Politecnico di Torino

UNIVERSITEIT GENT

M.Sc. in Territorial, Urban Environmental, and Landscape Planning

Master of Science Thesis

Session: 2024-25

An Activity-Based Approach to assessing Street-space Allocation: Insights from School Streets in Ghent

Master of Science in Territorial, Urban Environmental, and Landscape Planning

Master of Science Thesis

An Activity-Based Approach to assessing Street-space Allocation: Insights from School Streets in Ghent

Supervisor:

Prof. Elisabetta Vitale-Brovarone

Co-Supervisors:

Prof. Silvia Crivello **Prof. Tim Devos**

Dr. Freke Caset

Author:

Suyash Ninad Sherekar

Academic Year 2024-2025

Abstract

The increasing reliance on car-centric planning over the years has significantly undermined the accessibility and safety of vulnerable groups, especially children. The conflicts arising out of contested street ownership have posed further challenges for equitable allocation of street space in many cities. In response, the city of Ghent introduced School Streets with a view to creating more space for children, by guaranteeing them safe access, ease of active mobility, and congestion and pollution free school environments. Using Ghent's school streets as a case study, this thesis critically examines the interplay of the allocated space with its use and societal perceptions – i.e. the Interpreted Space. Grounded in Henry Lefebvre's Space triad, The Interpreted Space is defined as a combination of the Lived and Perceived Space which are calculated separately using two distinct methodologies. The thesis develops an 'activity-based approach' combining ethnographic observations and stakeholder perspectives to analyse the societal interpretation of the school streets. The mixed-methods data collection process focuses on documenting on-street activities –diverging from existing approaches that ask for distribution of street space among different travel modes. The findings reveal that reorganisation of space on school streets in favour of biking and walking significantly leads to higher adoption of active travel modes for school trips. Alternatively, temporary vehicle restrictions – a model adopted by many cities globally – yielded relatively limited benefits, as they failed to recognize the multifunctional role of streets as safe spaces for travel, play and social interaction.

Keywords: *Street Space Allocation, Interpreted Space, School Streets, Activity-based Approach, Pedestrianisation, Ghent*

Acknowledgements

With a deep personal resonance, I start with my humble attempt in the translation of a composition by Indian classical vocalist Dr. Ashwini Bhide-Deshpande. She writes -

Without a guide, who shows the way?

The intellectual abyss is dark, they say…

--

The guide and the wisdom are the same

Just like the wisdom lights its flame

Without the flame how shall I see —

What way lies ahead of me?

--

Research is never a solitary endeavour, and this thesis would not have been possible without the collective support, guidance, and generosity of my supervisor, co-supervisors and many individuals. I am deeply grateful to those who have contributed to this journey, offering their expertise, encouragement, time and patience along the way.

First and foremost, I start by acknowledging the profound role played by my supervisor Prof. Elisabetta Vitale Brovarone in realizing this thesis. From the formulation of the idea for proposal to opening up the opportunity of internship, until the very conclusion of thesis, her invaluable guidance have played a crucial role in shaping my thesis. At the same time, it was Prof. Tim Devos who welcomed me at the Centre for Mobility and Spatial Planning (AMRP) of the University of Ghent. I am equally indebted to him for officiating my research stint in Ghent, mentoring my fieldwork and guiding the development of the overall research design and data analysis. I sincerely thank Prof. Silvia Crivello who guided me in refining and finalizing the methodological aspects of this thesis and for introducing me to the world of Urban Ethnography. I am grateful to Dr Freke Caset, who has been generous and

while offering her insightful feedback, particularly in the development of research questions and the theoretical framework and regularly suggesting relevant readings.

This research would not have been possible without the cooperation of school authorities and management in facilitating the parent surveys. I extend my heartfelt appreciation to Sven De Schutter (Director, Freinetschool De Vlieger), Ruth Melis (Director, VBS De Krekel), and Ann Jacobs (Director, Montessori Klimop) for their incredible support and dedication in the survey distribution process. My sincere thanks also go to all the parents who took the time to participate, ensuring the success of this study.

Special thanks to Alexandra Stankulova and Can Doğrul for their assistance in reviewing Bulgarian and Turkish translations of the survey.

At this moment, I would also like to thank Prof. Nishant Manapure, Principal – PIADS Nagpur, who immensely encouraged me to take up this master's course and shaped my inclination towards urban studies. His continuous encouragement and his invitation to deliver a lecture on my research topic were both inspiring and deeply meaningful.

Finally, I am forever grateful to my parents, family, colleagues from AMRP, and friends, whose unwavering support over the past two years has been instrumental not only in the completion of this thesis but also in my successful journey through this master's program in Torino.

Table of Contents

List of Figures and Tables

Figures

Tables

Cover Image: Created using Canva AI Image Generator

Chapter 1 – Introduction

The street is an essential public space, and at the same time, it is interpreted by people on an innately personal level in different ways. Collectively, it is a societal place that is individually owned by many people in different ways. Due to this interpretative complexity of public spaces – they are always under moral conflicts as people occupy them in their ways. Jane Jacobs has described streets as the most vital organs of the city (Jacobs, 1961). Historically, streets have been functioning not only as conduits facilitating traffic, but also as vibrant public spaces supporting a range of day-to-day social, cultural, and economic facets of urban life (Jones, Marshall, & Boujenko, 2008). The advent of the automobile and its dominance in urban planning affected how streets were perceived and designed. Car-centric urban planning significantly compromised the multifunctionality of streets and a significant proportion of street space was increasingly allocated to automobiles (Gössling et al., 2016). The attributes of streets unrelated to transportation were grossly overlooked to accommodate more cars and create unhindered access for them.

Over the years, the unquestioned predominance of cars has led to traffic congestion, pollution, and the erosion of accessible and inclusive public spaces, especially for vulnerable groups like children. Recognizing these challenges, urban planners and mobility experts have devised innovative approaches and policy tools to reclaim streets from cars and open the streets for other salient uses. One such initiative is the concept of 'School Streets', which prioritize the safety and mobility of children by limiting vehicular traffic near schools at peak hours. School Streets are realized to address many objectives, including creating safe and congestion-free environments promoting active mobility, fostering community interactions, and reducing carbon footprints at a municipal level. Since 2012, The Flemish city of Ghent in Belgium has emerged as a key city in implementing school streets. The implementation of school streets inherently demands redistribution of existing street space among different

users, uses, and functions apart from transit. This thesis explores how the allocation of street space in different scenarios impacts the intended goals of School Streets in the context of Ghent.

Any exercise of spatial redistribution not only re-configures the ownership of streets across the varied cross-section of its users but also determines the existence and effective functioning of a variety of activities that take place on the streets daily. Planning practices that prioritize vehicular mobility in school zones undermine accessibility, safety, and inclusivity of school children as the presence of cars follows up with the congestion and high speeds. This not only affects the spaces outside schools but also impacts larger mobility behaviours reducing opportunities for active travel and diminishing the social utility of streets as public spaces. Moreover, school streets are areas of intense human activity, and activities like social interactions among teachers, parents, and children – playing, walking, etc are inherent to school life that takes place daily on these streets. While the introduction of School Streets represents a significant step toward addressing the conflicts between pedestrians, cyclists, and vehicles, their reliance on temporary vehicular restrictions often falls short of achieving broader objectives such as fostering social interactions, promoting active lifestyles, and enhancing environmental quality.

Existing approaches in the assessment of street-space allocation are largely mode-based (Nello Deakin, 2019), emphasizing the distribution of space among different travel modes. However, this approach overlooks the qualitative dimensions of how space is perceived, interpreted, and utilized by its users. Thus, there is a pressing need for alternative frameworks that integrate both the physical allocation and the societal interpretation of street space. This thesis aims to bridge this gap by proposing and employing an *Activity-based Approach* that combines the study of public perception and public use of street space to develop a judgment on the existing spatial allocation on the school streets in Ghent.

The primary aim of this thesis is to critically assess the allocation of street space concerning its societal interpretation, using Ghent's school streets as a case study. To achieve this aim, the research analyses the relationship between allocated space and societal interpretation on school streets, combining non-participant observations with stakeholder perspectives, thereby offering a nuanced understanding of how school streets function as dynamic public spaces. The study evaluates how varying levels of street space allocation affect safety, accessibility, social interaction, and physical activity, and examines the role of school streets as multifunctional spaces that extend beyond their functional purpose as traffic conduits. The research addresses two key questions:1) what added value an activity-based analysis brings to the existing framework of mode-based street-space allocation analysis? 2) How do different spatial allocation scenarios impact the societal perception and usage of school streets? To address these questions, this study employs a mixed-methods approach, by combining two data collection methods: observational activity mapping and survey data collected from parents and other stakeholders. Non-participant observations qualitatively document on-street activities to capture the 'Lived Space,' while surveys quantify perceptions and experiences, reflecting the 'Perceived Space'. These two dimensions of spatial production, as conceptualized within Henry Lefebvre's Space Triad (Lefebvre, 1991, p. 33) are integrated to form a comprehensive analysis of the 'Interpreted space' on the School Streets of Ghent.

This research contributes to the broader discourse on urban mobility and public space design by shifting the focus from mode-based to activity-based street-space analysis. By highlighting the interplay between allocated and interpreted spaces, the study develops a critical understanding of streets The study also provides actionable insights for designing school streets that are not only safer but also more inclusive and socially vibrant. The findings are expected to inform policy and practice, offering a replicable framework for assessing street space allocation in other urban contexts.

The thesis is organized to reflect a logical progression of ideas, starting from the exploration of school streets as a concept and studying the implementation of similar

models globally in Chapter 3. In Chapter 4, the theoretical framework is established by defining the key concepts of Allocated and Interpreted space and their basis in Lefebvre's Space Triad. This chapter also reviews the existing literature on Street Space Allocation by identifying gaps and detailing the need for an Activity-based Approach. Chapter 5 discusses the methodology for data collection highlighting the fieldwork plan for observational activity mapping the techniques used and how the parental surveys were conducted. The sixth chapter presents the findings from the two datasets and the seventh chapter integrates them in a discussion. Chapter 7 also maps the Interpreted Space and discusses the inferences drawn out from the study. Chapter 8 concludes the study with a synthesis of insights and reflections and the possibility of scaling this analysis to different contexts.

Chapter 2 – Research Design

This key chapter summarises the design and development of thesis for the reader. The first section titled Problem statement summarizes the need for bringing society-centric approaches in street-space allocation studies – which was the primary idea that sparked the formulation of this topic. Succeeding this, the aim, objectives and questions this study asks are given. The concluding sections outline the stepwise formulation of the thesis (Research Structure) and the timeline within which the study was executed.

2.1 Problem Statement

Automobile-centric transport planning, increasingly over the years, has wedged a disconnect between the intended conceptualization of street functions and their real-world use. Areas around schools are characterized by intensive activities, large social congregations, and contested accessibility among vulnerable groups like children. School Streets were conceptualized to prioritize safety and promote sustainable mobility among children and the city of Ghent started as a forerunner in their implementation. Today, the School Streets in Ghent operated with temporary vehicular closures, profess a significant gap in the allocation of space and its daily interpretation by different stakeholders. Temporary vehicular restrictions alter temporal spatial allocation; however, this policy has posed limitations in fulfilling the intended goals. While urban design policies often allocate space with specific intentions, these spaces are continuously shaped by people's activities and their perceptions that diverge from their intended function. There exists a significant theoretical gap in the existing street-space allocation assessments which distribute street space among different travel modes. As an academic response, we critically assess the allocation and societal interpretation of street space on school streets in Ghent. The objective is to develop an activity-based framework that combines stakeholders' perspectives with their actual use of street spaces. Through this

exploration, the research aims to contribute to a more nuanced understanding of how space is planned, perceived and practiced.

2.2 Aim

The thesis aims to critically assess the allocation of street space with respect to its societal interpretation, by developing an activity-based framework that combines stakeholders' perspectives with their practical use of School Streets in Ghent, Belgium.

2.3 Research Questions and Objectives

Intending to critically analyse the allocation of space keeping Ghent's School Streets in the background, this thesis was conducted with the following objectives:

1. To analyse the relationship between allocated space and its societal interpretation on school streets, using Lefebvre's Space Triad as an analytical framework.

2. To evaluate how varying allocation levels of street space among different users affect safety, accessibility, social interaction and physical activity on the streets.

3. To examine the nature of school streets as places, apart from their functional role as traffic conduits.

With the following objectives, the thesis asks the following questions and answers them with a methodology based on the conceptualization of the activity-based approach:

RQ1. What added value does it bring to employ an activity-based approach to the analysis of spatial organization of streets apart than the existing frameworks of travel mode-based analyses?

RQ2. In what ways do different spatial allocation scenarios impact the user perception and usage of street space on the School Streets in Ghent?

2.4 Research Structure

The following diagram outlines the stepwise formulation of the key elements of the thesis topic, concepts in the Theoretical framework, and the strategy for the data collection and analysis.

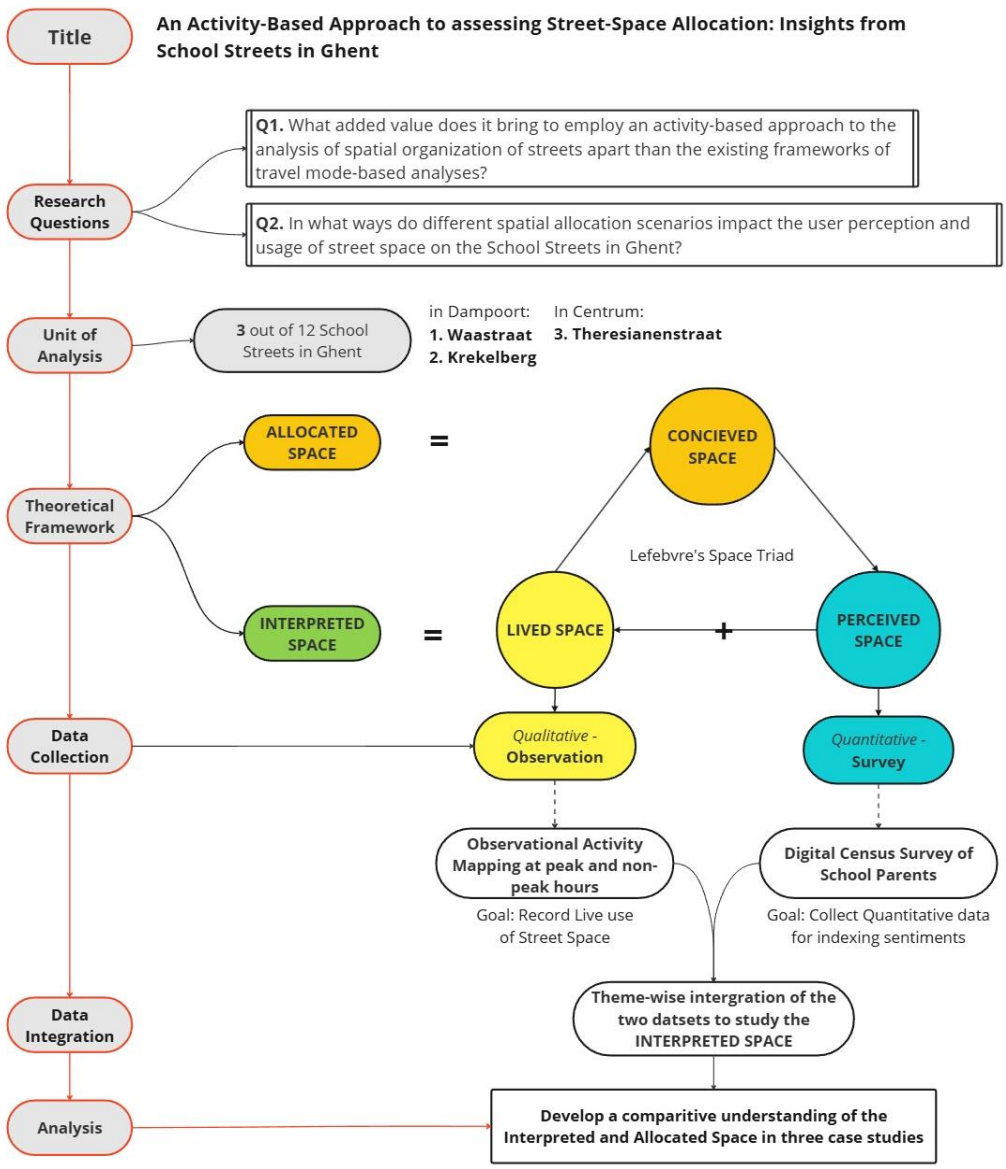


Figure 1: Research Structure and Phases

2.5 Timeline

	PHASE	ACTIVITIES	TIMEFRAME
1.	**Preparing Conceptual Overview and proposal**	Writing proposal	October 1, 2024 – October 15, 2024
2.	**Literature Study and document review**	Reading and examining existing studies on Street Space Allocation and Activity Mapping	October 15, 2024 – November 5, 2024
3.	**Preliminary Site Visits**	Selection of Case Studies in Ghent	October 2024
4.	**Finalizing Theoretical Framework**	Exploring methods of Urban Ethnography and finalizing mapping techniques	November 1 – 7, 2024
5.	**Data Collection Phase**	Observational Activity Mapping	November 6 – December 5, 2024
		Distribution of Surveys and collection of Responses	November 26 – December 15, 2024
6.	**Data Integration and developing themes for discussion**	-	December 16 – 24, 2024
7.	**Developing Discussion and Thesis Conclusion**	-	January 5 -20, 2024
8.	**Corrections and Reviews**	-	January 20 -Feb' 10, 2024
9.	**Final Submission**	-	February 10, 2024

Table 1: Phase-wise Timeline of Thesis execution

Chapter 3 – What are School Streets?

In recent years, the concept of 'School Streets' has emerged as a tactful response to increasing children's safety around the schools. To deal with the challenges of traffic congestion, deteriorating air quality and pedestrian safety, local governments across the globe have employed the concept of School Streets as an effective tool to ensure the safety and accessibility of children near the schools. What are School Streets? – The answer varies and is highly contextual. In 1989, Bolzano, a city in northern Italy, decided to restrict vehicular traffic near schools at peak hours during the drop-off and pick-up times of the school hours. After Bolzano, Ghent, a city in the province of Flanders in Belgium has been governing School Streets since 2012. So far, the concept has taken many new forms and evolved with different meanings in different parts of Europe and North America.

A School Street typically restricts vehicular access on the streets in front of schools during critical times such as drop-off and pick-up for children. Around the schools, there is a high volume of students arriving within a limited timeframe. This makes schools significant contributors to peak traffic congestion in the mornings and afternoons. A particular concern arises from parents who drive their children by car, always seeking to drop them off as close to the school entrance as possible. This behavior compromises road safety and generates broader adverse impacts, including increased local air and noise pollution and reduced opportunities for physical activity. To minimize traffic-related conflicts and promote safer environments for children, 'Schools Streets' are being increasingly adopted by city governments over the recent years.

School Streets prioritize pedestrian movement and encourage active travel to schools. It has been observed that School-Street initiatives have contributed to the larger goals of the sustainable mobility paradigm which typically advocates for higher adoption rates of bike travel. On the other hand, they also cater to the rising concerns

of deteriorating air quality around schools as motorized traffic is curtailed in and around the school limits (Liverpool Express, n.d.). Thus, over the years, planners and policymakers have realized implementing School Streets could help create safer, more inclusive environments for children and families. As cities grapple with the limitations of car-dependent infrastructure, school streets provide a tangible solution that not only answers contextual issues but also aligns with broader sustainable urban mobility goals (Clean Cities Campaign, 2022).

The significance of school streets in action extends beyond the immediate benefits to safety and health; they also represent a paradigmatic shift towards creating more people-centering urban spaces. We have discussed in the introductory chapter how streets can be vital 'places' in themselves. By reducing traffic, school streets naturally become gathering spaces for parents and caregivers who accompany their children. These environments foster informal social interaction among adults, facilitating community bonding and mutual support. Parents often take advantage of these open environments to interact with one another. Meanwhile, children use these streets as their extended playground after school hours. This strengthens community ties and leads to greater neighborhood cohesion. In a way, School Streets foster social life not

Figure 2: A functional School Street in Southampton, UK. (Portsmouth Climate Action)

just for the parents and children but also residents of the neighbourhood, for whom these streets become gathering spaces in the afterhours.

The gradually increasing popularity of school streets across diverse urban contexts—from Bolzano in Italy to Ghent and beyond — reflects a growing awareness for the need to design urban spaces that prioritize vulnerable groups like children and support their unique capabilities to ensure their mobility in the city.

The choice of School Streets as the focus of this study is purposefully grounded in two key considerations. At the outset, I was particularly drawn to Ghent's broader urban mobility policy shift, emphasizing the creation of inclusive public spaces and the encouragement of active transportation. Additionally, School Streets are distinctive in their focus on addressing children's needs while simultaneously fostering neighborhood revitalization. Thus, this policy initiative in Ghent, along with its challenge-driven implementation, provides a focused yet comprehensive frame of reference for investigating spatial allocation on streets—a topic that is inherently broad in scope.

3.1 The backdrop of Car-Independent urban politics

This subsection elaborates how the emergence of School Streets as a program has its roots in the political and policy-driven attempts of regulating the dominance of cars in the city. At the same time, it is highlighted how the mobility of children within a city is contested.

We live in times when basic rights and necessities of people are curtailed because of policy tilts towards fulfilling the needs of some are implemented. This creates a class of vulnerable groups that find it increasingly difficult to grapple with this reality and ascertain their rights and access in a world that is created unjustly for them. When it comes to urban mobility, we have witnessed cities increasingly building infrastructure for automobiles after a boost in car production and easy availability of oil after WWII Bernhardt, C. (2020). Urban planners increasingly felt the need for widening roads with

more lanes and building flyovers citing an ever-increasing demand for cars in the days to come. With more cars, and car-centric planning came the problems of congestion, worsened air quality and a challenge to the accessibility of open spaces. This also meant that the city built on the foundation of the automobile discriminated against those who did not own it or drive one. This created a wide cross-section of *have-nots* including lower-income groups, women, senior citizens and children. It has been established that a car-centric city challenges accessibility, threatens safety and questions the belongingness of vulnerable groups in their city.

The realization that cars posed a threat to the mobility of common citizens came in the 1970s. It was in Amsterdam that the first protest against the increasing menace of cars and congestion they cause took place (Bruno et al., 2021). It was led by local focus groups and NGOs who were protesting against traffic accidents that killed as high as 500 children and led to 5,500 casualties in total in the Netherlands in 1971 (Environmental Justice Atlas, n.d.). Traffic deaths of children were at an all-time high and it was increasingly becoming difficult to ride a bike on an average Amsterdam Street. In response, the city of Amsterdam implemented its first 'Traffic Circulation Plan' to curtail car traffic and make way for cyclists and other users to ensure safe mobility and accessibility for all (Stadsarchief Amsterdam, n.d.).

It is worth mentioning that Amsterdam was not alone in taking the initiative against car-centric city planning. Many cities, since the beginning of the 1970s have shifted the Overton window in favor of a car-independent future. For example, in Freiburg am Breisgau of Germany it was to boast integration of transport planning with Land Use for a compact city. In 1969, The General Urban Transport Policy called for extension of the existing tramline network with conversion of Freiburg's entire city center into a pedestrian zone. Later, the Transport Development Plan implemented in the 2010s (Freiburg City Council, 2008) called for better reallocation of road space favoring car transport to walking, biking and public transport.

Similar examples of creation of car-independent mobility policies can be cited from Utrecht and Groningen in the Netherlands, Ghent in Belgium and cities like Copenhagen, Stockholm and Oslo from the Nordic countries. The creation of School Streets from its inception to the recent development is a story deeply related to the development of car-free paradigms in cities majorly concentrated across Western Europe. School Streets, since they call for restriction of vehicles to create-child friendly environments rest on this bedrock. However, their evolution, implementation and scope vary in character according to the ground realities and local policy frameworks.

3.3 The Need for School Streets in today's age

All over the world there has been recognition of the overall climatic impacts automobiles leave on the cities. However, vehicular restriction has been more of a policy tool than a motive behind implementation of school streets. The primary concern that birthed the idea of School Streets stemmed from the need to create safe spaces for children around school areas. However, the concerns were multifold and not merely restricted to safety and traffic congestion around schools. This segment discusses the needs and concerns that prompted the proliferation of school streets in various contexts.

3.3.1 Traffic and Child Safety: It is evident in today's urban landscape that road safety remains a critical issue for children. Various aspects of traffic data show that vehicular traffic and its organization on the streets – be it in terms of high speeds or congestions, significantly impact young pedestrians and cyclists. Research has shown that high traffic speeds increase the probability of collisions, as it becomes difficult for drivers to slow down and avoid conflicts. Higher vehicular speeds have a direct correlation with the degree of fatality of the victim (Taylor, Lynam, & Baruya, 2000). Moreover, dominant car behaviour poses critical threats to children who are particularly vulnerable while navigating streets given their immaturity in detecting potential hazards, taking unguaranteed risks and incompetency to drive a bike.

Protecting streets that children take to school is therefore an essential safety measure, given these routes are taken daily by them. Statistics across various parts of the world underscore that a considerable portion of child injuries related to road traffic occurs within proximity to schools (FIA Foundation, n.d.). For example, in Canada, child road injuries most often occur within a 500-meter radius of schools (von Kries et al., 1998). This pattern is similarly observed in Chile, where 95% of child casualties take place within five hundred meters of schools, with 70% occurring even closer, within a 250-meter radius (Comisión Nacional de Seguridad de Tránsito, 2019). In the United Kingdom, data further reveals that roughly one-third of child road injuries happen during travel to or from school, emphasizing the high-risk children face in these environments (Transport for London, n.d.). These findings highlight the urgent need for targeted safety interventions near schools to reduce child traffic incidents globally.

3.3.2 Health and Environmental Concerns: Traffic congestion near school not only undermines the safety of children in terms of their accessibility but also has adverse effects on their health. If vehicular traffic is let to breed around the schools without needed regulations, carbon emissions in the overall neighbourhood increase. In many cases, school playgrounds face the streets and hence, children are more prone to encounter toxins emitted from the vehicles. Primary School children are particularly vulnerable to these toxicants as their lungs and the respiratory system is still in a developmental stage (who.int). Thus, the impact of traffic-related air pollution on children's health can be significant if it is not handled at the school-level.

While concerns around health are important, it is also to be considered that the environmental conditions around schools also have an impact on children's mental and physical health and in a way their learning abilities (Basu & Banerjee, 2020). More space for cars equals to more paving on roads, resulting in urban heat islands inside school zones. School Streets in cities like Paris; have accommodated greens and landscaping elements such as rain gardens as part of permanent changes (Ville de Paris, n.d.). Such practices not only enhance children's relationship with nature but also create streets that are environmentally just.

3.3.3 Promoting Active Travel and Healthier Lifestyles: As a response to unhealthy conditions existing around schools, School Streets can provide an alternative background for adoption of healthy habits among students in many ways. One of the ways inactivity among the youth can be tackled is by providing them with open and safe spaces for cycling, walking, and running. Municipalities are increasingly accommodating dedicated bike-lanes near school areas to encourage kids to bike. This not only leads to a safe and socially equitable street design for all but also leads to children adopting active modes of travel. A recent study has revealed that 81% of adolescents aged 11 to 17 are insufficiently active (van Sluijs et al., 2021). Active travel among children has multiple benefits that include development of cognitive functions such as attention, but also social and interpersonal skills as children navigate their ways and interact with peers (Ikeda et al., 2019). School Streets that promote active travel also help in controlling risks of obesity and other diseases and reducing anxiety and symptoms of depression among children.

Cumulative benefits offered by School Streets like improved air quality, enhanced safety measures, curtailment of vehicular traffic and lowering the risk of road accidents can lead a modal shift towards bicycles. This is a crucial step for cities to achieve sustainability goals and the respective targets set by them (United Nations, 2017).

3.3.4 Urban Mobility and Sustainability Goals: The idea of School Streets has proliferated all over the world in the light of sustainable mobility. Thematic streets being designed in consideration of specific user groups and promotion of sustainable modes over cars, encompass spatial arrangements to create car-independent contexts. These arrangements can be tactical (temporary) or can be permanent after a trial period. Examples of such *thematic streets* have increasingly originated from North-western Europe - be it with the creation of *Woonerfs* (living streets) in the Netherlands, or shared streets like the *Fietstraat* (Bike Streets) where cars cannot overtake bikes. School Streets, in many contexts fall under the same ambit of thematic streets aimed to reduce car-dependence. Having originated in Bolzano in the 1990s, School Streets were adopted by other cities in the post-Covid era, as a tool

to promote sustainable mobility. School streets apart from tackling traffic congestion and safety concerns, have been developed and adapted to suit the sustainability paradigm of today – one of aspect of which is promotion of sustainable modes of travel like biking and walking. In Ghent, for example, The Schoolstraten program was started by the city as an 'incentive for more exercise for children' (Stad Gent, n.d.) which underlines the need for promotion of active mobility among the youth. A European-level case study conducted by the EU Urban Mobility Observatory also highlights School Streets as a measure to minimize car trips on a routine basis and development of 'sustainable mobility behaviour' among children. In the next section, we will see how School Streets in different cities have been adopted to address sustainable mobility goals (European Commission, 2024).

