nl)

DATA PROTECTION AND CONSENT: Your collected data will remain anonymous and confidential. The email of the researcher (found at the top of this form) is open for any doubts or ethical concerns. Your data will not be stored in any personal devices during and after the interview is finished (voice only) recorded. The data will be transferred to be stored in the university's platform (X drive) and deleted off the device used to record it. You give consent on your voluntary participation, and that you were properly informed.

The data will only be used for Ignacio Ricci's Bachelor thesis project.

GEGEVENSBE SCHERMING EN TOESTEMMING: Uw verzamelde gegevens blijven anoniem en vertrouwelijk. De e-mail van de onderzoeker (te vinden bovenaan dit formulier) staat open voor eventuele twijfels of ethische zorgen. Uw gegevens worden tijdens en na afloop van het interview niet opgeslagen op persoonlijke apparaten (alleen spraak). De gegevens worden overgedragen om te worden opgeslagen op het universiteitsplatform (X-schijf) en verwijderd van het apparaat dat is gebruikt om de gegevens op te nemen. U geeft toestemming voor uw vrijwillige deelname en dat u goed geïnformeerd bent.

De gegevens worden uitsluitend gebruikt voor het bachelorscriptieproject van Ignacio Ricci.

I give my consent / Ik geef mijn toestemming (1)

End of Block: Block 5