3.4 Foundational Principles and Practical Realities

The success of School Streets lies in the strategic balance between policy guidance and effective implementation of urban design principles. Three key aspects are discussed in this section – the overarching global frameworks that emphasize child safety and sustainable urban environments, the key facets of Implementation and localized best practices and the diversity of challenges that have arisen in different contexts. This section explores how School Streets align with international policy goals while incorporating proven design approaches that create safer, more accessible streets for children.

3.4.1 Guiding Policy Principles and Design approaches: On school streets, the allocation of space and its design is based on two dimensions. Firstly, there is an outlay of global guidelines, goals and advocacy that puts an impetus on child safety and sustainable urban life. The second dimension is related to child-friendly urban design principles and best practices that are established as safety standards.

School Streets align with global frameworks for Child Safety. They could help achieve the combined goals under SDG 11 and SDG 3, emphasizing sustainable cities and

improved health (United Nations, 2017). Implementation of School Street projects also aligns UNICEF'S Child Friendly Cities Initiative which advocates for safe and accessible environments for children (Child Friendly Cities Initiative, n.d.). Road safety frameworks like Vision Zero and WHO guidelines promote measures such as traffic calming and pedestrian safety which are central to the goals of School Street projects. Because of their contribution to reducing car dependency and emissions, they additionally contribute to the Climate Action Goals under the Paris Agreement (United Nations Framework Convention on Climate Change [UNFCCC], n.d.). Sometimes, cities use tactical arrangements to encourage low-cost and community-driven transitions which underline the advocacy for participatory planning and co-creation.

At the same time, School Streets represent a comprehensive urban design approach towards creating pedestrian-friendly environments around educational institutions. These initiatives typically involve tools like vehicle restrictions at specific timings, transforming streets into pedestrian/biking priority zones and introducing traffic calming design elements. Traffic calming methods like temporary street closures, designated walking zones, reduced speed limits, and enhanced visibility of pedestrian crossings can be observed in successful school-street projects like London, Paris, Barcelona, etc. Key safety measures include clear signage, physical barriers, or removable bollards to prevent vehicle entry, designated safe crossing points, improved street lighting, and increased presence of crossing guards or traffic supervisors. This approach not only addresses immediate safety concerns but also aims to reshape urban mobility cultures, for example in promoting children's independence, reducing car dependency, and create more socially connected environments.

3.4.2 Key facets of Implementation: Implementing School Streets requires a systematic approach based on strong community participation foundations. This could involve phased-out implementation of street redesign interventions – at times backed by tactical trials and prior stakeholder consultations.

a) Stakeholder Engagement and Community Roles: In projects that concern rescaling streets for enhanced priority of certain users, the reliance on stakeholder engagement is heavy. School Streets projects are typically but not necessarily executed in areas of high urban density and high traffic flow with residential settings. Key stakeholders typically include local governments, school administrations, parents, children, and nearby residents. While local governments provide the regulatory framework and funding, it is the school administration and parents who are responsible for the everyday volunteering on the streets to manage traffic conditions. At the same time, local residents also further their concerns regarding change in traffic-direction regulations, parking, and safety while any intervention is being tested. Thus, collaborative planning workshops, community consultations, and feedback mechanisms ensure that the design and implementation of School Streets addresses local needs while fostering a sense of shared ownership.

b) Operational Steps and Trial Phases: The implementation of School Streets typically begins with temporary interventions with tactical urbanism approaches. Steps include identifying high-risk areas around schools, introducing traffic-calming measures (e.g., barricades, signages), and reallocating street space for pedestrians and cyclists. Such trial phases allow cities to test closures during peak school hours, gather community feedback, and observe traffic behavior changes. These trials often use cost-effective materials, enabling flexibility for adjustments. Success during the trial phase can lead to permanent fixes supported by enhancements like greenery, dedicated bike lanes, and playground extensions.

c) Monitoring and Data Utilization: Monitoring and data collection are essential for evaluating the impact of School Streets and refining their designs. Cities often collect data on traffic volume, air quality, accident rates, and active travel usage before, during, and after implementation. Surveys of parents, students, and residents provide qualitative insights into perceived safety and satisfaction. Advanced tools like GIS mapping and real-time traffic sensors help identify areas for further improvement.

Data-driven evaluations not only support evidence-based decision-making but also provide compelling metrics to justify scaling up School Streets programs.

3.4.3 Challenges and Constraints: Given the number of stakeholders, actors, and users they involve, School Streets, while benefiting a large-cross section of the society, come with their own challenges in implementation. The challenges arise from several factors, including contextual infrastructural limits, generating public awareness and support, social dynamics, city-wide scalability, and the unintended consequences of traffic diversion.

a) Infrastructural Constraints: One of the primary hurdles is the lack of pedestrian-friendly infrastructure in urban areas. Narrow streets, inadequate sidewalks, and limited space for bike lanes make it difficult to allocate space exclusively for School Streets. In densely populated cities, competing demands for road space often prioritize efficient vehicular movement over child safety. Additionally, the need for temporary or permanent barriers, signage, and enforcement regulations may strain municipal budgets, especially in resource-constrained areas.

b) Social Acceptance and Resistance: Resistance from parents, residents, and local businesses often hampers the success of School Streets. Parents who rely on cars for school drop-offs may initially view these restrictions as constraining or time-consuming. Nearby businesses may oppose the initiative, fearing reduced footfall or delivery disruptions. In some cases, residents may also resist changes to traffic diversions. Thus, building community consensus and addressing these concerns requires substantial effort by designing awareness campaigns, open consultations, and pilot tactical programs to demonstrate the benefits to the common public.

c) Scalability and Consistency: Scaling School Streets in a broader urban area presents unique logistical and policy challenges. Cities often lack standardized frameworks for implementing these initiatives, leading to inconsistencies in design, enforcement, and impact. Each school's unique urban context requires tailored solutions – which can complicate city-wide adoption of a pre-designed template.

Moreover, coordination across multiple stakeholders like schools, traffic authorities, and urban planners is a time taking process, which can slow down the expansion.

d) Sustainability and Spillover Effects: While School Streets improve safety and air quality locally, they can create unintended spillover effects, such as increased congestion and pollution in adjacent areas. Redirected traffic may worsen conditions on an adjacent street, undermining the initiative's overall impact. Ensuring long-term sustainability also calls for regular maintenance, enforcement, and community engagement, which are inherently resource intensive. Thus, addressing these challenges requires holistic planning that measures and mitigates these externalities while maintaining public support.

3.5 Examples around the world

3.5.1 Bolzano, Italy

School Streets were first introduced in Bolzano, a city in Northern Italy's autonomous region of Trentino-Alto Adige. In the early first decade of this millennium, a section of neighbourhood police in the city, decided to close traffic on streets coinciding with the local elementary schools with a view to curtail rising accidents in front of schools. While it is difficult to trace the early origins of this project, the municipality of Bolzano was working to address this issue from as early as 1989. After the intervention by the local police, the municipality validated the initiative and extended it to other parts of the city. By 2011, there were eight active School Streets or *Le Strade Scolastiche* in the city (Interventi.net, 2011). Initially, the project received criticism from the residents as well as teachers who complained that they could not drive their cars until the school gates. However, gradually the initiative was increasingly appreciated by families of the school children and the residents as well. Sometimes, groups of children are helped by *Nonni Vigili* or the Vigilant Grandparents to cross the streets (Nonni Vigili Bolzano, n.d.).

Gradually, the success of the program in Bolzano inspired other cities in Italy who employed similar measures to tackle the issue of children's safety. The city of Parma planned 35 pedestrianized zones in front of primary schools under the Cambia Spazio Plan in September 2020 (Sapere Ambiente, 2020). School Streets in Parma focus on traffic calming interventions, regulation of 30kmph zones, and designing of play areas on asphalt among other methods. Followed by the legalization of School Streets in the national high code, other cities like Milan, Rome and Torino (Torino Today, 2023) have announced plans for similar initiatives dedicating streets and plazas to school children (cleancities.org, 2023).

3.5.2 Brussels, Belgium – From School Streets to School Quarters

School Streets were first launched in Brussels in 2019, the Belgium capital city with its independent capital region administration. With a mission to improve air quality around schools and ensuring a safe environment for school children, the city administration planned the first School Quarters in 2022. Brussels wanted to go a step

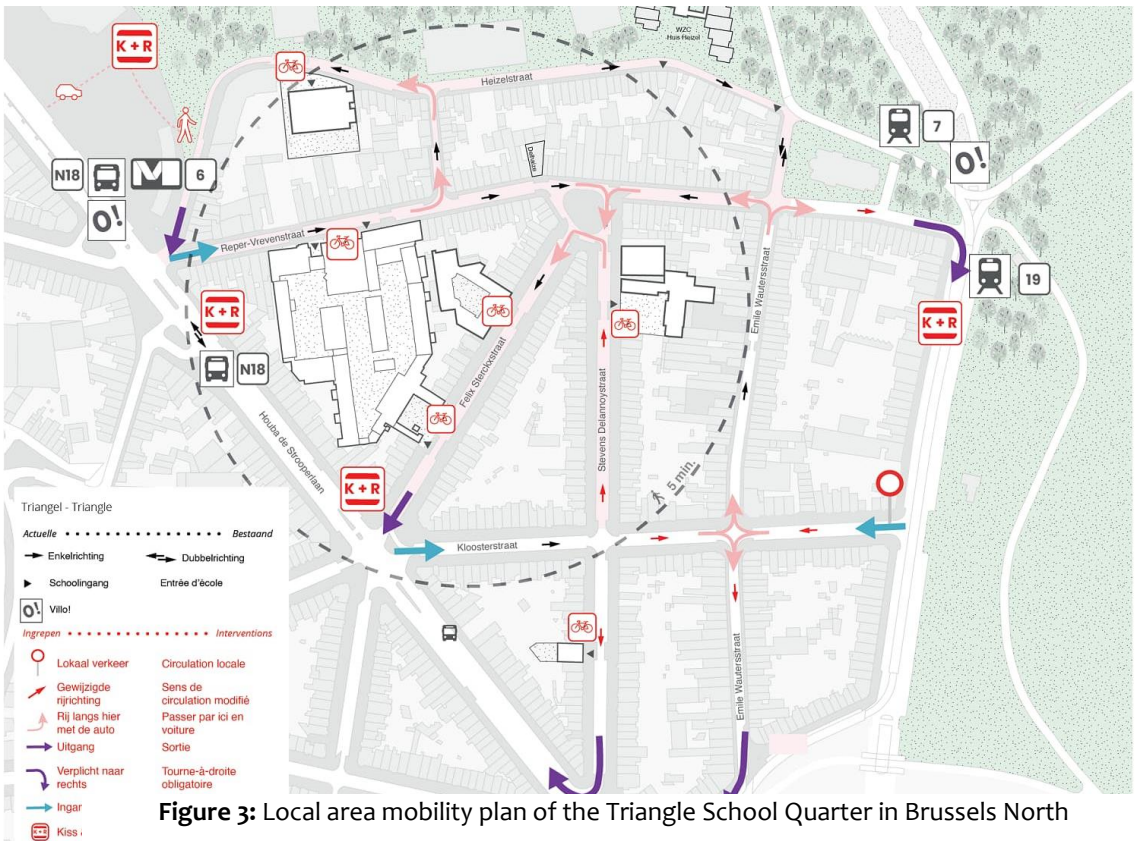


Figure 3: Local area mobility plan of the Triangle School Quarter in Brussels North

further with its ideation of School Quarters – with a motive to use school streets as an opportunity to revitalize mobility patterns and find solutions to bottlenecks on a neighborhood level. The city adopted School Streets as a specific planning tool to realize its long-term objectives linked to curbing unnecessary car traffic, improving air quality and greening of public space (CityTools, 2019). With a long-term view towards permanent local-area revitalization, Brussels' approach signifies looking at School Streets beyond temporary closures, with a step towards addressing larger goals such as creating more car-free neighborhoods. To realize the School Quarters, the city of Brussels teamed up architectural and urbanism studios Architecture Workroom Brussels, CityTools and Filter Café Filtré Atelier to oversee local supervision, project communication and stakeholder participation (City of Brussels, n.d.). The joint consultancy of these studios is responsible for identifying potential school street scenarios, objectifying local concerns and contextual constraints and draft suitable solutions. These drafts are presented in the district meeting before rolling out the test phase with temporary interventions. The consultancy evaluates the impact of these interventions on modal behaviour, changes in circulation patterns and acceptance among residents during the test phase. On this basis, a final plan for long term in-changes is prepared.

The phased rolling out of School Quarters in Brussels has enabled the city to utilize School Streets to meet its larger goals right from the start of their implementation. School Quarters encompass larger areas than an individual street and hence, they cater to more than two schools at the same time. For example, the Triangle School Quarter alone caters to six primary schools and three nurseries lying closely within a neighbourhood (City of Brussels, n.d.). When a School Quarter is implemented, it encompasses a range of measures such as introduction of one-way streets, bike lanes, change in driving directions, installation of traffic lights, speed breakers and at times redesign of parklets and green areas. However, this procedural complexity has restricted the pace of proliferation newer quarters in the other parts of the city. In August 2022, three initial School Quarters were launched as part of the so-called Good

Move Pentagon Plan - a city-level traffic circulation plan that restricts through traffic passing through the city centre. However, only three additional School Quarters were planned further which are currently functional under the evaluation phase. An independent overview of the programme by a non-profit organization Les chercheurs d'air revealed that every two out of three primary and nursery schools in Brussels is eligible for a School Street. Justine Di Prima, a member of the organization revealed that while as of 2023, the existing quarters catered to only 43 schools in the city, this number could be easily increased to ten times the number of existing school streets (Bruzz, 2023).

3.5.3 Paris, France

In Paris, School Streets (rues aux écoles) are alternatively called Children's Streets (rues aux enfants). The city aims to make children's journey to the school safer by increasing pedestrianization of streets. The goal of these streets in Paris is towards reallocation of existing street space rather than temporary closure during school times. Paris has focused on revitalization of public space by taking it from cars and adding more greens, spaces for play, etc. The initiative was part of a set of larger steps taken to curb car traffic in the city under Mayor Anne Hidalgo.

First School Streets were introduced in Paris in 2019. The programme was inspired by similar initiatives kicked off in Bolzano and which later spread to parts of Flanders, Belgium. However, Paris set off the beaten path of implementing School Streets with Temporary Vehicular Restrictions as a core tool, but rather focused on permanent pedestrianization of these streets. Since 2019, School Streets have rapidly spread all over Paris with 218 streets traffic calmed and 70 streets permanently landscaped and greened. By 2026, the city hall ambitiously aims to achieve 300 traffic calmed streets and 100 permanently landscaped ones (Ville de Paris, 2024). The scaling of school streets at an exponential rate is steered by radical political will towards car independence and the city is well within its goal to achieve set target.

While there is no overarching document that guides the way School Streets should be (re)designed, two typical models of development can be observed (Respire, n.d.). Alike Brussels, Paris too follows a phased approach in developed a selected street as a School Street. The first model is a template of streets that are permanently closed to traffic but not landscaped. Traffic on these streets is controlled by installing barriers and marking 'pedestrian area' signs, so that the school gates can only be accessed on foot or by bike. Sometimes, certain streets are not considered for the next phase of permanent landscaping conforming to legal permissions granted to emergency and service vehicles to pass. In such cases, traffic is not blocked but heavily controlled, and at the same time measures as widening of sidewalks, raised intersections, etc are implemented. The second model for developing the school streets is witnessed when the first model streets are 'fully developed'. This model focuses on landscaping of streets, adding green cover and dedicating the space reclaimed by neutralising parking spots to areas for play, meet and adding street furniture.

Figure 4: Street with permanent vehicular closure in 13th arrondissement (Model 1)

Figure 5: Fully developed Street with permanent vehicular closure (Model 2)

Paris' particular approach towards driving permanent changes sets it apart from other cities willing to implement School Streets. Reconfiguring spatial allocation of streets

may result in dynamically altered realities of street ownership, moving the discourse beyond concerns around safety and environment.

3.5.4 Barcelona, Spain

In Barcelona, the program “Protegim Les Escoles” (translated as "We Protect Schools") aims to improve safety, accessibility and environmental quality of streets around schools. Every year since 2020, the city of Barcelona has been creating newer School Streets that create healthier public spaces for children by transforming existing streets by using traffic calming measures, adding urban furniture and creating new green spaces (Honey-Rosés, 2023). As of 2023, Barcelona added as many as 217 School Streets across the city limits. According to the city council, this initiative has added 35,000 square metres of new public space since 2020 (Ajuntament de Barcelona, 2023). Transformation of a street into a School Street in this context includes widening of sidewalks, extending street corners, creation of new play zones and elimination of traffic lanes. School Streets in Barcelona focus on permanent changes and children-centric landscaping streets devoted to public use, as opposed to the temporary closure approach in cities across Flanders, UK, North America and parts of Germany. A 2023 evaluation report from City Lab Barcelona revealed that streets that the use of public space and the instances in children playing on the streets drastically increased where car traffic was entirely restricted (Protegim les escoles, 2023)

3.5.5 Vienna, Austria

In Vienna, Schulstraße or the School Street is typical a residential street where a temporary driving ban of 30 minutes is enforced at the start and the end of the school hours. The driving ban applies to through car-traffic including residents, but bikes are allowed to pass. Setting up scissor gates that are placed as temporary barriers is the responsibility of the schools, while the district covers the costs of placing regulatory traffic signages and physical barriers. Currently, ten school streets are being governed

in Vienna, whereas Märzstraße was converted into a permanently car-free forecourt in 2020. (Wien zu Fuß, n.d.)

Sr No	City	Name of the Programme	Year of Commencement	Scale	Measures
1	**Bolzano, Italy**	Le Strade Scolastiche	1989	9 school streets operational across the city	Temporary Vehicular Restrictions, Traffic calming
2	**London, UK**	School Streets	2017	500+ school streets across 31 boroughs in the London metropolitan area	Temporary Vehicular Restrictions
3	**Brussels, Belgium**	Schoolstraten	2022	4 school streets and 2 school quarters	Designing School Quarters
4	**Paris, France**	Rues aux écoles	2019	218 streets traffic calmed, 70 permanently landscaped	Focus of permanent car-free measures, street redesign

5	**Barcelona, Spain**	Rues Scolaires / Protegim Les Escoles	2020	streets adjacent to 217 schools catered as of 2023.	Tactical assessments, traffic calming
6	**Vienna, Austria**	Schulstraße	2018	10 operational streets, 1 permanently car-free school forecourt	Temporary Vehicular closures
7	**Vancouver, Canada**	School Streets	2018	12 Vancouver schools have participated to this date	Temporary Vehicular closures

Table 2: Key School Streets Programs implemented in different cities (as of January 2025)

3.6 The School Streets Program in Ghent

Since 2012, the city of Ghent has played a pivotal role in the re-imagination of School Streets among European cities. Drawing lessons from Bolzano, which was already experimenting and implementing with the concepts since 1989, Ghent established the first school streets outside Italy. In 2012, Ghent established its foundational school Street Streets catering to two schools in the city (European Commission, 2024). The 'Schoolstraten' project picked up momentum after the Traffic Circulation Plan was implemented in 2017, with the rise in city-wide development of biking infrastructure since then. In 2018, Belgium formally included the concept of School Streets as a road type in its national highway code. Since then, School Streets have proliferated not just in other parts of Ghent, but across other cities in Flanders like Antwerp, Hasselt and Leuven.

The idea that pedestrians and bikers deserve more space on the street was necessitated largely by the need for physical distancing during the Covid-19 pandemic.

Thus in 2020, the city of Ghent realized that people need more space on the street which led to the implementation of temporary School Streets for twenty-five schools in the city (COVID Mobility Works, 2020).

In principle, the idea of School Streets in Ghent has been about enforcing temporary vehicular closures as a tool to curtail traffic congestion, increasing air pollution and safety challenges for kids. Vehicular restrictions are implemented by putting barriers like turning fences, trestles and scissor gates for restriction of car traffic on the street at the start and the end of the school day. To put the trestles on the street, Ghent relies on volunteers who are tasked to mind the barriers as well as monitor traffic conditions on the street. In most cases, Schools encourage parents to volunteer for the collective effort, however lack of interest among the parents remains a challenge.

However, the approval ratings for the project have increased gradually over the years. The School Streets project, combined with the new bike lanes and bike streets have generated a mobility scenario where parents and children overwhelmingly prefer bikes for daily school trips. In cases where kids are dropped by cars, they can access the school street on foot and cars are asked to park further away. This ensures safe, unhindered access for the children outside the school area.

Currently, the city of Ghent, with support from schools operates 12 school streets in different parts of the city (City of Ghent, n.d.). Compared to other major cities in Europe the proliferation of School Streets in Ghent has remained steady, however, they are gradually increasing. With the streets temporary vehicular restrictions have to be enforced in principle, schools have come up with different management systems to realize the project. While a majority of the schools enforce temporary vehicular restrictions, some schools monitor the traffic conditions instead. At times, school street restrictions could not be administered due to the shortage of volunteers. On Wasstraat, a street in the Dampoort neighborhood car traffic has been permanently blocked similar to the measures taken in cities like Paris.

Name of the Street	School	Neighborhood	Type of closure
Wasstraat	Frienetschool De Vlieger	Dampoort	Permanent blockage for cars
Krekelberg	VBS De Krekel	Dampoort	Temporary Vehicular closure
Theresianenstraat	Montessori Klimop	Gent centrum	No closure observed, Traffic monitoring
Joseph Gérardstraat	VBS Sint-Janscollege	Sint-Amandsberg	Temporary Vehicular closure
Sint-Baafskouterstraat	GBS De Wijze Boom	Sint-Amandsberg	Temporary Vehicular closure
Vinkeslagstraat	VBS Mariavreugde	Wondelgem	Temporary Vehicular closure
Sint-Sebastiaanstraat	SBS De Regenboog	Wondelgem	Temporary Vehicular closure
Zandloperstraat	SO Visitatie	Mariakerke	Temporary Vehicular closure
Nieuwkolegemlaan	VBS Sint-Lieven Kolegem lager	Mariakerke	No closure observed, Traffic monitoring

Vanhaevermaetestraat	VBS Sint-Lieven Kolegem kleuter	Mariakerke	Temporary Vehicular closure
Parking trekweg 1		Mariakerke	No closure observed, Traffic monitoring
Désiré Van Monckhovenstraat	SBS Van Monckhoven		Temporary Vehicular closure
Hazenakker en deel Ooievaarsnest	GBZ Hazenakker + Atheneum Gentbrugge	Gentbrugge	Temporary Vehicular closure

Table 3: List of operation School Streets in Ghent as of December 2024

Chapter 4 – Theoretical Framework

Allocated space and Interpreted Space

As far as it can be traced, the recorded endeavour for measuring space has been centred on how space is shaped by the objects within it. In 4th Century BCE, Aristotle introduced his idea of Space (*Platos*) – as a container whose existence can be defined by the objects it contains. On a philosophical level, the Hindu school of philosophy called *Nyaya*, also talks about the nature of Space as imperceptible, all-pervading; the existence of which can only be inferred from the positions of its objects and their relative distances (Goswami D, 2014). Later, Rene Descartes' conceptualization of the coordinate system incrementally visualized the idea of space as a geometric network within which objects exist and move. This thesis too, aims to understand space and find a way to quantify it by how it is being used by people.

Extending the concept of space as a resource (Correa C, 1991) to methods of urban planning and governance, space is often introduced as a commodity that is to be used optimally for living and other reasons. The responsibility of allocation of space is thrust upon the State and its planners. The technical process of street design, however, along with the political compulsions reveals the ethical priorities of the decision makers (Hartman & Prytherch, 2015). With a view to measure fairness in the exercises of allocation of (urban) space, scholars have come up with different methodologies suitable to their respective study areas. Over the years, Street Space allocation has emerged as an academic concept employed by researchers who not only have counted how much space is made available to different modes of transport on a street but have also reflected upon the justness in the act of its distribution. Ian Henning Jones (2014) defines Road Space Allocation as an act of "resolving particular competing needs, uses and desires over the best uses of space" and an exercise that reflects "the explicit intent of transport planners over the appropriate use of road space".

This term concurrently exposes the dichotomy between *Allocated Space* and the use of space. A particular space may be allocated exclusively to a certain function, but it may not be used for the same as individual behaviour is not always synchronous with collective intention. In Henri Lefebvre's 1974 book, The Production of Space, he famously conceptualized 'the Space Triad' which differentiates between the Conceived Space, Perceived Space and the Lived Space (Lefebvre, 1974/1991). **Allocated Space**, which is the first concept in this theoretical framework, refers to the space that is conceived through planning processes, shaped by politics and policies and whose design is governed and monitored by the authorities. In other words, Lefebvre calls this 'conceived space'.

Interpreted Space is a conceptual assumption for this study. It refers to the way individuals or groups perceive, appropriate and transform the *allocated space* based on their behaviour, background and place in the society. To study the use of space and how it is (being) interpreted continuously by people, it is best to employ methods that are society-centric, qualitative and exhaustive in nature. The second concept in the theoretical framework which is *Interpreted Space* is explored by applying an 'activity-based approach' to measuring Street Space Allocation.

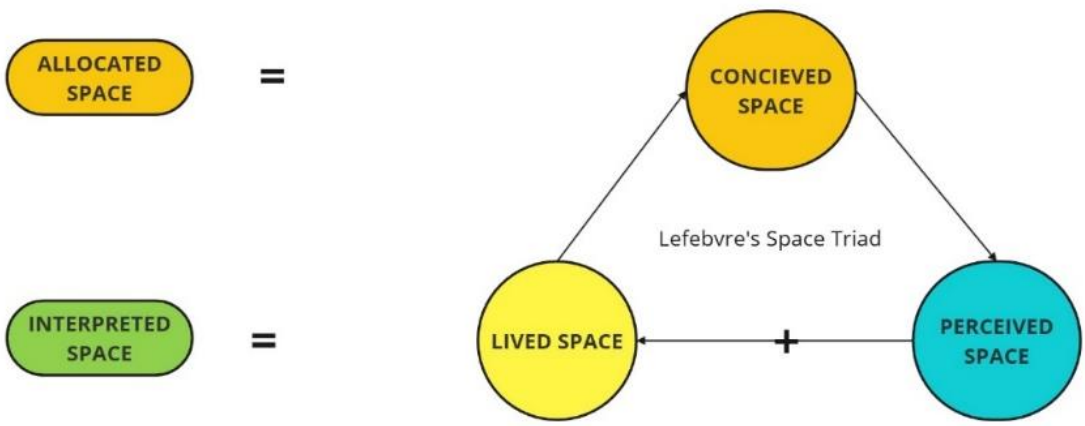


Figure 6: Theoretical Concepts derived out of Henry Lefebvre's Space Triad

4.1 Street Space Allocation: Literature Review

4.1.1 Key Academic Approaches

The analysis of allocated street space has been a critical area of investigation in the fields of urban studies and sustainable transport. Recognizing the need for serious academic approaches to measure spatial allocation to different modes of transport, studies that have emerged over the last decade reflect diverse methodologies to analyse optimization of street-space. Key studies in this field have been thoroughly reviewed for two specific objectives – First, to explore distinctive context-specific methodologies employed in different studies attempting to calculate street space allocation; and second, to draw insights that can inform the development of theoretical framework and identification of existing gaps for this research.

In their paper 'Urban Space Distribution and Sustainable Transport', Gössling, Schröder, Späth, and Freytag (2016) provide the foundational assessment for urban road space distribution to different modes of transport including walking, biking, public transport, and cars including parking. Their study comprises of an analysis of four different city quarters in Freiburg, Germany including Wiehre, Herdern, Weingarten and Vauban representing different periods of the city's development. The approach comprises of calculation of relative shares of area allocated to different transport modes using digitalization by GIS mapping. The study highlights that spatial allocation to individual motorised transport modes (58-59%) was significantly greater than the total area available for bikes (1.3-4.1%) in all the quarters. The central argument discussed by (Gössling et al., 2016) is the comparison of transport infrastructure distribution to the 1999 modal split data for number of trips per mode. Demonstrating the misalignment between allocated space and modal share, the study reveals that the share of transportation infrastructure dedicated to bikes was smaller in comparison to the total modal share of bikes (27%). The findings suggest that the area distributed to different travel modes in Freiburg was not proportional to their trip numbers (Gössling et al., 2016).

The contribution of (Gössling et al., 2016) in providing an introductory framework on measuring Street-Space allocation is significant since it underlines the paradox between political ambitions and advocacy to create sustainable transport systems and the realities that exist even in a so-called 'green city' of Freiburg (Gössling, 2016). In the larger framework for transport justice, this study focuses solely on the dimension of distribution of space – while the other identified dimensions of 'transport injustices' as stated by Gössling (2016) being exposure to traffic risks and parity in travel time while using different modes. With the idea of contesting area devoted to modal infrastructure with number of trips by mode, the paper seeks to conclude that certain user groups are unfairly disadvantaged than others in the realm of urban transport. While the findings suggest a clear trend in supposed 'unfairness' in the allocation of street space among users, the argument overlooks different capabilities of travel modes including passenger carrying capacity, efficiency, relative space occupied, speeds, etc. For example, a car and a bus would inherently occupy more space on road than a bike or a pedestrian. The overall share of motorised modes in longer trips would also be higher than that of active modes, given their relative speeds. (Nello-Deakin, 2019) calls this approach of measuring 'fairness' in allocated space based on modal split an 'underlying assumption' that looks intuitively appealing but simplistic.

Following the above line of argument, Nello-Deakin (2019) calculates the distribution of road space in Amsterdam among Cars (including highways, main and secondary roads and parking), Pedestrians and Bikes. This study presents three alternative methodological critiques to the modal share-based approach of Gössling et al. (2016) and Milieudefensie (2017) in determining street-space distribution. Firstly, for Amsterdam, the present study points out that while pedestrian trips add up to 18% of all trips, the spatial distribution for them is 40% - which accounts for 22% of 'additional' space than the modal share. Given the line of Gössling et al. (2016)'s reasoning, a logical question arises that should pedestrians deserve lesser space than they are allocated – which, however, would contradict the sustainable mobility paradigm asking for promotion of active transport. Hence, this argument is applicable only in

selective cases where the modal share of non-motorised modes is larger in comparison to the allocated road-space they currently enjoy. Following this, when spatial distribution was compared to average distance travelled by person per day, it resulted in cars having 20% less space and pedestrians and bikes have significantly greater space in the current allocation. This argument demands spatial redistribution favouring longer trips (made by cars) over short trips (by walking and biking), inherently leading to an urban sprawl scenario. In the third consideration, Nello-Deakin (2019) compares spatial distribution for a travel mode in relation to its modal share plus its relative physical size combined. This approach combines the variables of number of trips with minimum space a single unit of the travel mode would occupy on the street. By generating weighted scores based on this combination, it was found that in a 'just' scenario, Cars should occupy 96% of the total road space while the remaining space should be relegated to bikes and pedestrians. While the above result hardly makes sense to justify any mobility scenario, the theoretical example succinctly exposes the myth that a just distribution of space should be proportional either to number of trips, length of the trips or the space any mode occupies.

Another study comprised of a needs-gap analysis conducted by Lefebvre-Ropars et al. (2021) addressing discrepancy between the demand and supply of spatial aspects of mobility infrastructure. Owing to the needs-gap analysis, spatial allocation data for street networks of 11 boroughs in Montreal was compared with the observed and potential modal share – in line with the egalitarian approach in previous studies (Lefebvre-Ropars et al., 2021). The evaluation found that while street-space allocation scenarios differed across different boroughs and during different times of the day, there was a consistent needs-gap found in road space exclusively allotted to bikers and bus riders.

All the above studies including a few others (Guzman, Oviedo, Arellana, & Cantillo-García, 2021) (Attard, Guzman, & Oviedo, 2023), while building distinctive academic approaches in assessing street-space allocation, rely primarily on quantitative methodologies. None of them addresses the need to consider qualitative aspects of street design – be it user experiences or the nature of stakeholder participation in

driving the change. Moreover, they rely on secondary digital data of neighbourhood or city level road networks, leaving a room for exploration of ground realities.

(Creutzig, F. et al., 2020) build on these gaps and present empirical insights on street-space allocation by manually measuring 18 street sections across Berlin. Addressing the dilemma of exploring spatial distribution and its relationship with modal share, the team of researchers derives 14 'allocation mechanisms' that are tested on the collected data of streets in Berlin. The allocation mechanisms are derived out of a theoretical framework that combines normative perspectives on the use of street space favouring either transport, sustainability or public space with ethical principles on justice. The ten ethical principles considered in this paper are taken from debates in practical philosophy – some of which include Liberal Equality, Utilitarianism, Communitarianism to Marxism, Critical Theory and Feminism and Environmentalism. Rooted in the practical application of justice ideals, the ethical framework put forward by Creutzig et al. (2020) estimates quantitatively as well as qualitatively - how cars currently occupy much more space than they would be allotted according to different allocation mechanisms. In the existing literature, this study is a breakaway case in terms of selection of focus area; as data was collected for individual streets in a city as opposed to consideration of a street network in whole. Another such study that compiles data based on street-sections and manual traffic counting emerges from Melbourne, Australia where Gruyter et al. (2021) collect data from different locations spanning across 36 activity centres in the city. This alternative methodology puts an impetus on rigorous observational multi-modal traffic counts aiming to study the relation between allocation of street space and its use. With an inference that space for pedestrians was undersupplied in all the selected activity centres, the study brings into light the nature of high-activity urban areas where the role of streets as a space and the aspect of accessibility (Jones P, 2016) are always in conflict (Gruyter et al., 2021). Peter Jones (2016) asks for a more comprehensive street classification system and states two broad functions of the Street - as a 'Link' and a 'Place'. The first function of streets as links relates to their aspect of facilitation of movement whereas the latter relates to Streets being places in themselves where time can be spent.

When we say, Streets as 'Public Spaces' (Creutzig, F. et al., 2020), we are not only referring to the access to open space for all, but also providing a free, level-playing platform for vulnerable and disadvantaged groups to conduct their activities. To put it simply, Streets encompass both Move (walk, drive, bike, run) and Pause (sit, observe, eat, gather) elements.

4.1.2 Alternative Considerations for evaluating spatial distribution

Notably, all the above studies covered in the literature review have adopted different calculation methodologies in different contexts of varying scale. Successive studies have addressed gaps in the previous research and have built upon arguments put forward by them. Over the last decade, the academic clarity over computation of street-space has come out increasingly clearer.

For example, with his critical arguments over studies primarily focusing on distribution of space, Nello-Deakin (2019) argues that alternatively focusing on distribution of traffic speeds across the city can serve as an alternative method of ensuring transport equity. He argues that greater road speeds require greater road space; increase the risk of traffic collisions and thence vehicular traffic eventually monopolizes the street.

Moreover, (Costa Valença, Moura & Morais de Sá, 2021) have proposed a 'dynamic street space allocation approach' asking for a flexible allocation of road lanes with the use of extensive big data and ICT solutions. This approach asks for reallocation of traffic lanes to active transport options during specific intervals of the day where limits to spatial reorganization and infrastructural expansion are constrained. Instead of opting for static, permanent solutions, the authors call for "accommodating the many uses and functions that the public space may have, with fluctuations of intensity and type of demand over time" as a response to traffic congestion, equity in accessibility and sustainability.

Extending the discussion to the recognised fallacy of reducing the meaning of road space allocation to different travel modes, many studies have shared this line of

reasoning in the existing literature. However, there is a significant methodological gap in how they have addressed this aspect – which will be discussed further in the 'Criticism and Gaps' section. At this juncture, the exploration of spatial distribution of street-space is expected move beyond how much space is dedicated to cars, bikes and buses in contrast with the space they 'fairly' deserve.

4.1.3 Position in Transport and Mobility Justice Studies

Fairness in street-space allocation is a central concern in the continued academic endeavour in the last decade. Even today, the concept of fairness, its definition and implementation remain contested. Attempts to assess 'Street-Space Allocation' in any scenario are intrinsically tied to the larger framework of Mobility Justice Studies. It comes unavoidably for a researcher attempting to analyse spatial distribution to question whether the given allocation of space is 'fair' or not. Both the academic concepts are interconnected as willingness to measure allocated space comes from the understanding that street space is a resource to which access for everyone is not equal. At the same time, application of distributive justice frameworks to rights over public space – particularly the concept of entitlement theory (Robert Nozick, 1973) asks for an assessment of the rights people have over the space they claim. Rafael H. M. Pereira, Tim Schwanen & David Banister (2016) explored the relevance of different political philosophies of Justice in transportation policies. (Creutzig, F. et al., 2020) derived theoretical indicators by applying these justice ideals to street-space allocation practices. Mobility and Transport Justice Researchers have put a huge impetus on Sen's (1995) research on Justice through recognition of Capabilities, as it cuts across most of the studies reviewed in this section.

Transport justice research has criticised the idea of considering street-space and accessibility a 'resource' that can be owned or distributed (Davidson, 2020). The focus on redistribution (in our case, of street space) hides underneath the representations of people and processes that drive the change (Verlinghieri & Schwanen, 2020). This invariably calls for the need for societal approaches in understanding the distribution

of space. Emerging studies that set to measure fairness in allocation of space can reflect upon how it is perceived, controlled, operated and appropriated by people.

This segues into a broader point that fair spatial distribution is just once way to meet the complete idea of justice in transportation. Stephan Gössling (2016) identifies three dimensions of urban transportation injustices - which other than addressing inequity in spatial distribution also include parity in travel times and exposure to travel-related risks. Even Amartya Sen's Capability approach and Raul's Egalitarianism as explored by (Pereira, et al., 2016) emphasize that justice is as much about the process as it is about its outcome. Further exploration of mobility justice in Street space allocation hence demands a critical consideration of people's perceptions and perspectives on how they use the street in contrast with their needs as to how they *would want* to use it.

4.1.4 Street-space allocation exercises in advocacy and planning practices

Attempts to quantify street-space also emerged in non-academic research and practice. A notable example is 'Copenhagenize' – a biking advocacy blog hosted by Mikael Colville-Andersen, for example, wrote an article about the 'arrogance of space' in which he measured space allocated for different modes of transport at certain intersections in Paris. Colville-Anderson's counting of image pixels to denote share of street-space, however, was an innovative visual experiment than a serious academic exercise highlighting 'unjustified' space dedicated to cars in contrast to walking and biking (Copenhagenize, 2014). Another example of such advocacy came from data visualization website called Whatthestreet.com, which utilized OpenStreetMap data to create user-interactive visuals to depict street ownership across different cities. A nearer example could also be of Streetmix – an online urban design tool created to analyse and redesign street sections. The website provides standardized templates for spatial allocation to different modes of transport including urban design elements such as lanes for through traffic, bus lanes, curb side parking lanes, sidewalks, plantation strips, etc. A noteworthy discussion in the public policy sphere took place

during the session titled 'Turning roads into streets – Road space allocation and public space resilience' at the Habitat – III conference in Quito, 2016. The session highlighted the importance of 'proper' road-space allocation in place-making and thus 'turning roads into streets' to encourage 'diversity in the public space and help create or recreate vibrant urban identities and social links' (Habitat III, n.d.). Broadly, it has been observed by many that there is a significant tilt towards automobile-based transportation in the urban policy domain. This is reflected in the design of streets which cater predominantly for cars as a major mode of transport, in many cities. Owing to this phenomenon, attempts to calculate space dedicated to different modes of transport started – with a view to demand equitable space for every user. In emerging literature, researchers and advocates of sustainable mobility have been criticising traffic engineers for justifying the existing road structures based on maximizing the traffic flow. For instance, (Creutzig, 2021) says Traffic engineers still optimize the allocation of road space towards maximizing traffic flow and justify such framing with cost-benefit analysis (Currie, et al., 2007; Zheng & Geroliminis, 2013). Following these arguments, the next segment reviews academic literature on measuring street-space allocation and further builds on the diverse methodological approaches adopted in the consecutive studies.

4.1.5 Criticism and Gaps

After reviewing the literature on Street Space Allocation, few gaps have been identified that exist concurrently in the existing academic studies.

a) The division of Street Space among travel modes: Previous research on street-space allocation has primarily focused on analysing mode-based allocations either over a road network or specific street sections. While studies have addressed the generalization of road-space essentially as a space for commute (Lefebvre-Ropars et al., 2021), this aspect has been overlooked in the methodologies proposed. As Peter Jones (2016) points out, the street is not only a functional space for providing access but also a place in itself. It is a datum that facilitates different activities encapsulating daily life from waiting for a bus to curb side seating for restaurants and taking a stroll

with a pet to children playing football on a neighbourhood street. Existing studies – both on theoretical and methodological levels have failed to integrate the above activity and use-oriented aspects of streets. While social interaction and participation form the core principles of some of the Allocation Mechanisms put forward by Creutzig, F. et al. (2020), their overarching analysis largely divides the street as a space for different travel modes. In fact, across the template of different approaches - emerging from distributive justice parameters to needs-gap analysis, the discussions compare allocation of relative exclusive road space among Cars, Public Transport, Bikes and Pedestrians.

b) Digitalized Street data is not always reliable: An overview of data collection methodologies reveals that the existing literature either employs calculation of space by mode based on street sections (Creutzig, F. et al., 2020) or overall space inside a road network (Gössling et al., 2016) (Nello-Deakin, S, 2019) (Lefebvre-Ropars et al., 2021) (Attard, Guzman, & Oviedo, 2023). Street-sections even in a single street can vary - so the result is dependent on the position they have been counted. Computation of space by mode in an overall road network yields more precise result. However, GIS-processed, digitalized road-network data may not always reflect dynamic conditions or changes in street designs over time. Not having well-defined data on allocated street space would adversely affect outcomes of any comparative analysis undertaken. Hence, while the analyses focus on the allocation of space single-handedly, testing its relation to the actual use of space would only determine the large picture of ground reality.

c) Simplistic understanding and one-way interpretation of justice parameters: (Creutzig, F. et al., 2020) having framed Allocation Mechanisms out of justice theories and principles have accepted that multiple interpretations of the ethical principles are acceptable given their inherent vagueness. A detailed discussion on the interpretation of these concepts was not covered given the limitations of the paper. However, with the multiplicity of interpretations a variety of justice indicators could be framed making evaluation of which indicators to consider relevant difficult. While

the attempt to consider a diversity of perspectives is laudatory, it is also important to note to that different streets are set in specific contexts and dependent on time, scale and the state of economics their collective needs change. A cookie-cutter approach to mobility Justice of juxtaposing a set of predefined justice indicators to different streets is thus, restrictive. To take an example from the case studies in the paper, Alexanderstraße, a commercial thoroughfare in central Berlin operates fundamentally different from Wrangelstraße, a tree-lined narrow street in a residential neighbourhood.

d) Considerations for temporal adjustments: Streets transform significantly during different times of the day due to variations in the activity of their users, their functions and the character of the neighbourhood they belong. In studies where modal share data is compared to the share of allocated space, temporal variance in the use of street space is overlooked as a variable. Moreover, some streets follow scheduled allocations such as fixed times of on-street parking, closure of vehicular traffic during peak hours or organizing markets or playstreets on weekends, etc. In such cases, it is difficult to differentiate between spatial allocation and spatial use – given the prior is not static. Sometimes, such temporary adjustments are employed as a measure to bring fairness in the ownership of streets. Hence, considering datasets based on fixed allocations of space can be conflicting as they do not account how street space alters according to time.

e) Lack of Societal Perspectives and qualitative assessments: Existing approaches to street-space allocation analyses have prioritized different parameters for assessment including modal efficiency, modal egalitarianism, addressing the gap between demand and supply, etc. An application of distributive justice framework(s) would inherently ask for an assessment of how the street-space has been distributed as a resource. Successive studies have focused on spatial distribution among modes of transport as opposed to the needs and activity patterns of different user groups. This is a notable limitation that exists in the analysis framework specified on modal-allocation. Verlinghieri & Schwanen (2020) have noted the shift towards society-

centric approaches in the broader transport and mobility justice studies – which is missing on a methodological level in the theme of street-space allocation analyses. Judgments on allocated street-space can be alternatively based upon societal parameters and data collection exercises focused on satisfaction levels of people, their involvement and participation in planning, use of street space on individual level and more.

This invariably calls for more qualitative assessments of streets in addition to the existing evaluations based quantitative data. The missing 'societal' approach may entail talking to people - and hence more time-and-resource-taking qualitative data collection exercises such as surveys, interviews, ethnographic fieldwork with participant observational studies. However, in the absence of such methodologies, the scope for assessment has thus remained purely theoretical.

Authors	**Copenhagen -ize**	**Gossling et al.**	**Nello-Deakin**	**Lefebvre et al.**	**Creutzig et al.**
Basis of Analysis	Travel Modes	Travel Modes	Travel Modes	Travel Modes	Travel Modes
Data Collection	Maps	Sections	Maps	Sections	Sections
Scale	3 Street Intersections from Paris, Tokyo and Calgary	Street Networks of Freiburg's 4 districts	Street Network of Amsterdam	Streets from 11 districts in Montreal	18 street sections across Berlin

Table 4: Comparative Assessment of existing literature on Street Space Allocation

4.2 Activity-based approach

4.2.1 An exploration to measure the Interpreted Space

It is established in the prior sections that there is a need for a wider consultation of social actors when allocation of space is scientifically judged. The absence of a qualitative approach not only overlooks the intentions behind the current allocation of space but also hampers our understanding of how street is eventually a space in itself. In the quest to form a framework for an in-depth wider assessment of allocated space, I was drawn to Lefebvre's conceptualization of the Space Triad, and I will expound on the dichotomy between the Allocated and Interpreted Space with the help of this axiom.

The 1991 translation of his 1974 book, The Production of Space revealed before the world what the Marxist thinker thought about how space is produced and operates in different ways. He put forward the idea of Spatial Practice, Representations of a Space and Lived Space mentioning how these understandings divulge from each other even though they are not three physical spaces entirely. With Spatial Practice, Lefebvre meant the societal understanding and appropriation of space - It is the space that the society produces and masters gradually. It is fundamentally different from The Conceived Space or the Representations of space by architects, designers and planners. It is called ***Allocated Space*** in this framework. Beyond this there is a lived space that is created by people's day-to day actions and processes.

While Lefebvre has established a dialectic relationship between the three spaces, The Perceived space and Lived space are more interlinked to each other as perceptions are sufficed on the lived experience and vice versa. At the same time, it has been established previously that the use of space usually differs from the way it is allocated (or conceived). Hence, under our framework, we study the Perceived Space and Lived Space together and call it ***Interpreted Space***. Interpreted Space is the overarching practical space that is perceived and used by people. To develop our understanding of the Interpreted Space, the use of ethnographic studies is best suited in this case.

The concept of Interpreted Space will thus be a parameter for assessment of Allocated Space in this study. While doing this, the idea was not to establish a binary between the allocated versus the interpreted space, as warned by Lefebvre himself. The combination of the Lived and Perceived space is for theoretical convenience. The idea is not dilute the essences of Lefebvre's two concepts into one, but establish, in fact, that how these spaces are more inter-related than the third – which will be explored further in the discussion.

While understanding the concrete realities of spatial production, Lefebvre's reservations in treating this triad as a mere 'conceptual framework' have also to be considered. Lefebvre maintains that the triad is designed as a framework, which is to be applied to study the of the conflictual nature of urban dynamics. However, for this study, it is used as a theoretical basis to academically ground the conceptualizations of *Allocated Space* and *Interpreted Space* – drawn during fieldwork studies.

4.2.2 Ethnographic Urban Studies

Urban Ethnography is a field that establishes a relationship between observational studies and urban studies. It allows us to study urban contexts through a societal lens often involving methods like participant observations, recording perspectives and real-life experiences of people. Ethnography uses the concept of **Participant Observation**, a methodology that employs rigorous fieldwork; in which the observer becomes a silent member in a group of actors who shape the place and its institutions. As noted by (Verloo, 2020), practices of ethnography are drawn from the works of The Chicago School of Sociology that are premised on the understanding that learning takes place through the observation of the action in a specific context. Thus, Ethnography is an over-encompassing datum that weaves the 'spatial' and the 'social' aspects of this research together.

With a preliminary understanding that this thesis would involve fieldwork in Ghent with a focus on mapping activities on School Streets, I deemed it necessary to proceed with a prior knowledge of Ethnographic methodologies. They form a basis

to the formulation of the so-called Activity-based approach, a lens with which allocated space on the School Streets was to be assessed.

The **Activity-based approach** asks for measuring the Interpreted Space, which in itself consists of two Lefebvrian concepts – The Perceived Space and the Lived Space. While these concepts are inter-related but differ from each other, hence they ask for different ethnographic methodologies for their assessment.

4.2.3 Activity Observation: Recording the Lived Street Space

A street is not merely a space for transit but a vibrant place in itself where human activities take place. Thus, for studies involving assessment of street space, it is imperative to document the nature of these activities that have an underlying relation with the space they are set in. This relationship – between the activity and the space is to be unravelled by urban researchers in investigating why and when certain activities take place, and what contextual conditions give rise to their presence. For example, on school streets, children as well as the parents are often seen engaging in mutual interaction with discussions on how the day was like to planning a homework project. While usually, there are no dedicated spaces that facilitate these interactions, it is often the sidewalks, or bike stands that are 'lived' as an interaction space amidst all the hustle-bustle of the pick-up hour.

Activity Observations are employed to study the urban life – by practitioners and academics alike. Often in practice, planners engage in observation counts, mapping the public engagement and use of public spaces to make guidelines for design. Alternatively, researchers often engage in participant observations to study the underlying factors for space use or non-use, test theoretical ideas on a real-life context and make thick descriptions.

Jan Gehl has used Direct Observation as a tool to study the 'interaction between public life and public space' (Gehl and Svarre, 2013). The argument for observation is posited in contrast with the role of surveying, which involves questioning people. Unlike questioning people on their preferences - which may lead to biased outcomes,

observation involves a silent, distant recording human behavior in a specific context. Direct Observation is often almost non-participant during which the observer is supposed to be a proverbial 'fly-on-the-wall' (Gehl and Svarre, 2013) and records units of people participating in different activities. Direct Observations involve different methods of documenting urban life in relation to the spatial context. Based on the type and nature of the activity - different methods of activity mapping are proposed by Jan Gehl including Tracing, Plotting, Counting, Keeping a diary, etc. Gehl differentiates between activities that are Stationary – where positions of people can be plotted and Transitory or Moving that ask for tracing people's movements within a space.

Methods of Ethnographic data collection extend beyond graphical representation and mapping. Other methods that are distinctively qualitative in nature include writing thick descriptions (Geertz, 1973: 27) and Fieldnotes. As suggested by Nanke Verloo (2020), this involves charting out a detailed Fieldwork Plan at the outset and defining the unit of analysis - which can be a defined space, set of people or a process within an institution. This method has a more participant focus, where the researcher as a participant collects descriptive ethnographic data describing in detail everything that can be seen, smelt, heard, tasted and felt.

Many studies demand a combination of more than one variety of data – often referred to as a Triangulation. To analyse how Interpreted Space is formulated in reality, a similar dynamic approach of data collection is needed – that not only captures the lived reality of a space, but also records the underlying perceptions, levels of human engagement, and the nature of ownership beneath.

4.2.4 Developing an Activity-based approach

Based in the above arguments, an Activity-based approach was developed, which builds a correlation between the established allocated space and how it is used, lived, perceived and appropriated by people on a daily basis. As the name suggests, the activity-based approach examines the validity of spatial allocation with respect to the

activities being performed under its regime, in a specific context. This approach to assessing street space allocation is born out of two principal needs – first, to study how certain practices of street space allocation impact the end realities of street life and second, to bring stakeholders' perspectives into the analysis. Hence, it serves as an integrated approach that combines observation of activities with societal viewpoints as a collective basis for a comprehensive assessment of a spatial status-quo.

The Activity-based approach thus asks for a measurement of the Interpreted Space and its operational reality on the ground. A systematic documentation of how a street is perceived and lived i.e. how it is 'interpreted' provides groundwork for data collection. The gathered data subsequently supports the development of a qualitative analysis on the use of street space, refining the findings of existing modes-based assessments.

The Activity-based approach answers following questions:

- What is the nature of the allocated space and how does it interact with the interpreted space?
- How does the interpreted space interact with the allocated space on ground, and where does it deviate?
- What aspects of the Interpreted space are not catered by the allocated space?

As an area of study, the setting of School Streets in Ghent was chosen to apply the activity-based approach. School Streets, especially those in Ghent, provide a compelling case for a variety of reasons. On these streets, the city of Ghent intends to favor the allocation of space to support children's mobility. At the same time, School Streets enable a range of activities related to school life – that celebrate these streets as a space for pause, interaction and play. This makes these streets suitable candidates to test the relationship between allocation of space and its interpretation on the ground.

4.3 The rationale for selection of School Streets in measuring street-space allocation

As a basis for the analysis of allocation of street space School Streets in the city of Ghent, Belgium were selected. Following are the key reasons for the selection of these thematic streets as a unit of this analysis:

a) School streets have degrees of varied allocation based on temporal needs: School streets prove to be one of the interesting cases for assessing street space allocation because they exhibit variations in how the same space is allocated to different uses during different times of the day. Many of the school street projects around the world temporarily restrict vehicular traffic during peak hours. In places of spatial constraints, same parking spots are shared between cars and bikes during the day.

b) School Streets focus on child safety, but their benefits cut across different groups of stakeholders: The direct and indirect benefits of School Streets which range from curtailment of traffic, improvement of safety and air quality to the overall revitalization of neighbourhoods are favourable not only for the children and the school staff but also parents, residents and daily commuters on the streets. Hence, these streets are a good platform to connect with a variety of stakeholder groups when a society-oriented methodology is applied.

c) They provide a good resource point for data collection and surveys: Spatial allocation analyses that focus on societal interaction and involve activity observation, are open to consider places of intensive human and vehicular activity like markets, transit stations, etc. However, schools set to be an interesting data collection medium for contacting parents for surveys – who are active participants on School Streets. They are also the areas of high activity and conflicts during the drop-off and pick-up hours – which make them worthy candidates for case studies involving observational fieldwork.

d) School Streets are thematic, special-use streets inherently asking for re-allocation of road space for children's free mobility: At the outset, there is a multiplicity of identified problems that initiatives like School-Street projects are set to solve. The way these initiatives are executed decides the approach towards reallocation of street space – whether permanent or scheduled – in favour of modes suited to children's mobility. However, it is clear that when School Street projects are in force, they carry the larger narrative of questioning car-centric status-quos across varied environments.

Chapter 5 - Methodology

Having defined the activity-based approach and establishing its need in spatial allocation studies, a methodology was devised to bring the two academic concepts together. The conceptual framework introduces the concept of Interpreted Space, the calculation of which was determined by two separate data collection methodologies. The first strategy involved Activity Mapping through Observational Fieldwork in front of School Gates. Placing School Streets as a unit of analysis, observational data was gathered on what activities take place on the school streets during pick-up and drop-off hours and other non-peak hours during the day. Observational studies were conducted on the basis of a pre-decided fieldwork plan after surveying all the School Streets in a city. The Second Strategy for data collection was more quantitative in nature – which involved conducting surveys with school parents. Parents were identified to be one of the important stakeholder groups in the School Streets Project, who not only could voice children's viewpoints but also maintained a connection with other stakeholder groups like school faculty, non-teaching staff, and district administrators on a regular basis. Thus, it was decided that a census survey that collects data on their modal behavior, safety perceptions, and their needs and wants, would be distributed among the parents of selected school cases. The two data collection strategies were simultaneously employed for collection of data on the Interpreted Space in Ghent's School Streets. The detailed description on the conduction of both the strategies is provided in the forthcoming dedicated subsections.

In addition, Allocated Space was digitally computed with the help of Orthophotos produced by Geopunt, an open digital cartography portal for the Flemish region. The Orthophotos were geo-referenced using Arc-GIS, and allocated street elements like sidewalks, road space, parking area, bike lanes, and green elements were digitized.

The measurements were taken within the street's extent exactly covering the length of the school boundary. The consistency of the digital quantifications was also checked by manual measurements taken during the fieldwork.

5.1 Selection of case studies

For studying the allocation of street space on the School Streets in Ghent, a comparative case-study approach was determined. The twelve functional school streets in Ghent are spread across different parts of the city and are shaped by the local spatial constraints, varied levels of public acceptance, nature of car-ownership as well as the character of the neighborhood they are set in. At the same time, while Ghent employs the temporary vehicular closure method as the backbone of realizing school streets, the nature of this closure varies, displaying different levels of spatial allocation and street ownership.

Three schools situated in different two neighborhoods in Ghent were selected as case studies. The School Streets that cater to these schools represent three different space allocation paradigms and vehicular closure patterns. Two Streets located in the neighborhood of Dampoort– namely Wasstraat and Krekelberg and one Street in Ghent Centrum – Theresianenstraat were selected. To elaborate, Wasstraat, a former living street, is permanently closed for vehicular traffic and the section that abuts the school boundary is pedestrianized with access to bikes. On Krekelberg, vehicular traffic is restricted for thirty minutes twice on a weekday, helped by volunteer parents. Theresianenstraat sees no vehicular closure, and School Street is managed by volunteers who manage traffic flows outside the school. On this street, a few parking spaces are shared between cars and bikes during different times of the day. Thus, the **three spatial allocation scenarios** that were identified as a basis for selection of case studies were - **Streets permanently closed for cars**, Streets that were **temporarily closed for cars by volunteered barricading**, and the third type of **Streets with no traffic closures** but traffic management by volunteers.

Case Study 1 (CS1): Wasstraat

School: Freinetschool de Vlieger, Primary School

School Intake: 340 students, 203 families

Spatial Allocation Scenario: Permanent closure for cars

Case Study 2 (CS2): Krekelberg

School: VBS De Krekel, Elementary School

School Intake: around 500 students

Spatial Allocation Scenario: Temporary closure with volunteered barricading

Time slots for Closure: Monday to Friday: 08:10 to 08:40 and 15:25 to 15:55, Wednesday: 08:10 to 08:40 and 12:25 to 12:55

Case Study 3 (CS3): Theresianenstraat

School: Montessori Klimop, Playschool

School Intake: 300 students

Spatial Allocation Scenario: No closure, Volunteered traffic management

5.2 Methods of Data Collection

5.2.1 Observational Activity Mapping

Drawing from Ethnography, Activity Mapping techniques were employed to visually represent the use of street space in front of the three case study schools in Ghent. School Street vehicular closures (or traffic monitoring in the case CS3), took place daily during the peak hours of school drop-off and pick-up hours. Across all three case studies, the highest activity is generated during these times of the day. Hence, observations were recorded at the peak hours in two slots of thirty minutes. Besides this, observations were also recorded for two non-peak slots of thirty minutes for all the three schools.

Method of Data Collection:

The fieldwork was based on preliminary visits to the schools and analysis of patterns of street usage during the day. After the case studies were finalized, peak and non-

Fieldwork Plan for Mapping Activity Patterns: Stationary vs. Moving across Three Case Studies				
School	Hour	Type of Activities mapped		Representation
		Stationary	Moving	
Case Study 1: Wasstraat	Peak Hour 1	06/11/2024 08:10-08:40	14/11/2024 08:10-08:40	Map 1.1
	Peak Hour 2	06/11/2024 15:25-15:55	14/11/2024 15:25-15:55	Map 1.2
	Non Peak Hour 1	14/11/2024 10:30-11:00		Map 1.3
	Non Peak Hour 2	14/11/2024 16:00-16:30		Map 1.4
Case Study 2: Krekelberg	Peak Hour 1	18/11/2024 08:10-08:40	19/11/2024 08:10-08:40	Map 2.1
	Peak Hour 2	18/11/2024 15:25-15:55	19/11/2024 15:25-15:55	Map 2.2
	Non Peak Hour 1	19/11/2024 12:30-13:00		Map 2.3
	Non Peak Hour 2	19/11/2024 16:35-17:05		Map 2.4
Case Study 3: Theresianenstraat	Peak Hour 1	28/11/2024 08:00-08:30	29/11/2024 08:00-08:30	Map 3.1
	Peak Hour 2	28/11/2024 15:20-15:50	29/11/2024 15:20 - 15:50	Map 3.2
	Non Peak Hour 1	28/11/2024 12:30-13:00		Map 3.3
	Non Peak Hour 2	05/12/2024 16:15-16:45		Map 3.4

Table 5: Schedule for Fieldwork Observation at the three case studies

peak hours were finalized for each case study. The peak hours coincided with the timings of traffic volunteering at the school streets. Based on this, a fieldwork plan was charted at the outset. On the day of observation, the observer (author) arrived on the site fifteen minutes prior to the commencement of the time slot and fixed his position. For the slots of thirty minutes, every activity that took place on the street was minutely recorded on printed A3-sized maps.

Method of Data Representation:

Data on the live use of street space was recorded in the form of maps. The activities so recorded were divided ad hoc into two segments – stationary activities and moving activities. Established practices in activity mapping demand separate styles of representation for them. Out of them, the tools proposed by Gehl & Svarre (2013) were deemed to be best suited to record the complex dynamics of lived street space. The Plotting was employed to jot down positions of people engaging in stationary activities. Coloured dots were used to locate stationary activities that took place on street with the fixed slot of thirty minutes. Additionally, the method of Tracing used represent how people moved within the limits of the street space. In this method different line-types of varying thicknesses depict moving activities on the school

streets. Due to logistical challenges, it was impossible for the author to plot and trace different activities at the same time during peak hour slots. Hence, stationary activities were plotted and moving activities were traced on different days for the same time slot. Keeping the timing of observation fixed, a combined map for that time slot depicting both types of activities were prepared. For non-peak hours, both stationary and moving activities were mapped during the same time slot. The maps were digitally processed and finalized for analysis using Adobe Photoshop.

5.2.2 Survey analysis

A distinct methodology was needed to formulate the perceived space, the third one in the triad. Apart from the observational analysis that attempts to qualitatively record the use of street space (Lived Space), another primary data form could not only quantify perceptions about the street space but could also verify the findings of observation was needed. Surveys were best suited in this case as larger audiences could be reached. Among a set of stakeholder groups, parents were identified as a set of individuals who used the street daily and had contact with other stakeholders' groups like teachers and residents as well. Also, parents' opinions naturally sufficed on the lived experiences of their children as well. Hence, Parental surveys in all the three schools were conducted individually. Three digital Census surveys with the same questions were prepared and distributed separately. After approval from the respective school directors, surveys were sent digitally to all the parents through common portals. The Surveys in CS1 and CS3 were sent with a weekly newsletter via email. In CS2, the school director emailed the survey link to all the parents with a personalized email. To increase the outreach, posters with survey QR codes were pasted on school notice boards and shared on social media handles. Parents were given a period of 15 days to fill out the surveys after which the responses were frozen. A majority of the responses were received within the first two days of distribution at all the three schools. The school authorities noted that the survey response exceeded rates of internal surveys conducted periodically; and reflected the awareness and concerns of the parents regarding the topic.

Chapter 6 - Data Collection and Observations

6.1 Observational Activity Maps

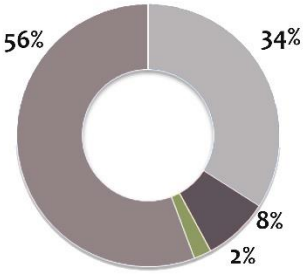
In the following pages, the data collected from the Fieldwork observation is compiled for each case-study in the form of maps. For each case study, the first page analyses the composition of allocated street space in front of the school. The second page compiles a gist of the fieldnotes taken during the preliminary visits. In Maps 1.0, 2.0 and 3.0, proximity of the schools from the residential addresses of the children is mapped according to the parental addresses collected in the survey (Q1). In the succeeding pages for each case study section, peak and non-peak hour maps are compiled. In every map, coloured dots represent stationary activities observed and lines represent the traces of moving activities marked during the fixed timeslot.

Case Study 1: Wasstraat
School: Freinetschool De Vlieger

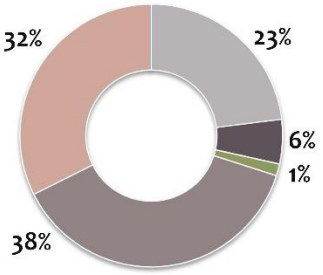
Sidewalks | Car - Parking | Street Greens
Road Space (Car-free) | Private School area for Bike-Parking

Allocation of Street Space

Share of Allocated Street Space on Wasstraat in percentages



Share of Allocated Space including the private bicycle parking facility of the school

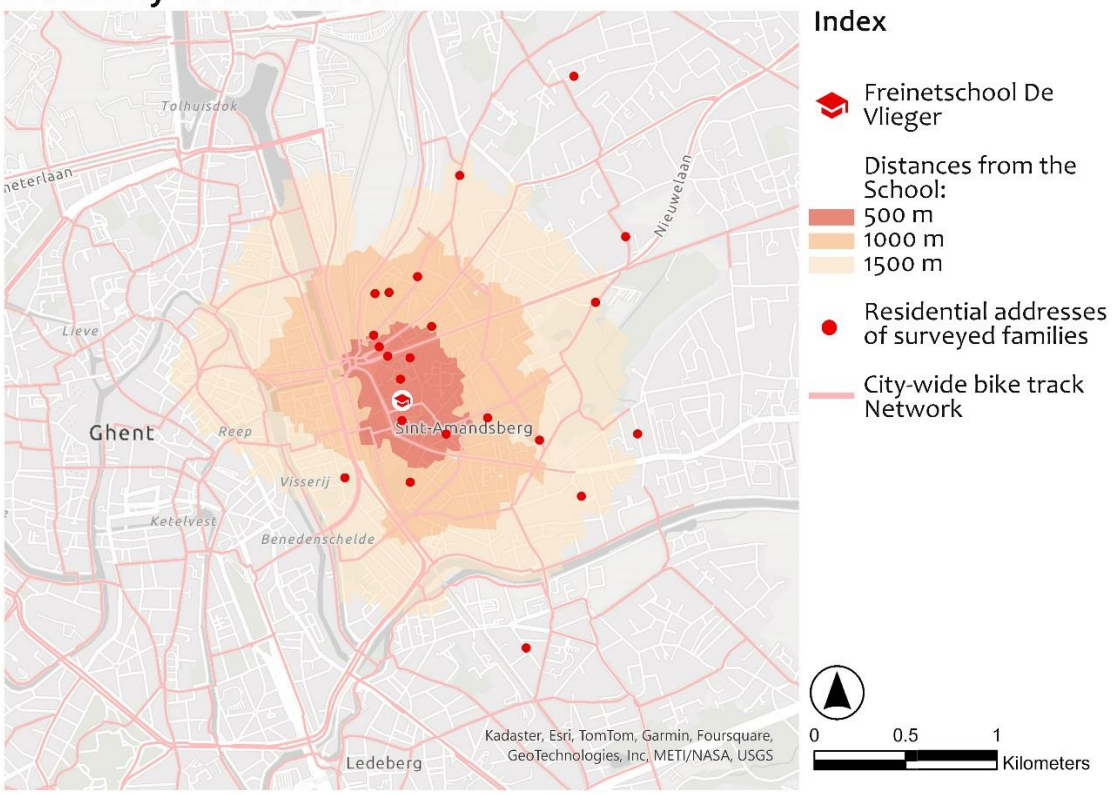


Wasstraat: Life as it happens on the School Street

Fieldnotes:

I walked towards Wasstraat by taking the Brnaustraat which is a bike street. The newly installed turning barricades are still not in use – which meant that the 'School Street' was not in force. However, unlike Krekelberg a part of this street that abuts the boundary of the park in front of the school has permanently blocked motorized traffic. The travelling speeds of parents and children are relatively higher here - given the timing as well as comfort on driving on a bike street. In this school, the gate opens to a large bike parking facility which is contained inside the boundary limits of the school plot. Parents park their bikes here and drop their wards off to a small gate opening upto a school ground beyond. However, the bike parking facility was largely occupied, forcing the parents to leave their bikes on the street unattended. The major concentration and intensity of the activity was in the bike parking itself than the street. However, the street remained an active space for bikes. Toddlers could be seen driving tricycles, skates, skateboards to mini-bikes. Parents can also be seen in a diverse range of bikes including cargo bikes. There are many parents who are dropping off more than one child to this school. In a case where parents have 3 children, the eldest child rides a bike while the other two sit in front of the cargo-bike. It is to be noted that the mist persists and the weather continues to be cloudly. A larger number of parents approach the school from the bike street whereas a few also reach from the opposite direction. The park in front, which is used by children during breaks, was completely empty. Sidewalks run on both the sides of this street. Yet, the sidewalk touching the school boundary remained empty for most of the time. No volunteer/teacher was seen minding the traffic on the road. ”

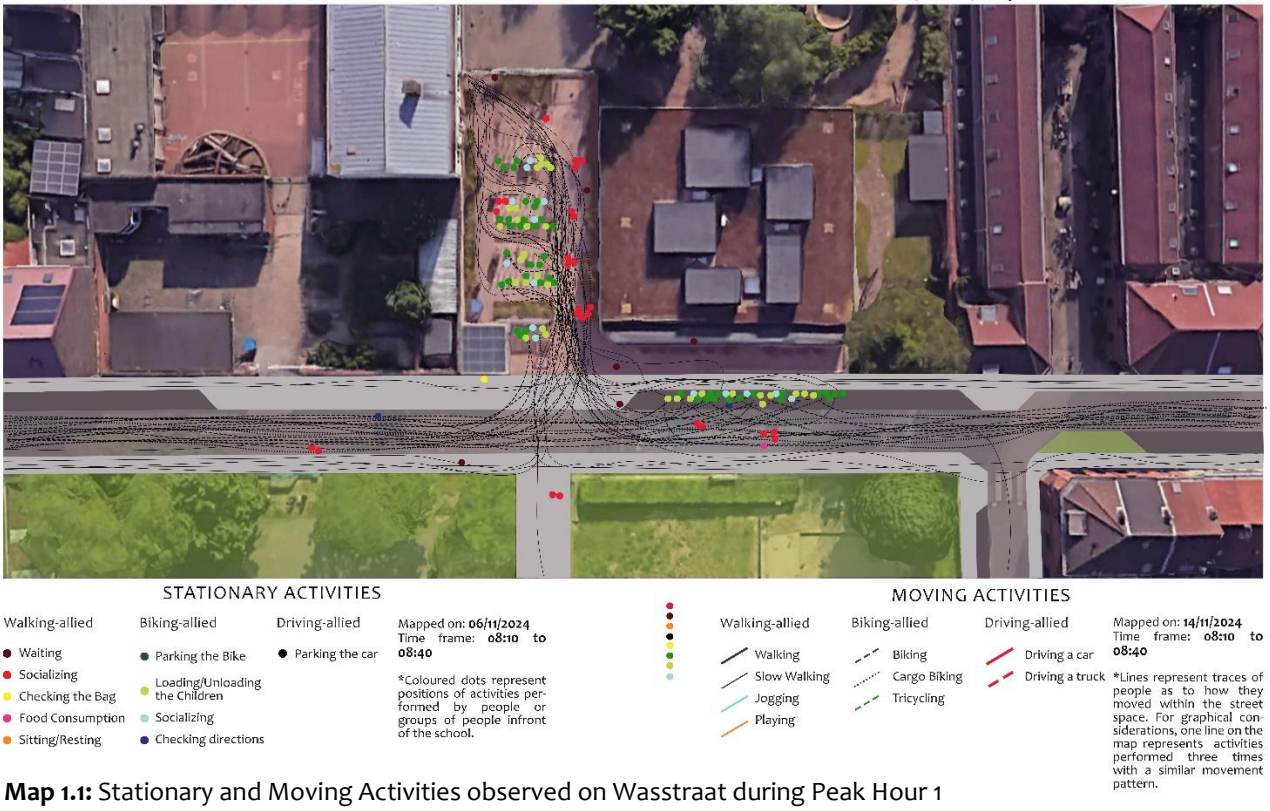
Proximity to the School



Map 2.0: Distribution of Residential Addresses and their accessibility to the School

Case Study 1: Wasstraat
School: Freinetschool De Vlieger

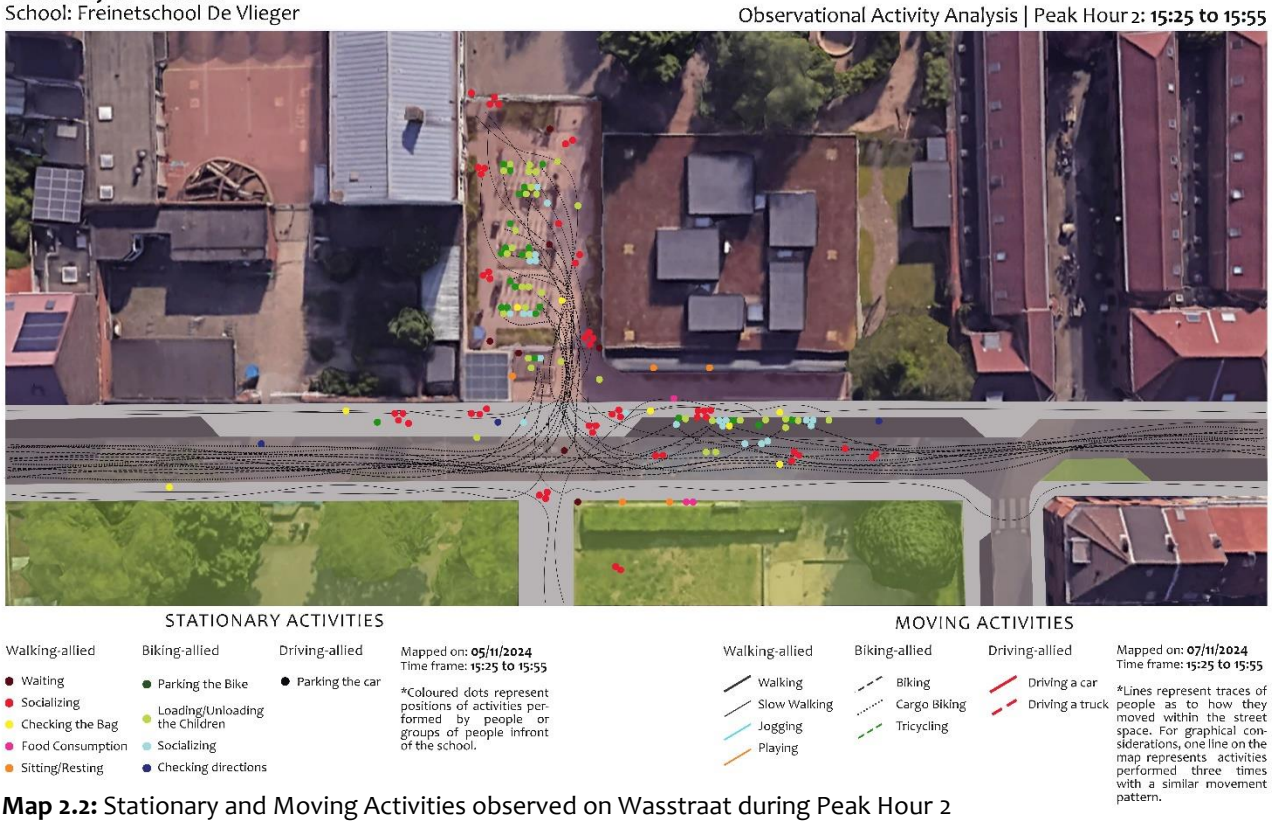
Observational Activity Analysis | Peak Hour 1: **08:10 to 08:40**



Map 1.1: Stationary and Moving Activities observed on Wasstraat during Peak Hour 1

Case Study 1: Wasstraat
School: Freinetschool De Vlieger

Observational Activity Analysis | Peak Hour 2: **15:25 to 15:55**



Map 2.2: Stationary and Moving Activities observed on Wasstraat during Peak Hour 2

Case Study 1: Wasstraat
School: Freinetschool De Vlieger

Observational Activity Analysis | Non Peak Hour 1: **10:30 to 11:00**

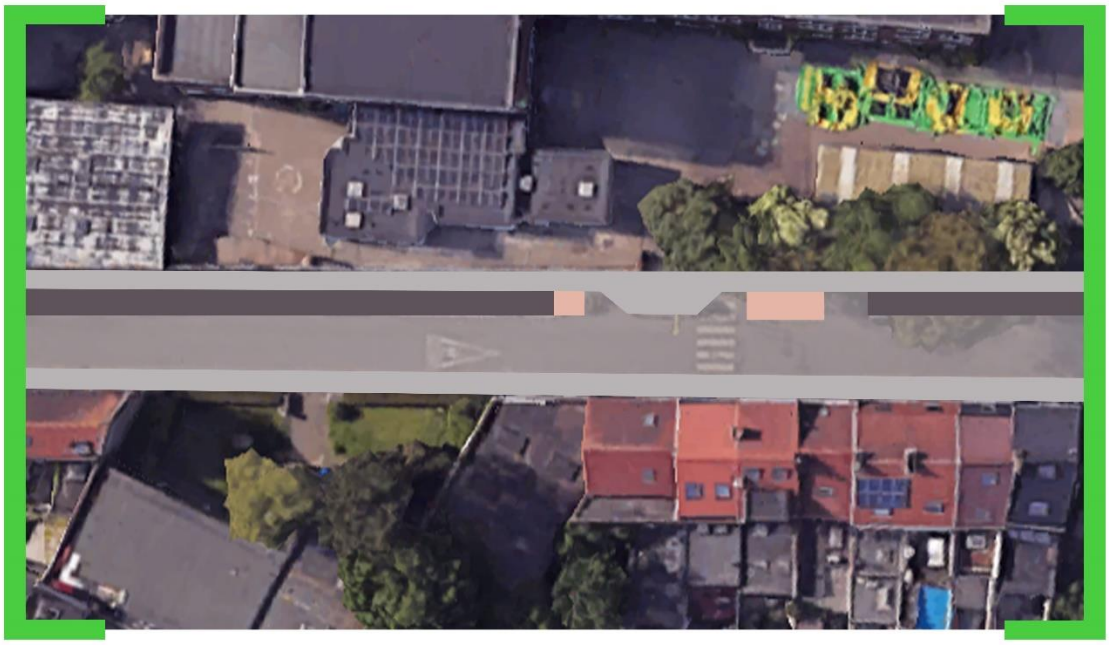
Map 4.3: Stationary and Moving Activities observed on Wasstraat during Non-Peak Hour 1

Case Study 1: Wasstraat
School: Freinetschool De Vlieger

Observational Activity Analysis | Non Peak Hour 2: **16:00 to 16:30**

Map 3.4: Stationary and Moving Activities observed on Wasstraat during Non-Peak Hour 2

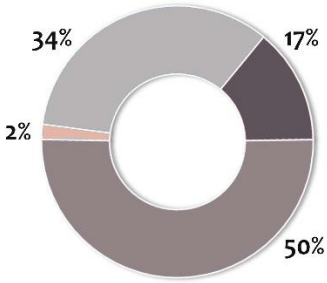
Case Study 2: Krekelberg
School: VBS De Krekel

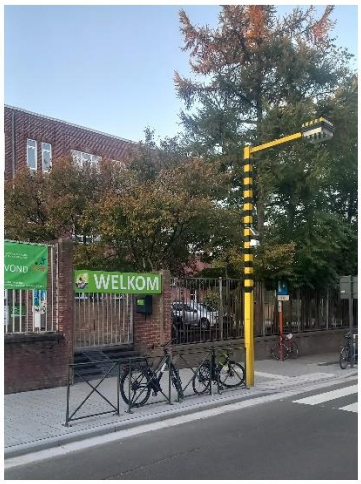


Sidewalks
Road Space
on-street Car - Parking
on-street Bike-Parking

Allocation of Street Space

Share of Allocated Street Space on Theresianenstraat in percentages



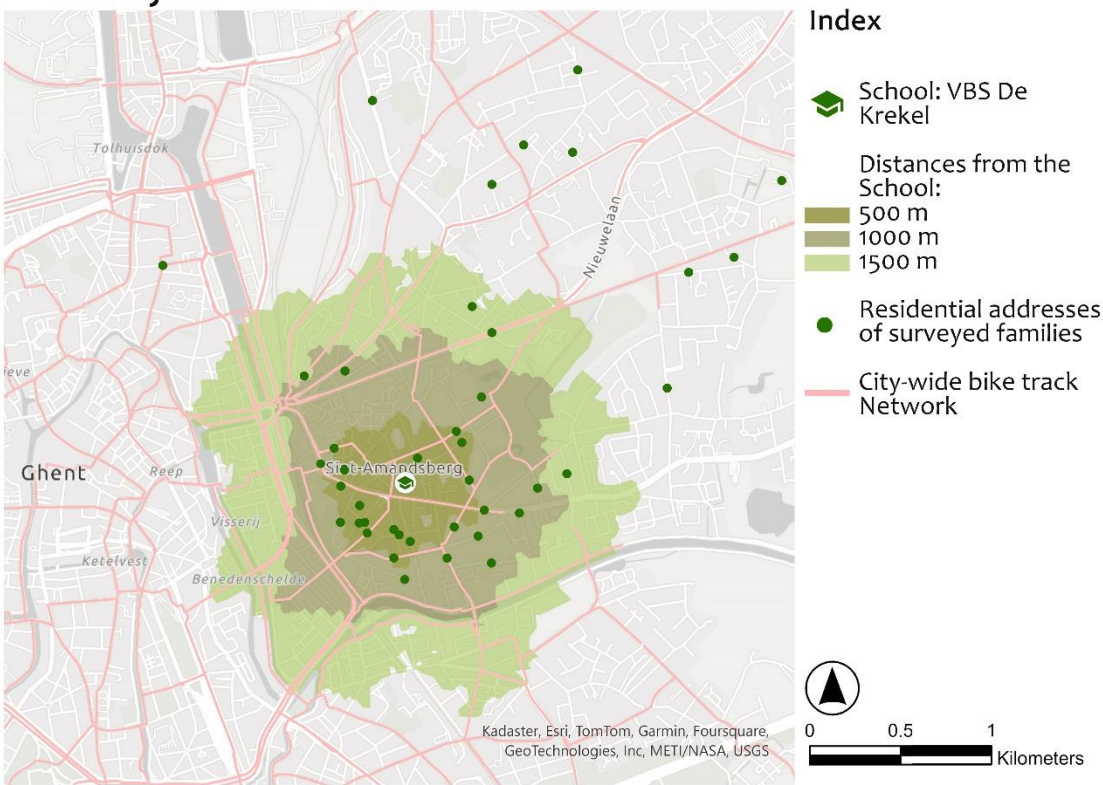


Krekelberg: Life as it happens on the School Street

Fieldnotes:

It is a misty Monday morning, the mist has gathered and street visibility is minimal. The streets that lead to VBS de Krekel are filled with students going to the school. Parents hold their children's hands while walking on the sidewalk. They make their way throw the narrow sidewalks through minute obstacles like parked bikes and plantings while also braving the cold at the same time. The temperatures have suddenly dropped since the beginning of November. As I reach the intersection that opens up the street Krekelberg ahead, I see a volunteer guarding the turning barricades. They are put up to restrict vehicular traffic from entering the street. Many parents driving bikes have passed by me. They carry their children on a basket that is tied on the back tier. Many parents have arrived with cargo bikes with sometimes 2 children sitting in the trolley. Sometimes, the parent is on a bike and the child is driving his/her own bike. Bikers – be them adults or toddlers wear a helmet compulsorily. Most of the parents have unloaded their kids off the bikes. Some parents are giving instructions to their children, some are fixing their dresses in a squatting position on the sidewalk. At 8:12, the the main school gate has opened. The parents could be seen dropping their children inside the school. The same happens at the second gate belonging to the kindergarten. Meanwhile the streets remain active with cyclist-parents doing their daily drop-off routine. Upon observations, an average parent spends upto 10 minutes at the drop-off. There is a concentration of people at the bike park on the street as it can hold upto maximum five bikes. I can see 3 bikes being parked on the road now which are not locked. Many children are still being dropped off by parents on foot. A host of parents and children on the parallel main road can be seen on the intersection waiting for the light to turn green. ”

Proximity to the School



Map 2.0: Distribution of Residential Addresses and their accessibility to the School

Case Study 2: Krekelberg
School: VBS De Krekel

Observational Activity Analysis | Peak Hour 1: **8:10 to 8:40**

Map 2.1: Stationary and Moving Activities observed on Krekelberg during Peak Hour 1

Case Study 2: Krekelberg
School: VBS De Krekel

Observational Activity Analysis | Peak Hour 2: **15:25 to 15:55**

Map 2.2: Stationary and Moving Activities observed on Krekelberg during Peak Hour 2

Case Study 2: Krekelberg
School: VBS De Krekel

Observational Activity Analysis | Non Peak Hour 1: **12:30 to 13:00**

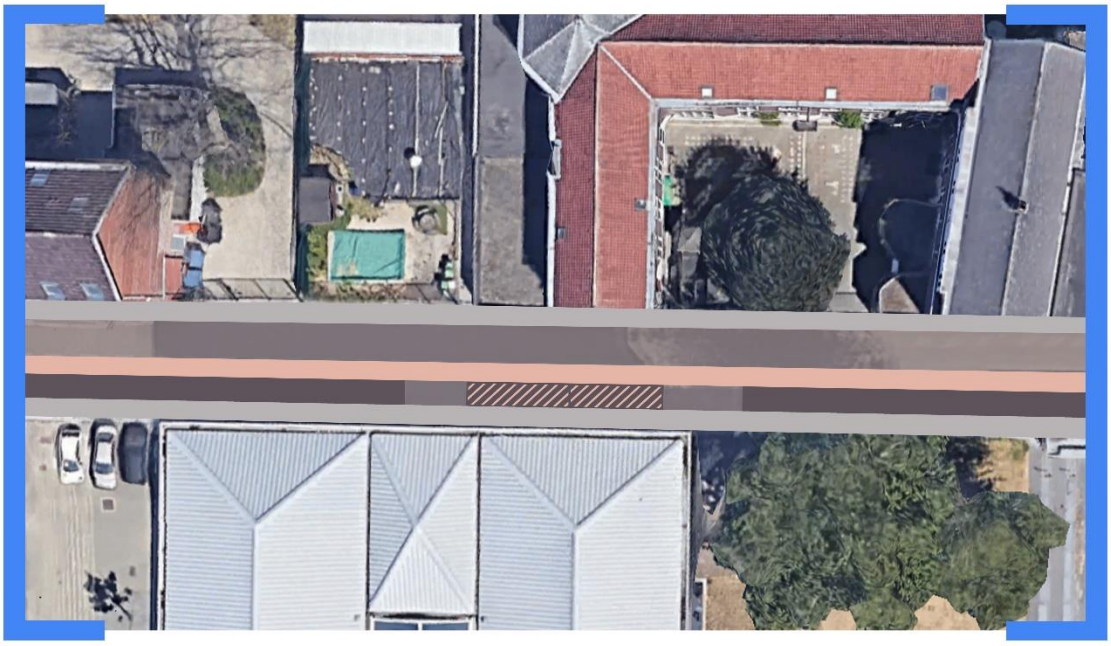
Map 2.3: Stationary and Moving Activities observed on Krekelberg during Non-Peak Hour 1

Case Study 2: Krekelberg
School: VBS De Krekel

Observational Activity Analysis | Non Peak Hour 2: **16:35 to 17:05**

Map 2.4: Stationary and Moving Activities observed on Krekelberg during Non-Peak Hour 2

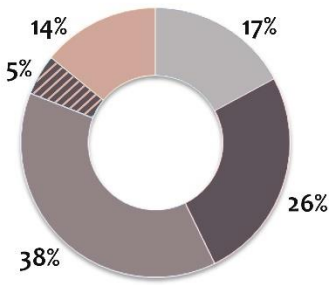
Case Study 3: Theresianenstraat
School: Montessorionderwijs Klimop



Sidewalks
Road Space
Car - Parking
Dedicated Bike Lane
Shared Parking between Bikes and Cars

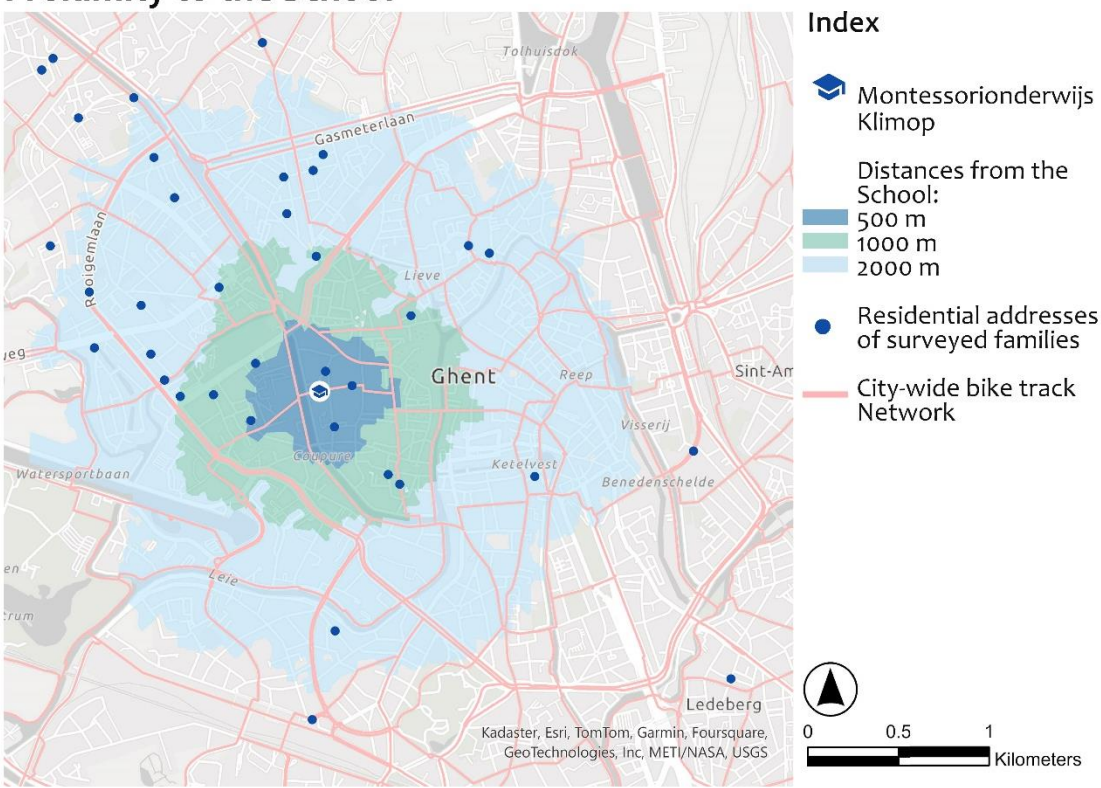
Allocation of Street Space

Share of Allocated Street Space on Theresianenstraat in percentages



Theresianenstraat: Life as it happens on the School Street

Proximity to the School



Map 3.0: Distribution of Residential Addresses and their accessibility to the School

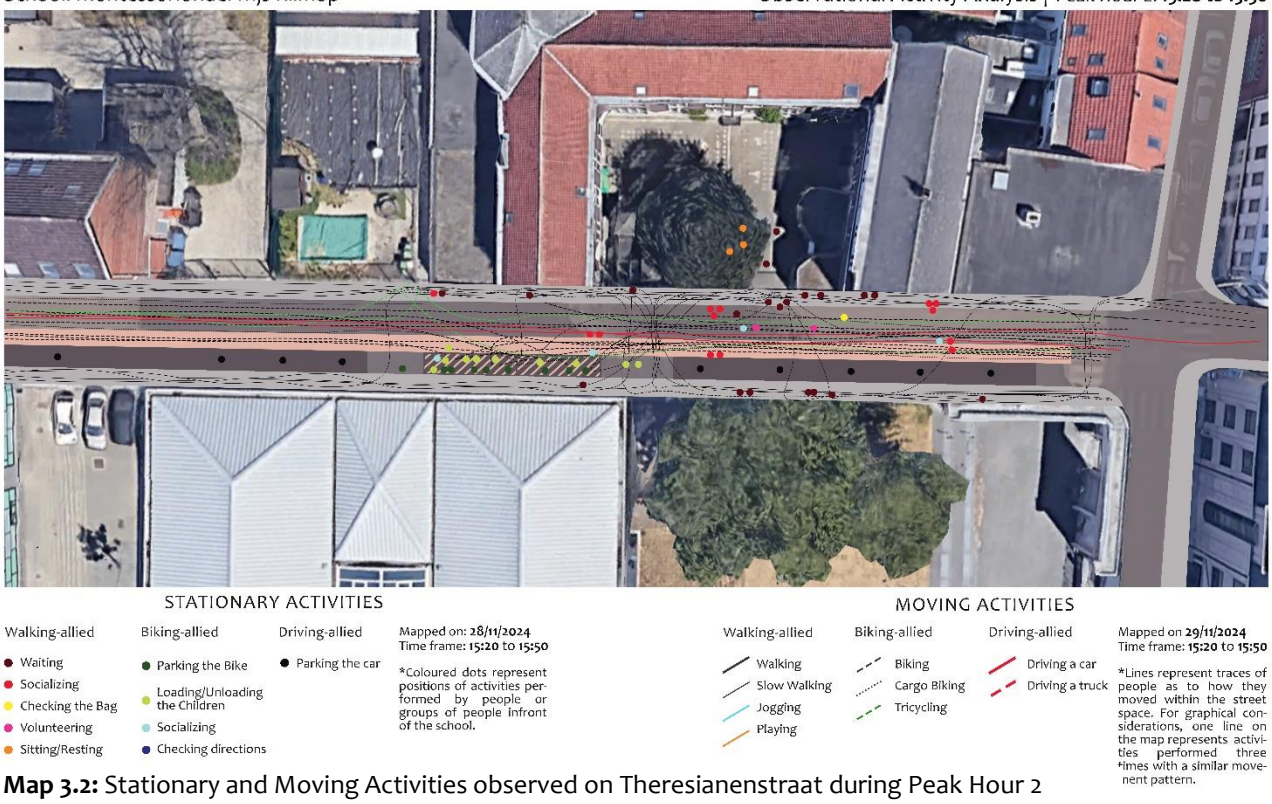
Case Study 3: Theresianenstraat
School: Montessorionderwijs Klimop

Observational Activity Analysis | Peak Hour 1: **08:00 to 8:30**

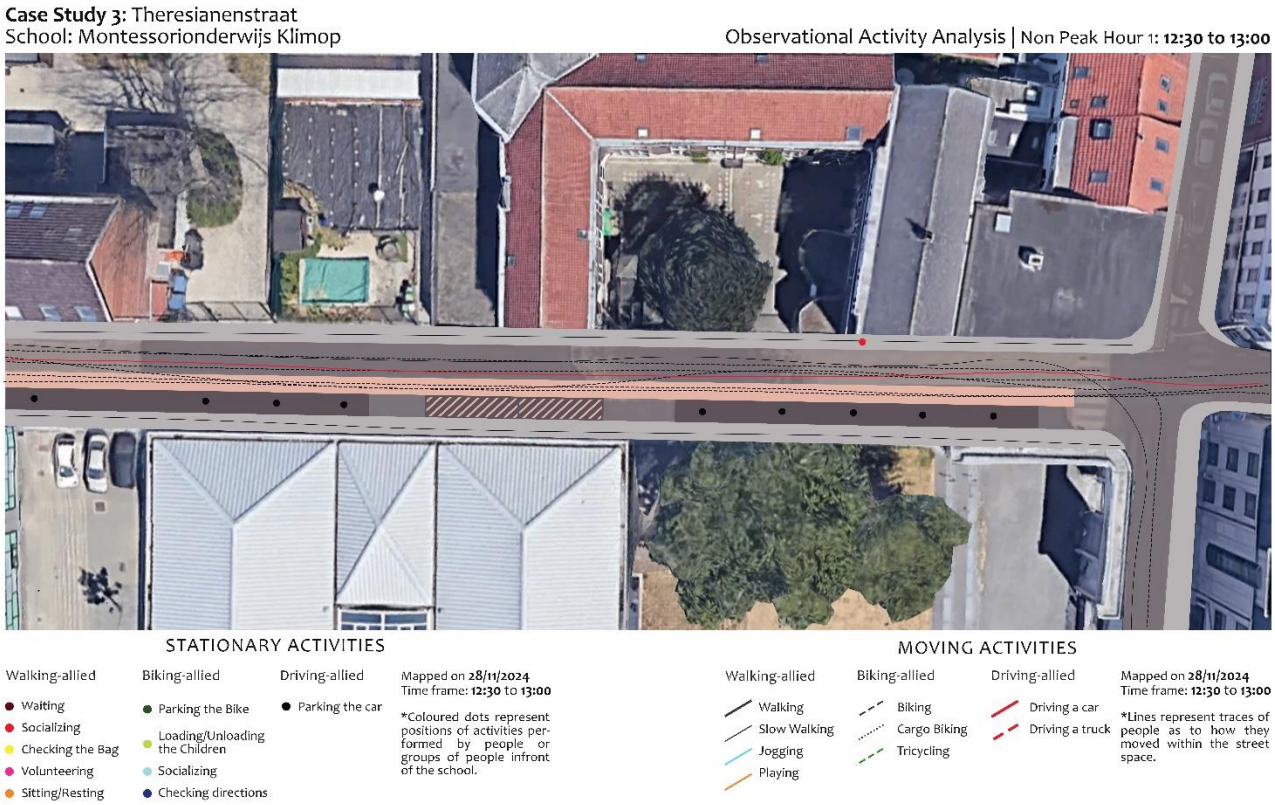
Map 3.1: Stationary and Moving Activities observed on Theresianenstraat during Peak Hour 1

Case Study 3: Theresianenstraat
School: Montessorionderwijs Klimop

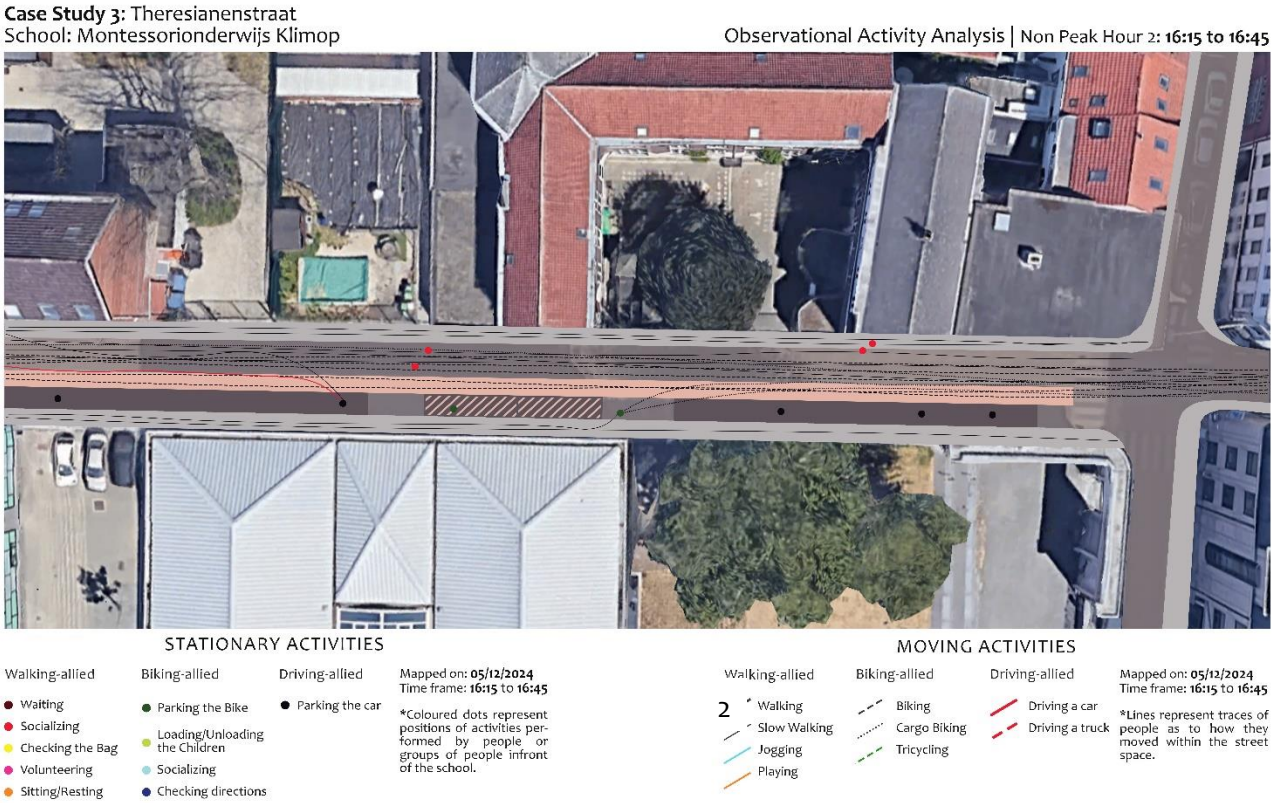
Observational Activity Analysis | Peak Hour 2: **15:20 to 15:50**



Map 3.2: Stationary and Moving Activities observed on Theresianenstraat during Peak Hour 2



Map 3.3: Stationary and Moving Activities observed on Theresianenstraat during Non-Peak Hour 1



Map 3.4: Stationary and Moving Activities observed on Theresianenstraat during Non-Peak Hour 2

6.2 Parental Survey

Title: Parental Perspectives on the School Streets in Ghent

Participants: Parents from three schools in Ghent

School 1: Freinetschool De Vlieger, Wasstraat

School 2: VBS De Krekel, Krekelberg

School 3: Montessori Klimop, Theresianenstraat

- Total Survey Responses: **236**

  School 1: 62, Response Rate: **30%**

  School 2: 119, Response Rate: **37.8%**

  School 3: 55, Response Rate: **31.3%**

- Surveys were distributed among parents on:

  School 1: 26/11/24 (via email newsletter)

  School 2: 26/11/24 (via email by the director)

  School 3: 05/12/24 (via email newsletter)

- Additionally, posters regarding the survey were pinned on noticeboards and shared on social media pages of the schools.

- Surveys were translated in Dutch, but Bulgarian and Turkish were also made available given the multicultural nature of parental ethnicities.

- All the three school directors have stated that the response has been overwhelming, with the survey responses exceeding typical rates for similar studies and internal surveys at the school.

Q1. Wat is de naam van de straat waar u woont? / **What is the name of the street you live on?**

Answers were collected and locations were geotagged using Arc-GIS to show parents' proximity to the school. **Refer Map 1.0, Map 2.0 and Map 3.0**

School 1:

V1. Wat is de naam van de straat waar u woont?

62 responses

Reginald Warnefordstraat
Schildersstraat
Engelstraat
Halvemaanstraat
Adolf Baeyensstraat
Jean Béthunestraat
Rozebroekslag
Land van Waaslaan 161

School 2:

V1. Wat is de naam van de straat waar u woont?

53 responses

Iepenstraat
Casinoplein
Ham
Anemoonstraat
Rietstraat
Hippoliet Van Peenestraat
Mezenstraat
Kiekenstraat

School 3:

V1. Wat is de naam van de straat waar u woont?

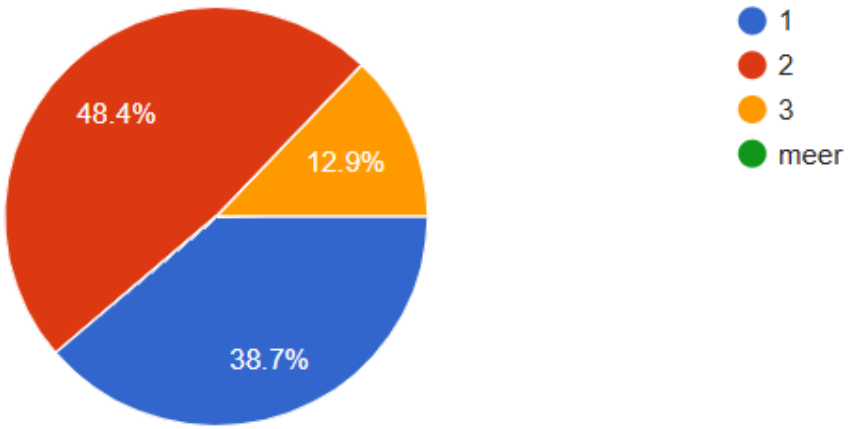
117 responses

Jos Verdegemstraat
Hogeweg
Kunstenaarstraat
Bouwmeestersstraat
Oscar Colbrandtstraat
Destelbergenstraat
Scheldestraat

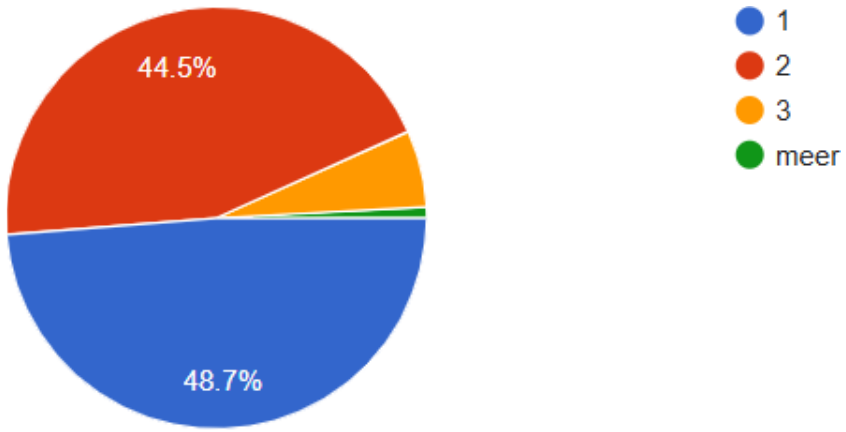
Q2. Hoeveel kinderen brengt u dagelijks naar school? / **How many kids do you drop off at the school daily?**

- 1
- 2
- 3
- Meer/**More**

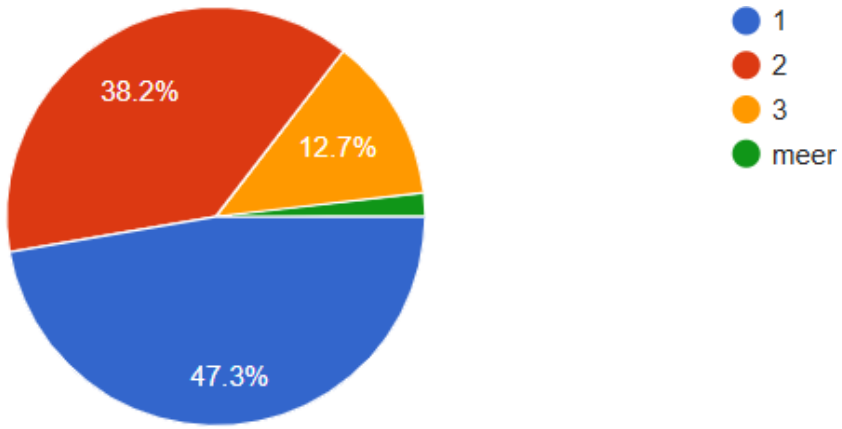
School 1:



School 2:



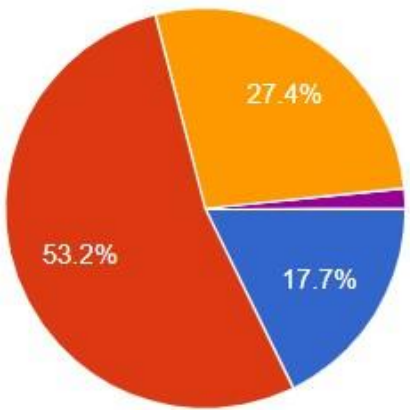
School 3:



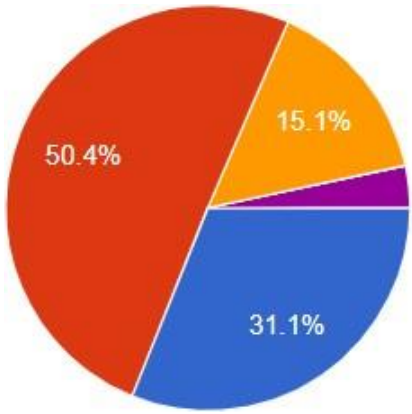
Q3. Welk vervoermiddel gebruikt u het meest wanneer u uw kind naar school brengt? / **What is the primary mode of transportation you use when taking your child to school?**

- Wandelenon / **Walking**
- Fiets / **Bike**
- Bakfiets / **Cargo-bike**
- Motorfiets / **Motor-bike**
- Auto / **Car**
- Openbaar vervoer (bus of tram) / **Public Transport (Bus or Tram)**

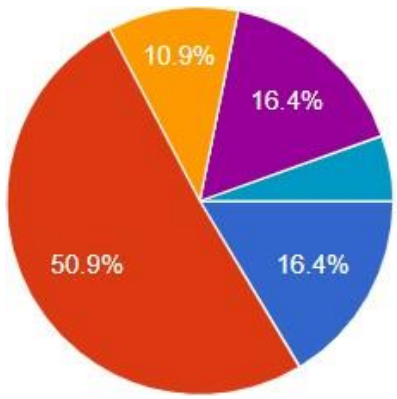
School 1:



School 2:



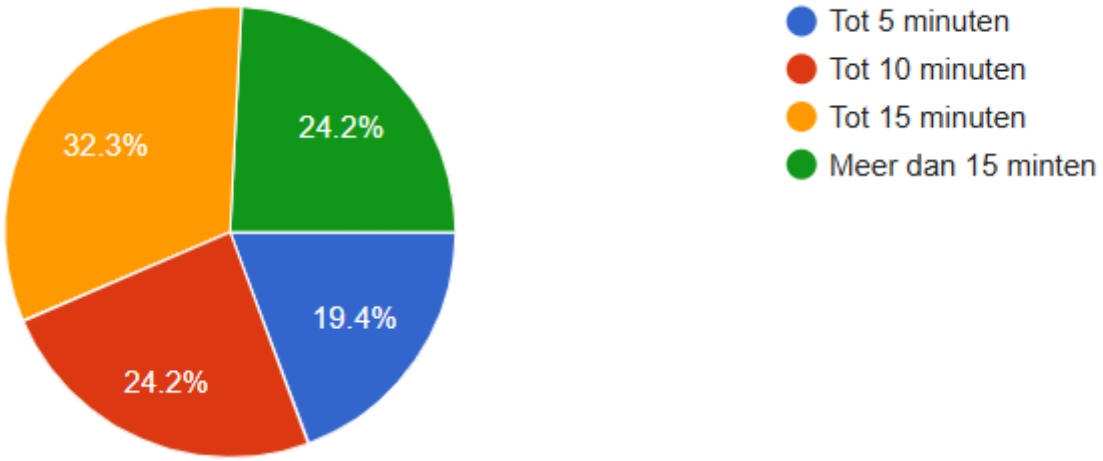
School 3:



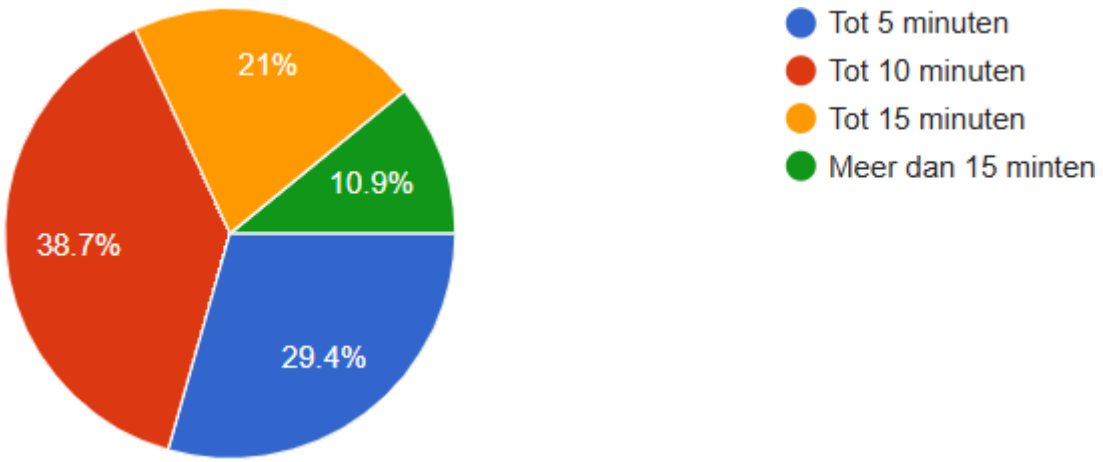
Q4. Hoeveel tijd brengt u door op het schoolterrein of op straat voor de school? / **How much time do you spend on the school premises or on the street in front of the school?**

- Tot 5 minuten / **up to 5 minutes**
- Tot 10 minuten / **up to 10 minutes**
- Tot 15 minuten / **up to 15 minutes**
- Meer dan 15 minuten / **more than 15 minutes**

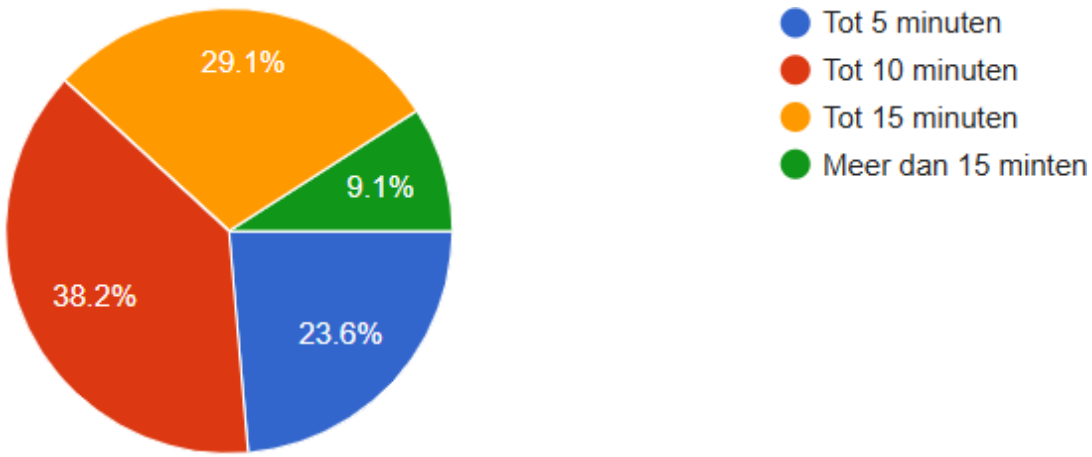
School 1:



School 2:



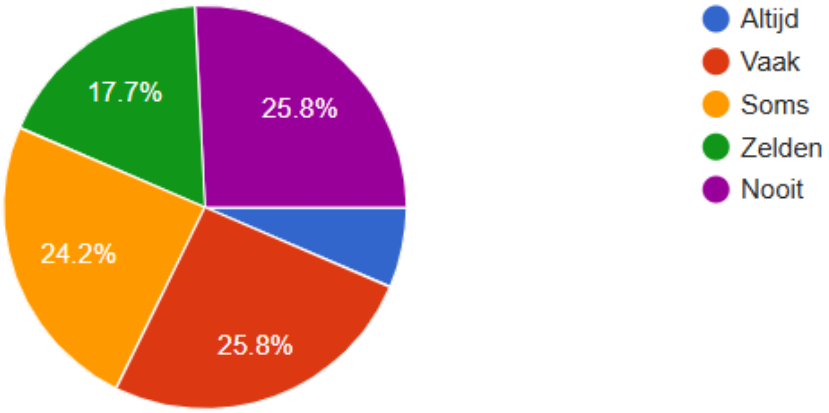
School 3:



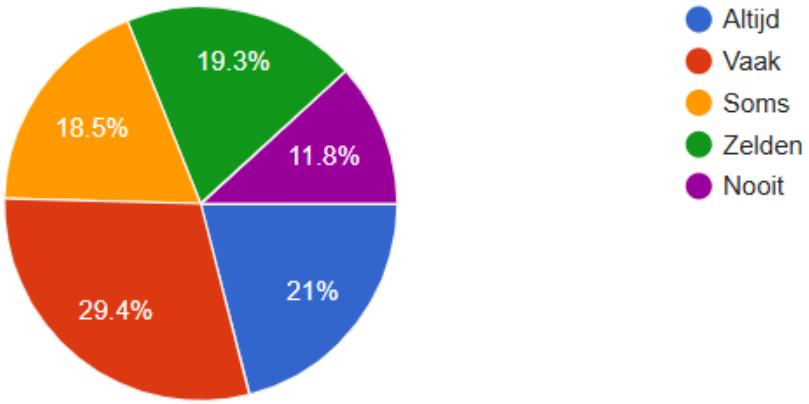
Q5. Hoe vaak komt u verkeersopstoppingen tegen in de buurt van de school tijdens het brengen en ophalen van uw kinderen? / **How often do you encounter traffic congestion near the school during drop-off and pick-up times?**

- Altijd / **Always**
- Vaak / **Often**
- Soms / **Sometimes**
- Zelden / **Rarely**
- Nooit / **Never**

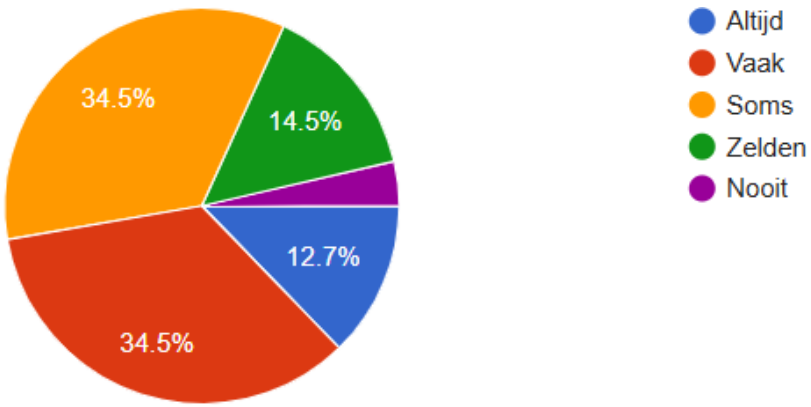
School 1:



School 2:



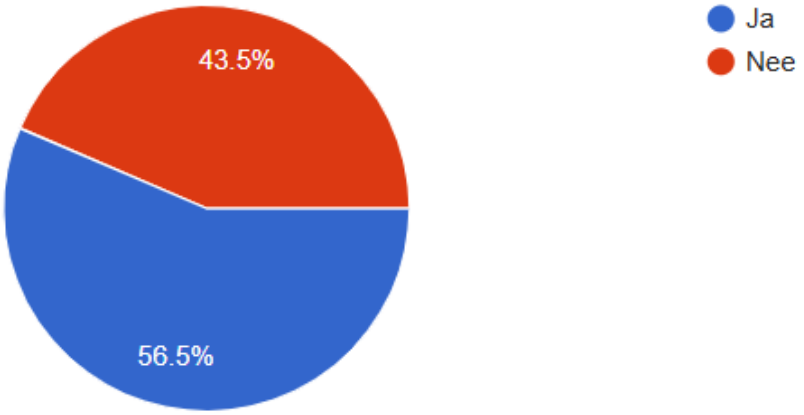
School 3:



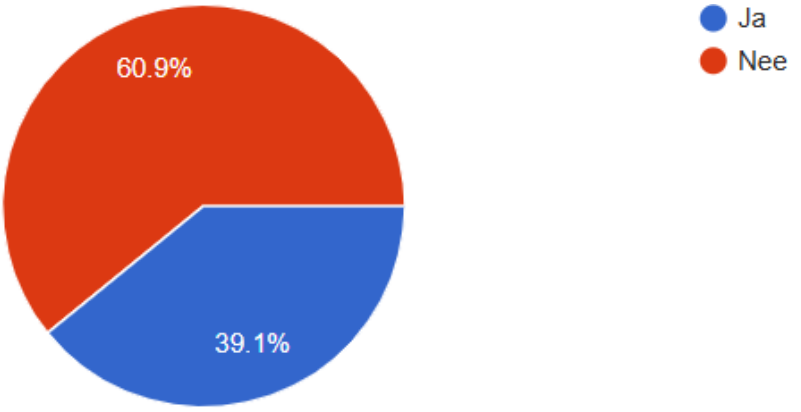
Q6. Is de huidige fietsenstalling voor de school toereikend? / **Is the current bike parking facility in front of the school adequate?**

- Ja / **Yes**
- Nee / **No**

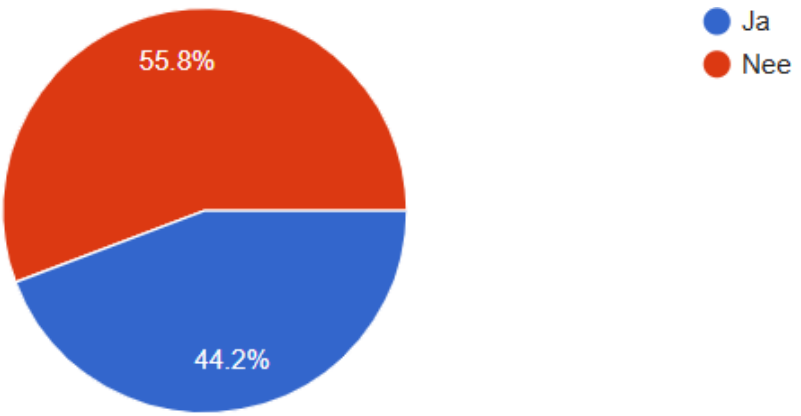
School 1:



School 2:



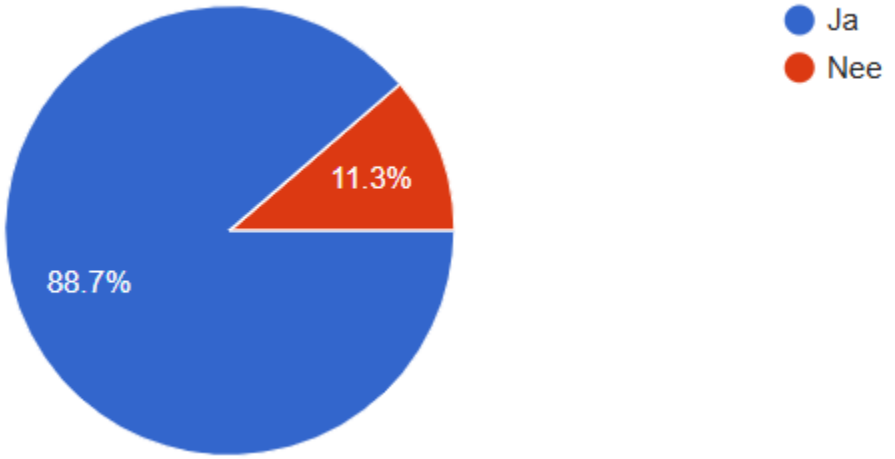
School 3:



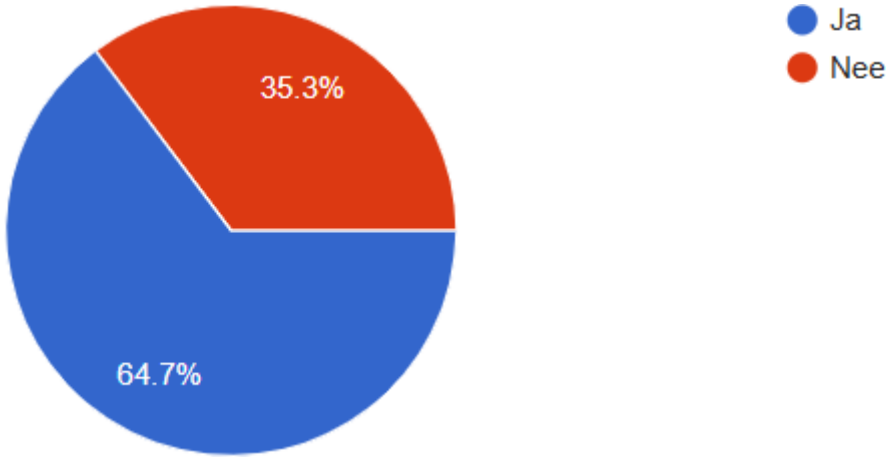
Q7. Hebt u dagelijks contact met andere ouders tijdens het brengen en ophalen van uw kind? / **Do you interact with other parents on a daily basis during drop-off and pick-up?**

- Ja / **Yes**
- Nee / **No**

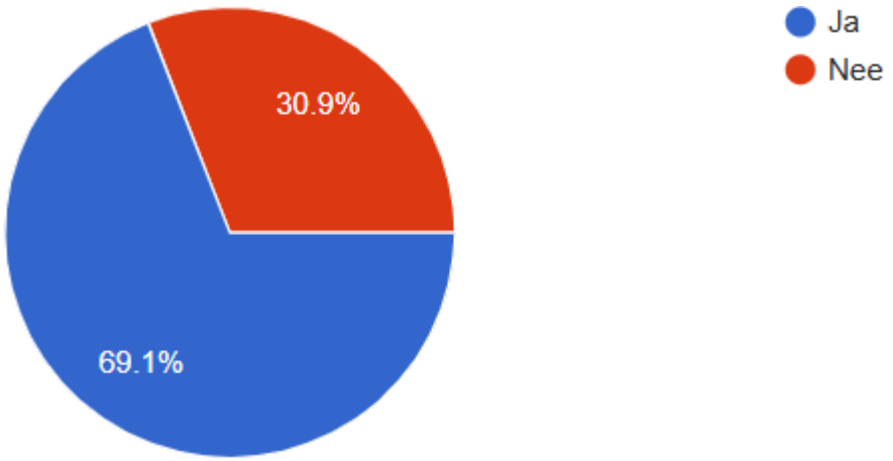
School 1:



School 2:

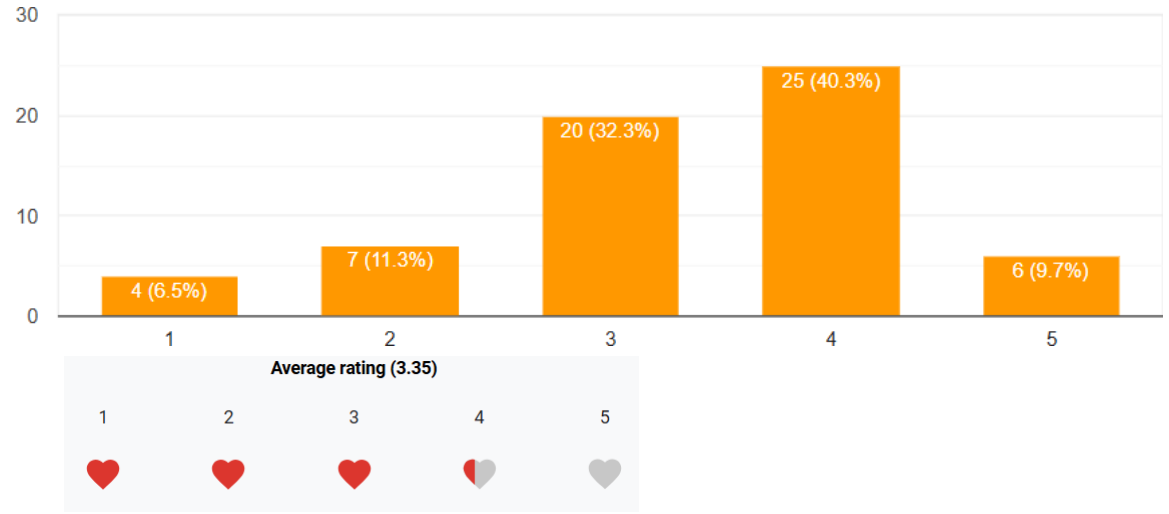


School 3:

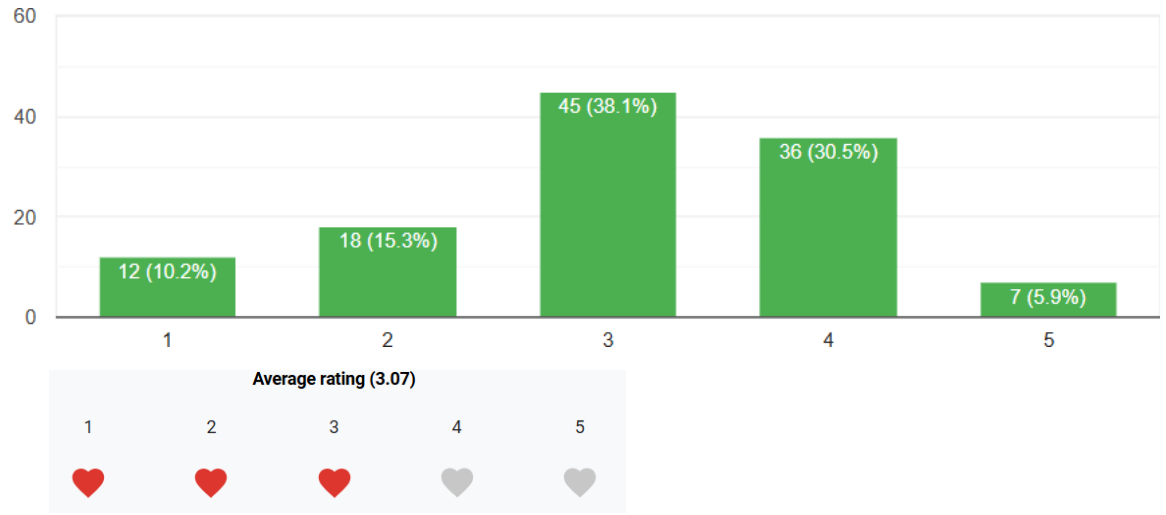


Q8. Op een schaal van 1 tot 5, hoe tevreden bent u met de algemene verkeersveiligheid rond de school? / **On the scale of 1 to 5, how satisfied are you with the overall traffic safety around the school?**

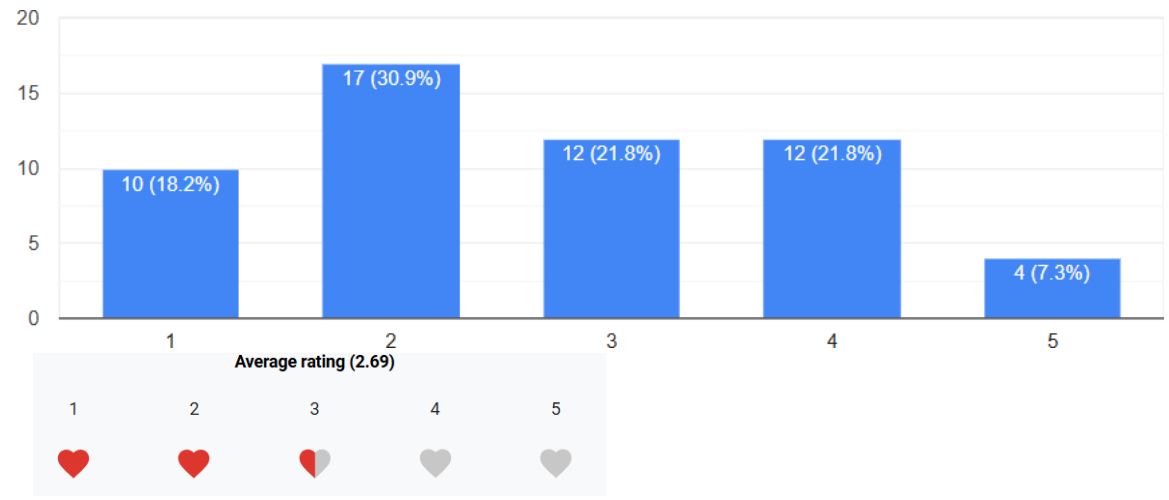
School 1:



School 2:



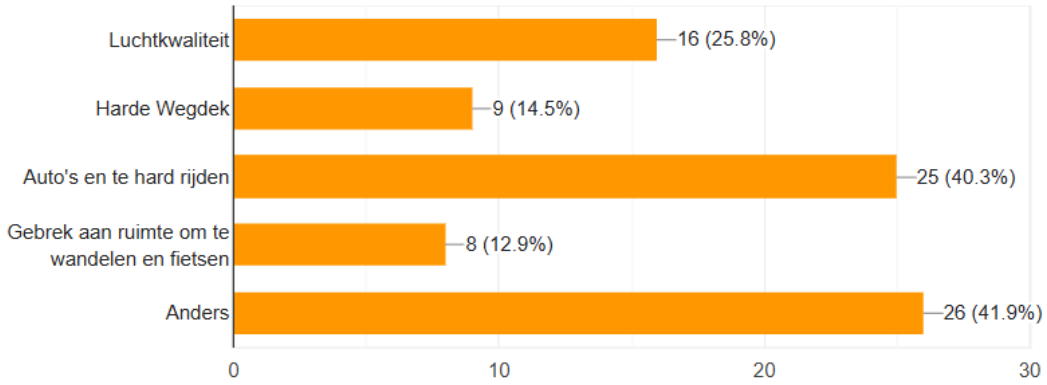
School 3:



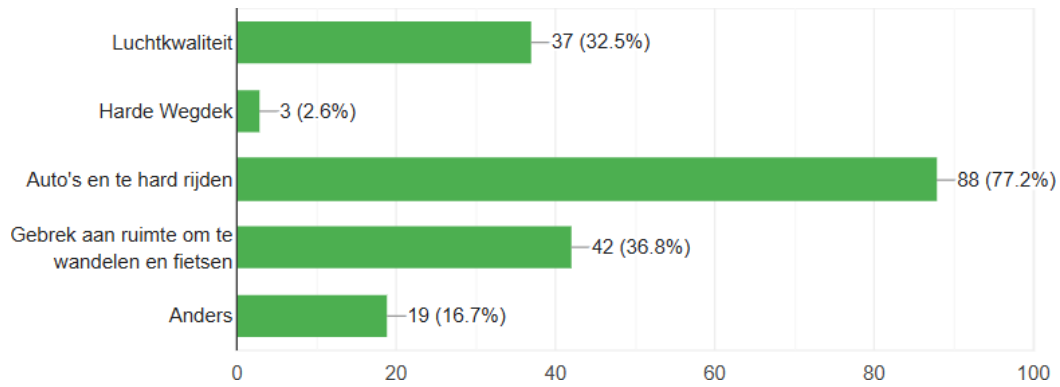
Q9. Wat zijn uw zorgen met betrekking tot de gezondheid en het welzijn van uw kind in de schoolstraat? / **What are your concerns regarding your child's health and well-being on the school street?**

- Luchtkwaliteit / **Air Quality**
- Harde Wegdek/ **Hard Road Surface**
- Auto's en te hard rijden / **Cars and Over speeding**
- Gebrek aan ruimte om te wandelen en fietsen / **Lack of space to walk and bike**
- Anders / **Others**

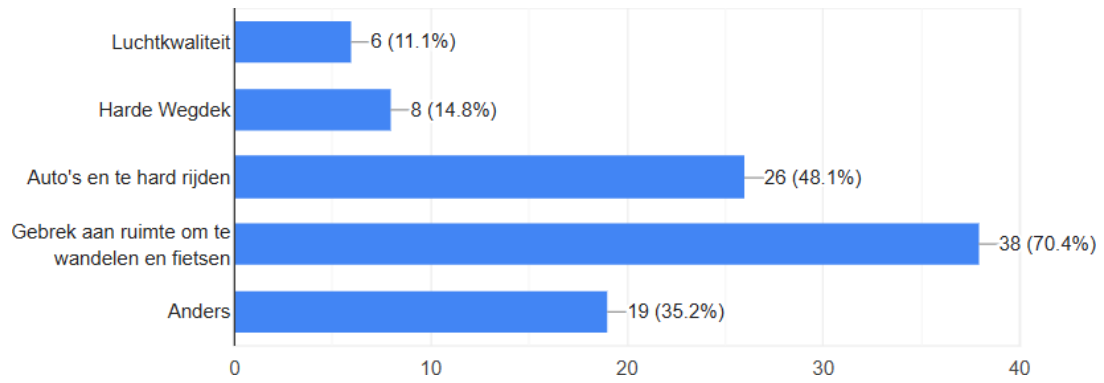
School 1:



School 2:

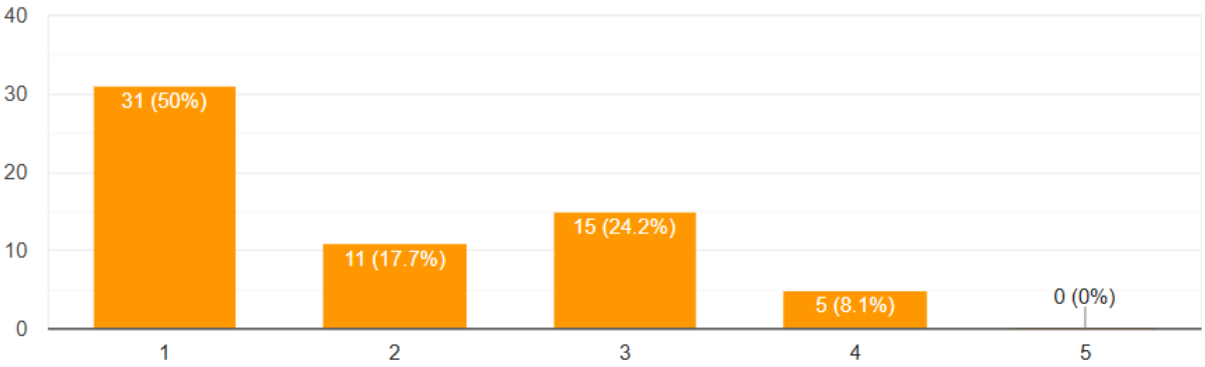


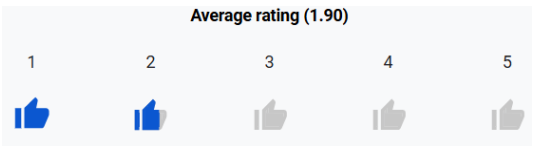
School 3:



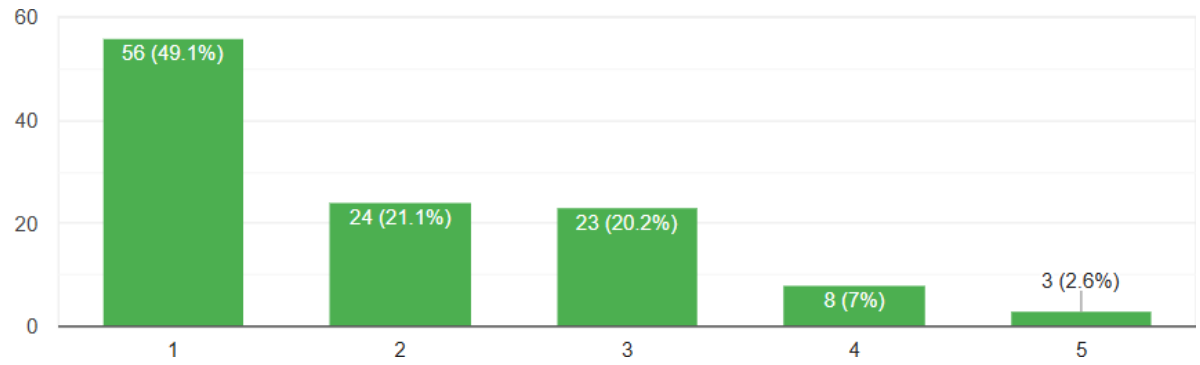
Q10. Op een schaal van 1 tot 5, hoe comfortabel voelt u zich bij het idee uw kind alleen naar school te laten gaan? / **On the scale of 1 to 5, how comfortable are you with the idea of letting your child go to school independently?**

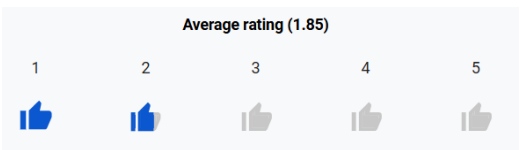
School 1:



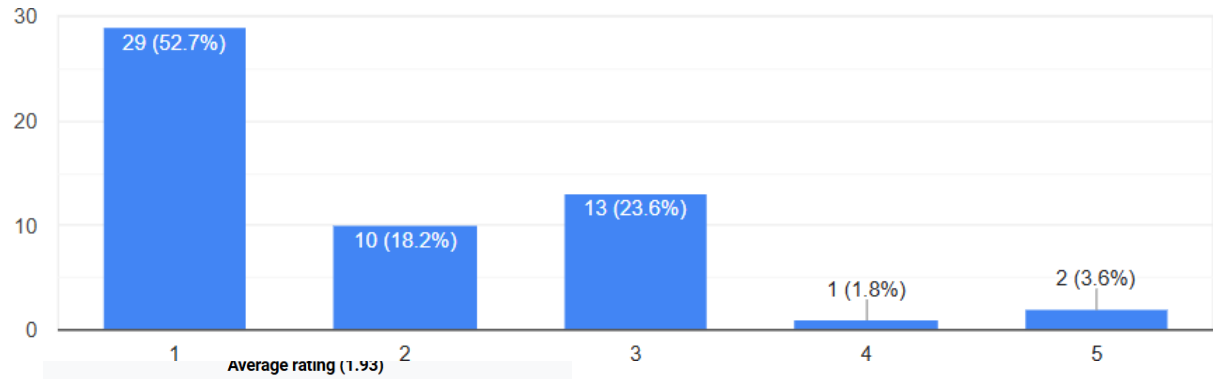


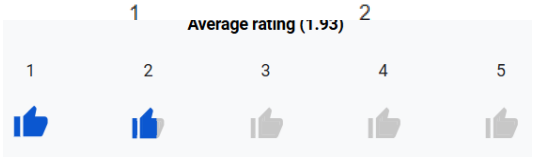
School 2:





School 3:





Q11. Denkt u dat de Schoolstraat in de huidige staat veilig is voor kinderen om te spelen tijdens en na de schooluren? / **Do you think the School Street, in its current state, is safe for children to play during and after school hours?**

- Ja, mijn kind speelt op straat / **Yes, my child plays on the street**
- Nee, straten zijn niet bedoeld om kinderen te laten spelen / **No, streets are not for children to play**
- De straat moet heraangelegd worden, zodat er meer ruimte is voor kinderen om te spelen / **The street should be redesigned to make more space for children to play**

School 1:

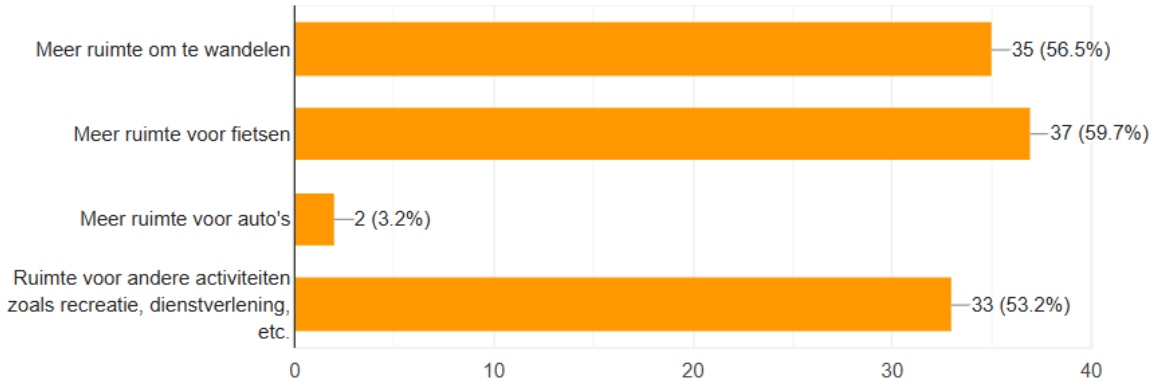
School 2:

School 3:

Q12. Welke van deze vervoermiddelen neemt de meeste ruimte in op straat? / **Which of these means of transport needs more space on the street?**

- Meer ruimte om te wandelen / **More space for Walking**
- Meer ruimte voor fietsen / **More Space for Biking**
- Meer ruimte voor auto's / **More Space for Cars**
- Ruimte voor andere activiteiten zoals recreatie, dienstverlening, etc. / **Space for other activities like recreation, services, etc**

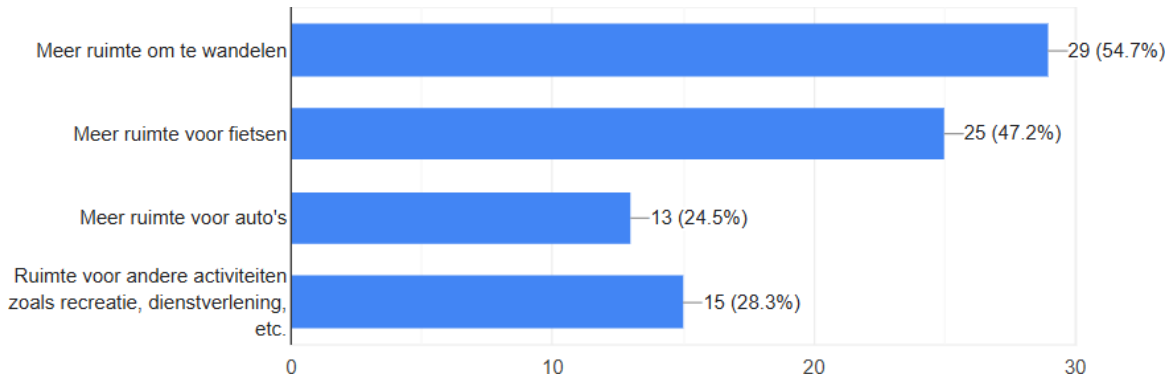
School 1:



School 2:

Response cannot be considered due to a mistake in Dutch translation from the author

School 3:



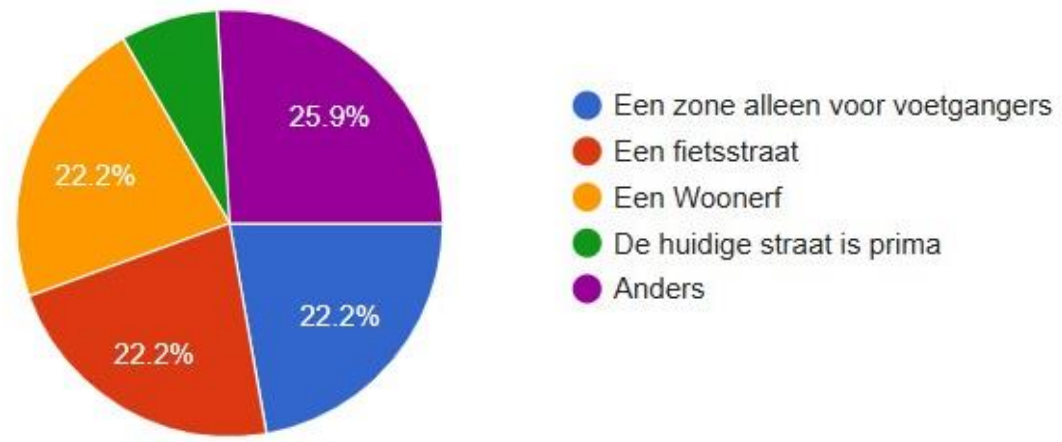
Q13. Hoe zou u de huidige straat veranderen als u de kans kreeg? / **How would you change the current street if given the opportunity?**

- Een zone alleen voor voetgangers / **A Pedestrian only zone**
- Een fietsstraat / **A Bike street**
- Een Woonerf (Woonstraat) / **A Woonerf (Living Street)**
- De huidige straat is prima / **The current street is alright**
- Anders/**Other**

School 1:

School 2:

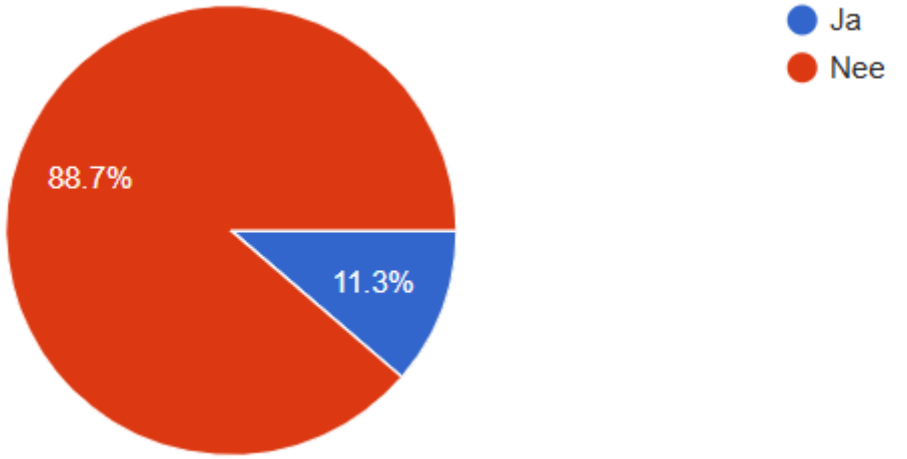
School 3:



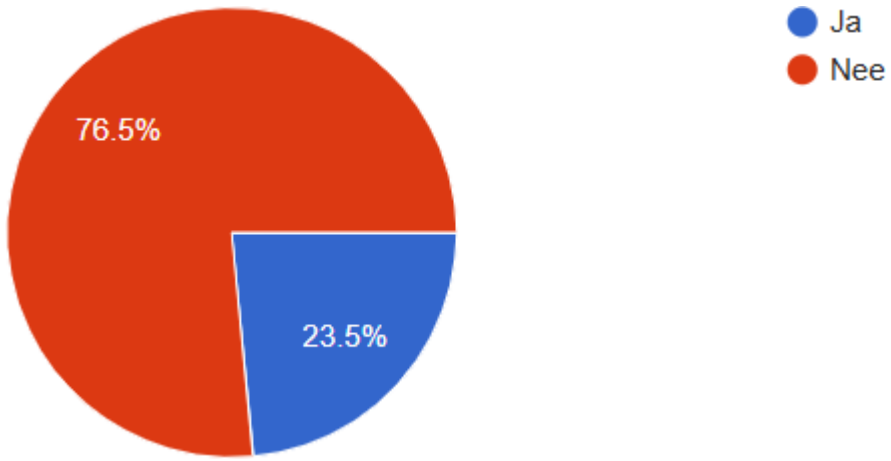
Q14. Zou u bereid zijn om een paar uur per week vrijwilligerswerk te doen om namens de school het verkeer te regelen? / **Would you be open to volunteering a few times per week to help manage traffic on behalf of the school?**

- Ja / **Yes**
- Nee / **No**

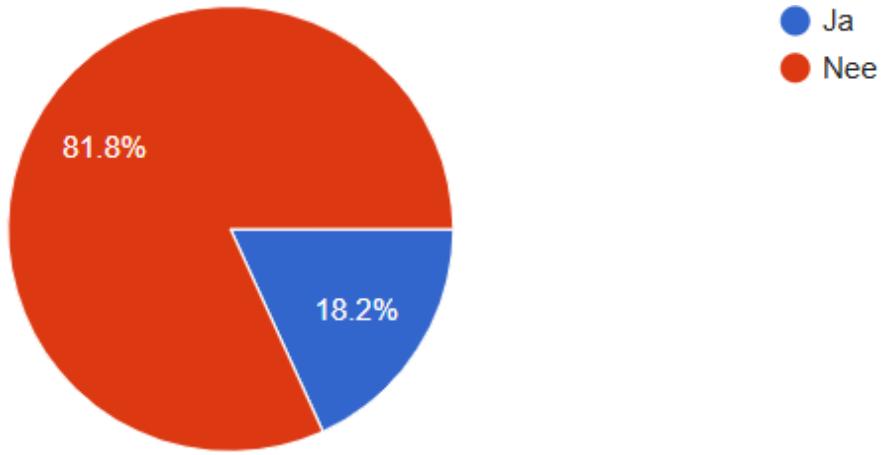
School 1:



School 2:



School 3:



Chapter 7 - Data Integration and Discussion

This section interprets the findings of the data collection phase with a particular focus on analyzing the two data sets in the same light. To interpret the findings in relation to RQ1, it is essential to study the current allocation of space according to the methods in existing studies. In Section 7.1, existing analysis approaches are applied to the data collected on Ghent's case studies. Results from the application of existing frameworks with an inherent focus on travel modes are purely quantitative and invariably necessitate a need for alternative methodologies. This forms a basis for the Activity-based approach, which involves integrating the observational and survey datasets.

The data collection involved two phases – the fieldwork which culminated in drafting the observational activity maps and individually surveying parents from all the case study school streets. This previous step has thus resulted in two primary data sets of two kinds – 1) Observational Activity Maps and 2) Parental Survey Responses. Activity Maps give us data that is visual and qualitative in nature, documenting the use of street space in fixed lived temporalities. On the other hand, the dataset of survey responses is quantitative in a sense that it quantifies perceptions of a stakeholder group. From survey responses, data on modal split, satisfaction levels, needs and wants, and views on the overall performance of the School Streets was obtained. In methodological terms with respect to the theoretical framework for this thesis, the maps represent Lived Space whereas the Surveys reflect spatial perceptions (Perceived Space). The next natural step is the integration of the two datasets (Section 7.2) as they collectively decipher the Interpreted Space. Section 7.2.1 develops comparative descriptions of the three case studies across various themes that are characteristic features of the School Streets program. These themes range from the effect of spatial allocation on the school streets on modal behavior (7.2.1),

the need and nature of parking facilities (7.2.2), spaces for social interaction (7.2.3), and play (7.2.4) to what drives the notion of safety (7.2.5), efficient management (7.2.6), and further expectations of the stakeholders (7.2.7). Under each specific theme, the interplay and discrepancy between the allocated, lived and perceived space is studied. Section 7.3 intends to represent the assessed Interpreted space visually with the help of thematic maps.

7.1 Mode-based Analysis of Street-Space Allocation

Before moving to the activity-based analysis of the data collected for this thesis, it is essential to perform an analysis of the allocated street-space based on existing studies. The mode-based analysis approach reflected in existing literature largely corelates user share and road space available to each mode. However, there is a considerable methodological variation in existing studies. With the help of (existing and collected) data on Ghent we will perform the mode based-street space allocation analysis based on previous studies in the relevant literature.

The motivation to perform this step is twofold – first, to study how analysis of the street space adopting an activity-based approach differs from the traditional mode-based analyses. Secondly, we will also observe how the measurement of the Interpreted Space after the data integration process contradicts or contributes to the mode-based understanding of street space. For this step, we have geoprocessed data on Allocated Space for three different school streets in Ghent. Existing studies have either used modal data from available municipality data sets or from physical observational counts. The district-wise modal data for the three case studies is given the table below (Stad Gent, 2020):

District	Walking	Bikes	Motorbikes	PT	Cars
Gent Rand (CS1 and CS2)	13%	36%	1%	18%	32%

Gent Centrum (CS3)	25%	34%	1%	12%	27%

Table 6: District-Wise Modal share according to the 2018 Displacement Survey (Source: District Mobility Plan Dampoort-Old Ghentbrugge, Stad Gent, 2020)

We will use the above data for performing mode-based analyses corresponding to studies that use city-level modal data (Gössling et al., 2016). However, for studies that use streetwise observational data like traffic counts, we will use modal split data from the parental survey. While traffic counts from the school streets were not recorded during the fieldwork, the survey response is still a primary dataset that also corresponds to the fieldwork observations on every school street. Also, in the case of Needs-gap analysis (Lefebvre-Ropars et al., 2021), to calculate the travel demand we will use the survey data as it shows the exact travel demand at peak hours of the day.

Case Study	Pedestrians	Bikes	Cargo-bikes	PT	Cars
Wasstraat (CS1)	18%	53%	27%	0%	2%
Krekelberg (CS3)	13%	50%	15%	0%	4%
Theresianenstraat (CS3)	17%	60%	11%	5%	16%

Table 7: Modal Share of School Trips for each case study (Source: Parental Survey Q3)

On a preliminary basis, we can observe how superimposing city-level modal share data for an individual street level analysis has its limits. Contrastingly, observational counts reveal contextual nuances of mobility behavior. For example, in our case of School Streets – the independent evaluation of Cargo-bikes is a key factor - not only due to the larger space they occupy but also because they alter the overall mobility experience for a parent dropping more than one child to the school. On the other hand, the relevance of public transport share is minimal, as no PT vehicles operate through any of the case-study streets. Even in the case of CS3, which holds 5% PT modal share, the journeys to the school on Theresianenstraat are made on foot, because the tram stop is located outside the street. However, since there is no dedicated space allocated to cargo-bikes, mode-based analysis demands us to club

the share of bikes, cargo-bikes or motorbikes into a cumulative share for bikes. The following results are achieved when the above modal share data is compared to existing street sections for the three case studies individually:

Case Study	**CS1**				**CS2**				**CS3**			
Travel Mode	**W**	**B**	**C**	**PT**	**W**	**B**	**C**	**PT**	**W**	**B**	**C**	**PT**
Existing Allocation of Street Space (in %)	34	56	8	0	34	52	17	0	17	14	64	0
Parameter	**Ideal Street Space allocation for each mode (in %)**											
Modal Share (trips per mode)[1]	13	37	32	18	13	37	32	18	25	35	27	12
Modal Share weighted by per capita space requirement[1]	1	17	77	5	1	17	77	5	3	18	75	4
Needs-gap assessment[2]	18	80	2	0	31	66	4	0	22	62	16	5
Rawlsian Justice (Improve accessibility for the least able)[3]	++	+	-	NA	++	+	-	+	++	+	-	+
Rawlsian justice of "street as places" [3]	++	+	-	NA	++	+	--	NA	++	+	--	NA
Local Environmental Efficacy[3]	+	++	--	NA	+	++	--	+	+	++	--	+

Table 8: Comparative results of ideal Street Space Allocation by mode according to various parameters in existing studies. W = Walking, B = Bikes, C = Cars, PT = Public Transport. 1 = (Gössling et al., 2016), 2 = (Lefebvre-Ropars et al., 2021), 3 = (Creutzig, F. et al., 2020).

The so-called Mode-based approach reflected in existing literature shows significant methodological diversification. The gaps lying in previous studies have already been established theoretically in a previous section. However, it was important to study how this approach fairs in the case of Ghent. A street-level comparative analysis based on modal share reveals significant disparity with existing ground conditions. For example, if spatial allocation is to be in direct proportion with the modal share as (Gössling et al., 2016) suggests, then for CS1 and CS2, the space dedicated to pedestrians should be cut down to half the existing space. This scenario would result in minimizing the sidewalks to half of their current width, which are already very narrow given their use. At the same time, some parameters suggest a dedicated road space for public transport vehicles – which is unviable given all the case studies are internal neighborhood streets.

The needs-based assessment calls for supply of the street space respecting peak mode-based demand. This parameter generates favorable results for increasing street space for bikes and reducing it to the least for cars given their respective modal shares. In a way, this assessment favors the sustainability scenario. However, it also says that pedestrians should have less space than they currently enjoy on two out of the three streets. It is to be noted here that if cars are to be allowed to pass through the pedestrianized CS1 again, a needs-based assessment would demand allocation of space to cars as well.

The latter three parameters are "allocation mechanisms" derived out of ethics of justice by Creutzig et al. (2020) and generate more qualitative results. In the above table, + represents additional space should be allocated and – represents space should be taken back in an allocation scenario corresponding to the parameter. The parameter of Rawlsian Justice for "Streets as Places" is particularly relevant as it highlights the role of school streets as essential public spaces that bring people together. At the same time, Local Environmental Efficacy caters to the concerns around air quality and urban heat islands in school zones.

The nature of this analysis, despite the methodological variance, is purely quantitative. Moreover, Mode-based analyses strive to calculate how much space should be given to each travel mode in percentages. As discussed earlier in the literature review (Section 4.1.5), this approach assumes the role of streets for purely transit use and divides the street space among transport modes. Concurrently, this overlooks the aspects of street life related to social interaction, recreation, greening and landscaping among many others. Tapping into this gap, an activity-based approach was developed for this thesis. The defining feature of the so-called Activity-based approach is the integration of two distinct primary datasets - Observational Activity Maps that depict temporal use of street-space and Parental Surveys for the three School Streets case studies.

7.2 Activity-based Analysis of Street-Space Allocation

7.2.1 Thematic Integration of the two data sets

Theme 1 - Modal Behavior

In the previous section, we discussed how mutually comparing modal share with the share of allocated street space leads to a restrictive understanding of street-ownership. The judgments drawn on the basis on such comparisons with respect to mobility justice could also be self-fulfilling in specific scenarios. In this step, we will interpret the results of the observational mapping and study them in conjunction with the data from parental survey responses. With this, we develop a qualitative discussion on how the ground conditions, especially the varying allocation scenarios in the three case studies have altered the modal split of school trips.

Modal behavior for trips to the school is dependent on several contextual factors. The School Streets program in Ghent has not only been intended to tackle concerns around safety and pollution but as a result it also has significantly altered the mobility patterns of neighborhood-level trips. We witness a significant adoption of bikes among parents and children for their daily trips to schools.

In Ghent, like other Flemish cities, parents can prioritize their ward's admission to a school near they live or work. This ensures daily convenience for parents to drop their kids at their schools on their way to work and favors them in making shorter trips overall. Proximity to the schools is thus one of the major factors that has favored parents' preference for bikes as a primary mode of transport. According to the survey (Q3), the combined modal share of bikes and cargo-bikes was the highest for CS1 at above 80.6% followed by 65.5% for CS2 and 62% for CS3. All the cases record for an individual modal share of bikes around 50%. Upon inspection, many factors have worked in favor of adoption of bikes – a trend which has gradually grown over the years (Stad Gent). From a spatial allocation perspective, a network of bike lanes and bike streets in areas around the schools make for a safer bike travel on a neighborhood street. A bike street or a 'fietstraat' is an internal street where the entire driveway is painted red to indicate that cars cannot overtake bikes, and they always have to be behind the bikes on these streets. CS1 and CS2, which lie in the neighborhood of Dampoort-Sint Amandsberg have an active network of such fietstraats, which parents use on a daily basis to access the school streets. These include Brunaustraat and Jean Béthunestraat and bike lanes on major streets like Dendermonsesteenweg and Land van Waaslaan. Proximity to the School and the ease of daily sustainable mobility are two external factors that have contributed to achieving the intended goals of school streets. The significant modal share of bikes in school trips is thus a composite result of congenial spatial conditions for bikes on the school streets tied to the backdrop of a functional network of bike-friendly streets in the neighborhood.

Another notable trend is also the adoption of Cargo-bikes in case studies. 'Bakfiets' are a type of front-loading cargo-bikes specifically designed to carry children and are typically found in Belgium, the Netherlands and other Scandinavian countries. Bakfiets feature a covered box typically in front of the rider, with seats for children or storage. Another type of cargo-bike that was observed in school trips was a 'Longtail' which has an extended platform above the rear tire for children to sit. Parents making

a choice for a cargo-bike to transport their children to school was found to be the highest in CS1 at 27%, 15% for CS2 and 11% for CS3. This statistic should be considered in parallel with the fact that approximately 40% of parents in every case have reported dropping more than one child to school daily.

Following the discussion of factors that have facilitated the adoption of sustainable modes of transportation and contributed to a car-independent environment, attention is directed to fieldwork observations. People with different travel modes utilize and engage with the allocated street space differently. In the case of CS1, the design of school streets largely fulfills its goal of promoting active transport systems. The car-free space creates a safer street environment for children to walk, run and bike, minimizing congestion and air pollution. Bikes dominate the street in the morning drop-off hour with larger speeds and the space they occupy. This relegates the pedestrians to the allocated sidewalks, who find it difficult to walk on the street – a space they are meant to share with the bikes. Measures like speed barriers or urban furniture elements could keep the rising bike speeds in control while increasing pedestrian engagement on the streets - similar to the models implemented Barcelona or Paris. The allocated space for pedestrians is minimal for CS2 and CS3, given the narrow sidewalks that run along these streets. The current conditions are challenging for pedestrians on both these streets, as many parents walk with multiple kids on a sidewalk holding their ward with one hand and their school bag in another. This activity necessitates wider sidewalk space, especially during the peak hours. The allocated walking space - i.e., the sidewalks - is insufficient, as it barely serves the basic function of providing space for walking. Consequently, it fails to support other aspects related to pausing and interaction, especially considering the residential context in which they are located. In the case of CS3, the bike lane painted on the street space is barely noticeable due to its narrowness. This causes bikers to exceed their limits, and they are left to use the street space alongside other vehicles. While on paper, we notice an allocation of street space for bikes, the ground realities reflect an unsafe scenario for them, especially at the peak hours. The bike lane, as a lived

space, is incoherent with its designated allocation being a part of the roadway on which bikes occasionally pass, and cars frequently encroach.

Theme 2 - On-Street Parking

Parking for bikes is a fundamental determinant given their large-scale adoption as a preferred travel mode for school trips. Naturally, many schools are not equipped to develop vehicle parking facilities inside their compounds. The satisfaction levels for parking facilities were recorded in the parental survey. At the same time, aspects like the everyday usage and occupancy of the parking facilities, the nature of allied activities that took place, etc. were studied during the observational phase. Based on the integration of these two data types, we develop an understanding of how allocation of parking spaces determines the use of street space and adoption of bikes as a primary travel mode.

It was noticed that parking spaces were used by parents and children alike for parking all types of bikes – including tricycles. CS1 possessed an independent parking facility in its front yard, the largest among all three schools. This space was shared between the children and the parents, even while intentionally being reserved only for the children. In addition to this, on-street parking stands were also placed on the streets owing to the growing demand. The majority of the bikes parked in CS2 and CS3 were on the stands placed outside the school gates. Additionally, CS3 allowed minibikes to be parked by the children inside one of its courtyards, that could only be accessed with a separate gate.

A majority of the respondent parents were unsatisfied with the allocated bike parking facility, with CS2 recording the least levels of satisfaction (Q6). Observations on the ground support this fact, when parents were left to park their bikes exceeding the limits of the space reserved. In congested environments at peak hours, some bikes were also parked on the street, giving rise to newer conflicts between pedestrians and bikers.

On the contrary, dedicated parking spaces, especially in CS1 and CS3 also opened as spaces for interaction among parents and children alike. It became the place where people saw each other, greetings were exchanged and short conversations were had, especially during the dop-off and pick-up hours. Further elaboration on the theme of Social Interaction is developed in the next dedicated section.

Theme 3 - Social Interaction

On School Streets, many people gather on a routine basis to carry out similar tasks. Whether it is teachers heading to work, children going to the school, or parents dropping them off– even if these tasks are performed individually, there lies a collective attribute to this shared routine. The mutual encounters among people linked to their school-related travel naturally make the school streets a 'place' for social interaction.

This aspect of social interaction on school streets is echoed by parents who note that picking up their child from school is an activity that inherently involves or rather demands interacting with others. Parents were observed to spontaneously engage in a conversation with the teacher while dropping off their child. Before the school gates open in the morning, the child and the parent briefly instruct each other before kissing a mutual goodbye. After this, school streets become hubs of short conversations among parents before they head to work or home. During the pick-up time from the school, the process repeats. It thus becomes vital for the street to encompass these interactive aspects of school routines. While mapping the spots of social interaction on the school streets during the observational fieldwork, it was observed that the ground conditions that provide for interactions to happen differ across the three case studies. In CS1, most of the teacher-parent and parent-parent interactions took place in the dedicated bike-parking and the car-free zone of the street in front of the school. Interactions between children and parents also happened on the street which provided a safer, unhindered environment for conversations to take place. Sometimes, the parents also used the park edges to

engage in short exchanges while looking after their children playing on the street. For this street, resoundingly 89% of the parents agreed to interacting with other parents on a daily basis. This statistic drops down to 69% for CS3 and 64% for Cs2. No matter whether the streets create a conducive atmosphere for mutual interactions, they are bound to take place on the streets in front of schools. Due to the reconfiguration of space on Wasstraat, the average time spent by families on this street about fifteen minutes.

Observational takeaways from CS2 with respect to social interactions note that parents gather at the school gates a few minutes earlier before they are opened for the collection of their respective wards. At this moment, a hoard of parents either waiting for their children on the sidewalks or engage in short conversations. After the bell is rung at 15:30 every day, the street gets crowded, and due to lack of dedicated space for parking bikes, the conversations that happen after picking up the children is minimal. Even if the street is closed for through car traffic, it doesn't transform into an ideal place for gathering or interpersonal engagement substantially. The majority of parents spend up to ten minutes on this street, which as per the observations involved parking the bike, collecting the children and loading them on the bike.

CS3 displays a similar scenario when conditions for social interactions are examined. Due to a shared bike parking space that is reserved for parents during the daytime, an increased level of interactions is observed here as compared to CS2. Before the final bell rang at the end of the school, parents waited for their words in large numbers. With narrow sidewalks (0.6 m on each side) and minimal space to stand, parents were seen avoiding engaging in any other activity than parking their bike. Some interactions did happen during the peak hours in the middle of the street, however, conditions remained unsafe as through vehicle traffic was not temporarily blocked unlike on other school streets in the city.

Thus, the nature of spatial allocation greatly alters how people behave on the streets. Transport-centric street-space allocation results in a street which is a contested space

among different travel modes. However, if the role of a street as public space is recognized, people ascertain their ownership over it in many ways. Fieldwork observations alongside takeaways from the parents convey that social interaction is an intrinsic activity tied to the daily school errands and thus requires an essential space on streets.

Theme 4 - Spaces for Play

The role of dedicated spaces for play demonstrates significant differences in terms of allocation, its perception and the lived reality across the three case studies. CS 1 – Wasstraat operating as a completely pedestrianized street blocked for cars, has a dedicated patch of street coated in paint. The colorful patterns on the gray asphalt surface imply invocation of activities like jumping, hopping and running among children – signaling that they have an independent space to engage in physical activity in the middle of the street. However, in terms of an allocated space for play, neither CS2 nor CS3 feature any dedicated areas for physical activity, furniture or play. The lack of intentional allocation for such use is also underscored by contextual factors as CS1 connects a school and an open park, whereas such physical infrastructure is absent in other case studies that have purely residential or institutional buildings around.

This disparity in allocation is also reflected in the Interpreted Space, as indicated independently in the observational and survey datasets. In terms of spatial perception, the surveys across the case studies display variations in acceptance of street space for the use of physical activities and the need to reconfigure street sections for this purpose. Upon being asked about the safety of the street in terms of children being able to play (Q11), 29% of parents responded that their wards regularly play on the school street for CS1. This percentage significantly drops to 12.4% for CS2 and drastically drops down to 0% for CS3. This data clearly indicates how allocation directs user perceptions, as well as how significantly reducing car traffic can open the street for uses like play and social interaction. At the same time, the number of

parents who discredited that streets could be a place for physical recreational activities was the least for CS1 and the highest for CS2 (49.6%) attributing the nature of the street as an important link that flows traffic through the neighborhood. This higher public acceptance for allowing the street for alternative uses in CS1 can also be traced back to Wasstraat being experimentally operated as a "Living Street" in 2014 (VanHoose & Bertolini, 2023) before being approved for permanent car closure since March 2018 (Bonami, 2018). Additionally, more than 60% of all the parents surveyed for CS3 favored the idea that the street should be re-designed to make more space for children to play. This acceptance is equally resonated for CS1 at 53.2%, highlighting that coating the road surface with paint is not enough, but some concrete interventions for play-related activities are needed. I had a short conversation with a parent who was monitoring her child playing on the street - who maintained that 'more could be done'; nodding with a definitive 'yes' when I proposed that could urban furniture elements like benches and slides be added.

In terms of the actual use of street-space for play-related activities, it was observed that children do not necessarily play during all times of the day in the dedicated play

Figure 7: Evolution of play spaces on CS1: Wasstraat. Left: Wasstraat as a Living Street with green mats and benches in 2014 (Source: Dries Gysels). Centre: The street before blockage of vehicular traffic before 2018 (Source: Stad Gent). Right: The functional School Street with marked play area as of today (Source: author)

area on CS1. The higher speeds of bikes during the peak hours of school drop-off and pick-up times, restricted pedestrians (parents and children alike) to access the car-free road space, and most of them maintained to traverse through the sidewalks. However, for some parents who collected their wards after the peak hour in the afternoon, pick-up from the school was a more relaxed process. During the non-peak

hour in the later afternoon, it was observed that parents were indulging in conversations with each other, as the children played independently on the street. As the evening approached, kids from the neighborhood also sportingly rode their bikes on the street and engaged in some play.

Any playing activity was rarely observed on CS2 and was majorly restricted to the internal school courtyard during lunch breaks in CS3 indicative of the fact that ground conditions were not favorable to do so.

Theme 5 - What drives the notion of Safety on the Streets?

Even though safety on streets is an attribute governed by subjective perceptions, it is however a result of broad spatial ramifications. The nature of street-space allocation strategies impacts the daily lived realities around safety. A safe space is a result of multiple factors – both physical and psychological. Because of the qualitative nature of the surveys conducted, the core methodology to measure safety across the school streets has been in the realm of the Perceived Space.

The factor that drives the core concerns around safety on school streets is traffic congestion and over speeding of vehicles. We have seen in the past chapter how school street projects around the world have employed a range of traffic-calming measures to create safe spaces for children around schools. The three case studies in Ghent display varying levels of parental satisfaction on safety, owing to different space allocation strategies adopted (Q8). This is reflected in the average parent ratings for safety on streets – which stood at 3.35 out of 5 for CS1, 3.07 for CS2 and 2.69 for CS3. Across the three school streets, parents are least likely to encounter traffic congestion in CS1, given that it is permanently blocked for cars and only allows bikes – which are more spatially efficient travel modes (Hensher et al., 2020). On CS2, which temporarily blocks automobiles using collapsible posts, the occurrence of congestion is still high – according to around 70% of the school parents confirming the same. For CS3, a whopping majority of 81.7% parental responses confirm encountering

traffic congestion regularly on the school street – which does not regulate but manages traffic with the help of volunteers (Q5).

Cars and vehicular over-speeding remain the more severe health and safety concern among parents across all the case studies (Q9). Even though cars are blocked during peak hours on two of the three case study streets, the increasing speeds of bikes has evolved to be a recent cause of concern among parents. This fact can be cross-referenced with the observational study results which display that the pedestrians continued to be relegated to the narrow sidewalks during school trips. As was observed for CS1 and CS2, the road space did not entirely turn into a safe space to indulge in activities that necessitate pause, wait or play as was intended.

Discussing the scenario of CS3 in detail, the street does not entirely block through vehicular traffic, but volunteers discourage cars from reaching within the proximity of the school gates. Even during peak hours, cars were observed passing through the street. It is the only street out of the three case studies to have a dedicated bike lane (painted street surface). However biking safety is severely endangered due to its narrow width and lack of separation from the vehicle lane. Thus, lack of space to walk and bike remains the concern for 70% of parents of CS3. This scenario results in many of the bikers not following the bike lane and leaving to use the street space more often.

It is noteworthy that more than 40% of the parents surveyed for CS1 have selected 'other' factors beyond traffic-related and contested road space that endanger their notion of safety on the streets (Q9). One of the aspects that largely contribute to this collective notion are the incidents of drug use in the park outside the school (Luyten, 2019). Interactions with the residents during preliminary fieldwork revealed that the park and the youth center next to the school have become hotspots of alcohol consumption and drug use, especially at night. The lack of proper lighting and absence of activity on the streets – provided a safe haven for such activities – the traces of which could be seen the next morning with empty glass bottles left on the

school compound wall. A parent revealed, "more than the safety concerns around traffic I am worried about the safety in the park which is used by the children during and after the school hours. Parents like me are concerned because recently a child accidently stepped on an open syringe and got infected by the drug." This indicates that the factors that determine street safety are both internal and external. Furthermore, parents from neither school have interpreted the street space as fully safe.

Theme 6 - On the governance of School Streets

One of the highlighting features of the School Streets program in Ghent is that its success rests on the shoulders of its volunteers. Volunteers for the school streets are often the parents themselves, who monitor the traffic situation at the school gates at the pick-up and drop-off periods. Schools need volunteers to manage and control the traffic situation, open or close the school gates when the bell rings off and monitor the traffic at the barricades to stop vehicular traffic from entering School Street (CS2). To cut it short, volunteering for School Streets is a demanding job that is to be carried out for thirty minutes, twice during the day. It is generally the parent-teacher associations that chart out the volunteering schedule among the interested parents. However, directors from all the three schools highlighted the growing shortage of volunteers and the unwillingness among the parents to carry out the task. Responses for Q14 of the survey reveal that the openness to volunteer for the project lies between 11-23% across all the case studies. The role of volunteers is far more critical in the case of CS2, as the temporal vehicular blockage could only be achieved if the barricades are set up by parent volunteers during the peak hours. The project fails to function effectively if this is not done, as was consistently observed on Tuesday afternoons throughout the fieldwork period. The traffic in front of the school remained as usual as the school did not have enough volunteers for this timeslot. In cases when parents do not show up, teachers must take this additional responsibility before and after their classes.

For CS3, the school street is organised between two schools that are situated on mutually perpendicular streets – Theresianenstraat and Wispelbergstraat. On both these streets, volunteered traffic management is the key to mitigate congestion and safety challenges, as the city is yet to approve installing barricades to temporarily close the streets. The single-handed reliance on volunteers for realizing the School Streets and the parallel shortage of the same, has posed an immense challenge to the governance of the school streets, where most of them not fully pedestrianised. This has also restricted the proliferation of more school streets at the city level, as lack of volunteers remains an underlying issue at other schools as well. At this juncture, it is thus ideal to advocate for a policy shift, moving beyond the idea of temporary vehicular blockages and in favour of permanent spatial re-allocations.

Theme 7 - Expectations versus Reality

This segment assesses the current character of the streets in relation to the wants of its users. The current streets represent a typical nature of spatial allocation – CS1 prioritizes the street for walking, biking and recreational purposes, while CS2 and CS3 cater to the more car-driven mobility approach. Parents, being a group of users who visit the school daily, were also the key stakeholders in the School Streets project. Due to time constraints, a similar survey with the residents on the school streets could not be conducted. However, further development of the activity-based approach could entail gathering perspectives from different stakeholder groups including citizens, policymakers and planners, teachers and volunteers, etc.

In the conclusionary questions of the Parental survey, respondents were asked as to how they would want to redesign the school streets given an opportunity. The typical nature of evolution of School Streets as witnessed in other cities suggests tactical experiments and temporary measures leading to permanent solutions being employed after the due assessments. Thus, typical street models with which residents of the city were familiar with were put before them as options. The compilation of the results from the three case studies is as follows:

Possibilities of Street re-design:	The current street is alright	A Bike Street (Fietstraat)	A Living Street (Woonerf)	A Pedestrian-only zone	None of the above
CS1	34%	13%	24%	15%	14%
CS2	16%	34%	20%	15%	15%
CS3	8%	22%	22%	22%	26%

Table 9: Parental Preferences for Street Re-design Alternatives

This reveals that there is a remarkable divergence from the reality of allocation against the user expectations. The percentage of parents who agree with the current nature spatial allocation doubles from CS3 to CS2 and CS1 but stays significantly minimal overall. Responses depict a split between all the options considered, with a considerable number favoring radical changes like creating Living streets and pedestrian-only zones. The idea of School Street as a potential Bike Street, however, equally resonates among parents of all the schools. This trend indicates a demand for a more car-independent scenario from parents, who have largely adopted bikes as their favored travel mode for school streets.

7.2.2 Mapping the Interpreted Space

After combining the two datasets in the form of theme-wise descriptions, we move forward to studying the Interpreted Space. Interpreted Space – born out of the lived realities and user perceptions may or may not necessarily have a physical-spatial dimension. However, at this step it becomes a methodological pivot to form judgement on the Allocated Space. The Allocated and the Interpreted space are two facets of the continuous process of Production of Space. To understand the street space and the continuous process of its production in its totality, its allocation and interpretation have to be studied in relation to each other. We address the inter-dependence and divergence of the Interpreted Space from the Allocated by mapping the material aspects of the Interpreted Space on the three streets. The intangible

Figure 8: Interpreted Space on Wasstraat (Case study 1)

aspects demand further interpretative comprehension, which is developed individually for each case study. The nature of Interpreted Space changes according to the specific allocation scenario. For example, in the case of Wasstraat (CS1) where permanent car restrictions are imposed, the space is opened up to a host of activities especially when the daily school routines unfold on the street. Parental perceptions from the survey suggested an overall sense of traffic-safety scenario, which was also evident in the activities like talking, playing, running that were carried out on the street with assurance even at peak hours. Since the allocated street space for cars in this scenario is minimal, large sections of the street space were interpreted as spaces for interaction and congregation. Large parts of the street acted as carriageway for bikes as their relatively higher speeds in the morning peak hour discouraged other users from accessing the lane. However, the unlikely presence of automobiles and the occurrence of traffic congestion in front of the school contributed to the dedicated play area being used actively at non-peak hours. The private parking area inside the school compound was also appropriated by parents as a space for having interpersonal interactions while loading and unloading their children off the bikes. On the street parents were observed parking their bikes outside the allocated area.

Figure 9: Interpreted Space on Krekelberg (Case Study 2)

Minimal physical activity and engagement was observed in the park opposite the school, as it was perceived as a relatively 'unsafe' zone due to the cases of drug and alcohol use. Children who were observed playing in the park, were vigilantly observed by their parents. Despite the restriction of cars in front of the school, the street space was not accessed by pedestrians and a majority of them were observed walking only through the dedicated sidewalks. Apart from the dominance of bikes with their high speeds, this behavior can also be attributed to the difference in surface pavements indicating space to drive (layered in asphalt) and for walking (sidewalks paved in concrete).

In CS2, where vehicles are temporarily blocked at peak hours, the traffic lane is predominantly occupied by bikes. The pedestrians are strictly restricted to the narrow sidewalks – who find it difficult to navigate through them as people gather in front of the school in large numbers during drop-off and pick-up hours. The sidewalk extension at the school gate is used as a limited space for parents to wait and talk. Here, spatial constraints have limited the use of street space for other activities like social interaction and playing. Observations reveal a pressing need for a larger bike parking facility as currently unloading the children from bikes directly exposes them

Figure 10: Interpreted Space on Theresianenstraat (Case Study 3)

to the vehicles on the street, endangering their safety. Moreover, conflicts arose when bikes were temporarily parked outside the dedicated parking stand or when the carriageway was used to take frequent stops while walking. Temporary vehicular restrictions have not fully answered the rising conflicts over limited space among different users of the street. Given the current organization of street space and its role as vital traffic node, the societal interpretation of this street as a place for recreation is severely restricted.

The painted bike lane on the street surface of CS3 was highly perceived as a space unsafe for driving bikes. At peak hours, bikers used the main street lane to ride bikes as the allocated narrow biking lane did not provide unhindered driving experience to its users. The narrow sidewalks also provide space for waiting and social interaction among parents before and after the school hours. The street space is shared between children, accompanying parents who drive and park their bikes, through traffic and parked cars. This leads to the collective interpretation of this street as an unsafe space with the frequent occurrence of traffic congestion. Parents were convinced that pedestrians and bikers deserved more space than the existing. Given this daily experience, none of the respondent parents noted that their ward engaged in a

physical activity on this street. At the same time, the idea of redesigning the street for physical activities was voted the highest among the three case studies.

Through their use and recorded perceptions, spatial interpretations reflect a particular pattern in informing us about the satisfaction levels of existing spatial organization on streets. The tangible and intangible aspects of Interpreted Space have unfolded differently in the three different spatial allocation scenarios of the School Streets in Ghent. With the car-restrictions and independent parking, the spatial allocation for CS1 is closer to user interpretation of the street as a vibrant public space for physical activity and social congregation. In the same aspect, temporary vehicular restriction in CS2 has resulted in limited outcomes. Re-organization of street-space is expected to be the most out of CS3, as shared street space among many activities leads to many conflicts and safety concerns.

7.3 An assessment of Link-Place attributes of School Streets

This section discusses the attributes of School Streets as a Link and a Place. Jones Boujenko & Marshall (2007) have provided a framework for understanding two principal functions streets perform – as a Link (facilitating movement) and as a Place (being a destination in themselves). The wide range of activities observed on the School Streets can be associated with one of the above two functional aspects. For example, the street facilitates movement while connecting other parts of the neighborhood with the school. At the same time, a school street essentially becomes a place where people gather to collect their children, spend time waiting, holding conversations, children engage in playful physical activities, etc.

The twin functional attributes of Link and Place have developed uniquely across the three case studies as they display different allocation scenarios.

Upon primary investigation into CS1, it might appear that link aspects of the street are curtailed given the restriction of cars. The primary function of this internal street is not connecting two areas of the neighborhood but instead providing access two

pivotal places – The primary school, Freinetschool De Vlieger and a local park. Both the educational institution and the recreational space functionally demand space for activities like congregation, taking part in physical activities and sports and cater to the vulnerable sections of the society like children, women and senior citizens. Essentially being embedded between public spaces on either side, the street space becomes a place in itself. Local mobility behavior seeks to minimize challenges that might undermine the attributes of the street as a place, like traffic congestion, inefficient parking and other factors that undermine the accessibility of children to school. Daily user patterns of this street also exemplify facets of public life like parents spending time in mutual conversations, children playing and riding bikes and minimized through traffic. Thus, the School Street program through its permanent car–restriction intervention has balanced the link and place attributes of Wasstraat, in alignment with the prevalent sustainable mobility scenario.

Focusing on CS2, we observe that Krekelberg serves an important link between the internal streets in the Dampoort neighborhood and Dendermonsesteenweg that connects the internal main road link R40. This is reflected in the through traffic that enters the street with speeds typically exceeding the limit of 30kmph. However, residents revealed that this scenario was also a result of traffic realignment policies implemented after the circulation plan. The mobility behavior concerning daily school trips reflects parents' tilt towards bikes. This is also a direct consequence of the restriction of automobiles on the school street during school hours. Acknowledging this, it is evident that temporal necessities drive the functionality of Krekelberg – acting as an 'internal thoroughfare' throughout the day as well as guaranteeing safe access to the vulnerable going to school. The temporary vehicle closures, however, do not result in transforming the street as a 'place' but only negotiate the access to the street space among its users.

The larger place attributes are majorly restrained in the case of CS3, as the street did not perform as an ideal place for walking, gathering or other public activities. The Link aspects of Theresianenstraat also appear challenged, as the allocated space for

walking and biking is very less compared to their daily use. This school street connects an internal street on side and a main street Copure Rechts running parallel to river Copure. During the fieldwork, the street was observed serving two principal functions – facilitating a connection between the river and the residents to the school and providing access for individuals traveling by tram from other parts of the city. In the present context, for CS3, the link attributes overweight the place functions. However, with redistribution of more the space for bikers and pedestrians, the street can also be a place in itself – aligning with the larger societal school streets can address.

Chapter 8 – Conclusion

This concluding chapter addresses the theoretical positionality of the researcher, a post-analysis reflection on the methodological approach employed and the limitations and constraints faced during the conduction of this study. In the last section, scalability of the Activity-based approach and future research avenues with regards to this research theme are also discussed.

8.1 Theoretical Positionality

I began this study being drawn to the idea of how a street is characterized by the many spaces it contains and how they are conceived. One way to look at the process of spatial production is that a space is conceived by practitioners and decision-makers and is used by its users. However, this judgement reflects rudimentary assumptions about the allocation and utilization of space as a sequential and self-contained process. The examination of data on Ghent's School Streets, backed by the theoretical application reveals that the nature of spatial allocation and utilization is reciprocal, co-constructive and deeply interconnected. The conceptualization, creation and consumption of space are distinct processes; however, they are mutually interlinked facets in the process of Spatial Production. Since spatial allocation and utilization are non-exclusive parts of a continuing process, evaluation of one should involve examination of its relationship with the other. Any such evaluation should be based on subscribing to the understanding of the street as a space in itself.

The discussion on the integration of the two datasets has revealed the relationship between the allocated and the interpreted street space in the context of the school streets in Ghent. The evolution of Spatial Interpretation was unfolded in terms of societal perceptions (surveys) and daily user-patterns on the streets (observational activity maps). Different allocation scenarios represented by the three case studies affect the Interpreted space so assessed differently. The Allocated, Perceived and

Lived Space are not three different spaces but three different facets in the production of social space. This assumption was grounded theoretically in Henry Lefebvre's Conceived-Perceived-Lived Space triad. A theoretical framework to assess the allocated (conceived) space was born out of integrating the concepts of Perceived and Lived Spaces theoretically; however, they were evaluated independently applying distinct methodologies. The combined concept was termed 'Interpreted Space' – which became a reference to gauge the nature of the allocated space in the real-world experiences of its users.

The implication of applying this framework is in the qualitative output of data analysis. The interplay of allocation, perception and use is discussed comparing all the three case studies in reference to the seven key themes that emerged from the data integration process. The theme-wise discussions led to the mapping of physical aspects of the interpreted space shaped by different allocation scenarios. This step revealed that allocating more space to pedestrians and bikers on the school street reduces car usage in school trips. Moreover, integrating the school street with bike lanes and provision of dedicated parking facilities contributes to the larger adoption of sustainable active travel modes. Permanent Car-free areas contribute the most in minimizing traffic congestion, increasing safety and safe places for social interaction. The benefits of temporary traffic closures are limited, and their success also depends on the availability of volunteers. The observations reveal that the Schoolstraten project in Ghent can be scaled up for permanent changes, aligning with the wants of school parents.

Understanding street-space involves ideological and competency-driven divergences. For example, a transport engineering perspective would conventionally assume the role of street for purely transit use; believing it to be a resource that is to be distributed among different travel modes to elevate individual efficiency. On the contrary, urban sociologists would advocate for a more people-centric approach – examining the underlying nature of ownership, power balances and rights enjoyed by different groups of people on the street. Before any attempts are made to discard the

above competency-driven differences as generalized, it cannot be discarded that multiple spatial research approaches have evolved to this day. Any such approach is grounded in its distinct set of objectives, methodology, and basis of evaluation, and the ideological and operational capacity of the researcher.

This study addressed the gaps in the existing analysis methods by developing the so-called Activity-based approach. While the methodological implications have been discussed in the next section, it is important to acknowledge the ethnographical background of the data collection processes such as activity mapping and stakeholder survey. The transport-centric, mode-based approach in the existing studies contrasts with the more societal, activity-based approach of this study. Needless to say, the sociological standpoint contributed to the understanding of street space as a social construct that is being constantly shaped by people, their perceptions and appropriations. Moving beyond the data on modal share, this approach allowed public perceptions and public use to be the parameters for spatial analysis. Thus, the data collection process involved intense fieldwork, and demanded more time to be spent outside.

8.2 Methodological Reflection

Stressing the need for alternative approaches, the fieldwork in Ghent started with the preliminary examination of School Streets. The twelve school streets represented different allocation scenarios. Thus, in contrast to considering city-wide or district level streets in some of the previous studies, the three case study school streets ultimately chosen represented varying levels of allocated space for different users. School streets are purposefully designed to fulfil certain goals and ask for realignment of space between cars and other active modes. This context-specific scale contributed to the development of 'activities' as a basis for this analysis. Instead of calculating the use of street space in terms of modal share, this study proposes to record the 'Lived Space' in terms of activities that are performed as part of school routines. As school streets opened up as vibrant places for social congregation during

the school hours, they embodied a host of stationary and moving activities that were noted as part of activity mapping. The intensive observation of activities revealed how allocation directs the way in which a space is used and also at times how live street usage is incoherent with the space allocated. Theoretical framework also demanded collection of spatial perceptions – hence, census surveys were conducted to gather comparative data on parental perspectives, satisfaction levels on paring facilities, overall safety, and views on how what further steps can be taken.

Authors	**Gossling et al.**	**Nello-Deakin**	**Lefebvre et al.**	**Creutzig et al.**	**This study**
Basis of Analysis	Travel Modes	Travel Modes	Travel Modes	Travel Modes	**Activities**
Data Collection	Sections	Maps	Sections	Sections	**Maps**
Scale	Street Networks of Freiburg's 4 districts	Street Network of Amsterdam	Streets from 11 districts in Montreal	18 street sections across Berlin	**3 School Streets in Gent**

Table 10: Comparative analysis of methods and data collection techniques

The mixed-method approach resulted in integration of two datasets, one qualitative and other quantitative, and qualitative theme-wise descriptions were produced out of this process. As compared to the other methods, this methodology is labor and time-intensive and demands critical examination of the street space, upon application of the theoretical framework. However, it posits the study in a unique place where a society-centric approach is employed to judge the practicality of street-space allocation. The added value of the activity-based analysis is in its assessment of streets which belong to the people and not along different travel modes. This also recognizes the role of streets as places in themselves where people gather and perform different activities. While schools are locations where journeys culminate, school streets are also destinations in their own right.

8.3 Limitations and Scalability

The development of Activity-based approach and the related data collection process was largely executed without any significant challenges. However, a few restrictions on logistical, conceptual and methodological levels should be acknowledged before contextualizing the application of theoretical approach or data collection strategies to other contexts.

The logistical and time constraints posed a limitation in selection of the number of case studies. While there was a choice to select more school streets, only three were selected for an in-depth assessment of street space allocation. As both of the data collection strategies were employed simultaneously within a span of three months, it posed a challenge for selection of more studies. Application of the activity-based approach to other streets on a bigger scale may alter the generalization of findings if limited case studies are considered. However, if the street space allocation exercise is to be held for streets in a single neighborhood, similar procedure can be repeated for four to five different types of streets (including internal, main, pedestrianized, etc.).

The survey responses, while adequate for the current study, overlook the residents' perspectives who live on the school streets. Incorporating another set of stakeholders in the data collection process demanded a separate outreach strategy. While residents' use of the street is documented in the activity maps, language barrier and time limitations constraints limited surveys among a primary set of stakeholders i.e. parents. In cases when groups of stakeholders are not organized or well-defined, sampling strategies can be used to minimize biases. Surveys can also replace structured or semi-structured interviews, if qualitative results from both the data collection strategies are desired.

It is important to recognize the possibility of observer bias and human errors during manual observations. The author was the lone observer on ground, and mapping of activities was challenging specifically during the peak hours. Also in an ideal scenario,

stationery and moving activities should be mapped on the same day. However, the above challenges were mitigated with precise marking of activities and digitalization of maps, conducting test observations before final maps were prepared.

While the possibility to extrapolate the analytical framework to other contexts remains uncontested, the possibility of theoretical limitations arising cannot be denied. The framework was wielded for a low-density, relatively progressive, yet ethnically diverse and a sensible context from the sustainable mobility lens. While the approach inherently asks for consideration of user perspectives, the current framework may not fully reflect the socio-economic, cultural and political diversity in other specific contexts. In such situations, it is best suited to adapt data collection strategies accordingly.

The activity-based approach is inherently asking for localization of analytical studies. It focuses on context-specific, in-depth, qualitative strategies that are centered around societal perceptions and lived realities. In conclusion, this thesis has explored the complex interplay between the allocated and interpreted spaces in the school streets of Ghent. The activity-based approach initiates a conversation on the need for larger societal considerations in the assessment of street space allocation practices. The findings expound on how interpretations of a space are shaped by its allocation. It also has lessons for the future direction of the School Streets project in Ghent, asking for more long-term street reorganizations. As cities continue to grapple with challenges of sustainability and contested ownership of public space, this research underscores the need for participatory and adaptive approaches in urban studies that prioritize people over vehicles and acknowledge the vibrancy of streets as places in themselves.

Chapter 9 – References

1. Ajuntament de Barcelona. (2023, November 27). *Work gets under way to transform areas around another 73 schools*. Ajuntament de Barcelona. Retrieved December 22, 2025, from https://ajuntament.barcelona.cat/ecologiaurbana/en/noticia/work-gets-under-way-to-transform-areas-around-another-73-schools_1235507
2. Attard, M., Guzman, L., & Oviedo Hernandez, D. (2023). Urban space distribution: The case for a more equitable mobility system. *Case Studies on Transport Policy, 14*, 101096. https://doi.org/10.1016/j.cstp.2023.101096
3. Basu, S., & Banerjee, B. (2020). Impact of environmental factors on mental health of children and adolescents: A systematic review. *Children and Youth Services Review, 119*, 105515. https://doi.org/10.1016/j.childyouth.2020.105515
4. Bruzz. (2023, November). *Twee op drie Brusselse basis- en kleuterscholen komt in aanmerking voor schoolstraat*. Bruzz. Retrieved December 22, 2025, from https://www.bruzz.be/mobiliteit/twee-op-drie-brusselse-basis-en-kleuterscholen-komt-aanmerking-voor-schoolstraat-2023-11
5. Bernhardt, C. (2020). The making of the "Stadtautobahn" in Berlin after World War Two: a socio-histoire of power about urban automobile infrastructure. The Journal of Transport History, 41(3), 306-327. https://doi.org/10.1177/0022526620951344
6. Bonami, H. (2018, February 21). *Wasstraat wordt schoolstraat én autoluw*. Stad Gent. https://persruimte.stad.gent/164071-wasstraat-wordt-schoolstraat-en-autoluw
7. Bruno, M., Dekker, H.-J., & Lindenberg Lemos, L. (2021). Mobility protests in the Netherlands of the 1970s: Activism, innovation, and transitions. Environmental Innovation and Societal Transitions, 40, 521–535. https://doi.org/10.1016/j.eist.2021.10.001
8. Child Friendly Cities Initiative. (n.d.). *Child Friendly Cities Initiative*. Retrieved December 21, 2025, from https://www.childfriendlycities.org/
9. City of Ghent. (n.d.). *Schoolstraten*. Stad Gent. Retrieved December 22, 2024, from https://stad.gent/nl/mobiliteit-openbare-werken/kinder-en-jongerenmobiliteit/schoolstraten
10. CityLab BCN. (n.d.). *School streets create healthy and social environments*. Retrieved December 22, 2024, from https://citylabbcn.org/school-streets-create-healthy-and-social-environments/

11. Clean Cities Campaign. (2022). *School streets factsheet.* Retrieved January 21, 2025, from https://cleancitiescampaign.org/wp-content/uploads/2022/10/School-Streets-Factsheet_w.pdf
12. Comisión Nacional de Seguridad de Tránsito. (2019). *Análisis espacial de puntos críticos de atropellos de niños en zonas de establecimientos educacionales: Santiago, Chile.* Retrieved November 13, 2024, from https://www.conaset.cl
13. Copenhagenize. (2014, September). The arrogance of space: Paris & Calgary. *Copenhagenize*. Retrieved from https://copenhagenize.com/2014/09/the-arrogance-of-space-paris-calgary.html
14. COVID Mobility Works. (2020, December 10). *Ghent allocates extra street space for active travel at 45 schools*. COVID Mobility Works. Retrieved December 22, 2025, from https://www.covidmobilityworks.org/responses/ghent-allocates-extra-street-space-for-active-travel-at-45-schools-58e0eb04cd
15. Creutzig, F., Javaid, A., Soomauroo, Z., Lohrey, S., Milojevic-Dupont, N., Ramakrishnan, A., … Zausch, J. M. (2020). Fair street space allocation: ethical principles and empirical insights. *Transport Reviews*, *40*(6), 711–733. https://doi.org/10.1080/01441647.2020.1762795
16. D. Nelson, G. Smith, & Y. Z. Wong (Eds.), *Understanding Mobility as a Service (MaaS)* (pp. 13–33). Elsevier. https://doi.org/10.1016/B978-0-12-820044-5.00002-6
17. Environmental Justice Atlas. (n.d.). *Stop de Kindermoord ("Stop the Child Murder"): Protest for children's deaths caused by motor vehicles.* Retrieved January 21, 2025, from https://ejatlas.org/conflict/stop-de-kindermoord-stop-the-child-murder-protest-for-children-deaths-caused-by-motor-vehicles
18. European Commission. (2024). *School streets: Safe and sustainable school trips*. Urban Mobility Observatory. Retrieved January 10, 2025, from https://urban-mobility-observatory.transport.ec.europa.eu/resources/case-studies/school-streets-safe-and-sustainable-school-trips_en
19. FIA Foundation. (n.d.). *School Streets: Putting children and the planet first.* Retrieved January 21, 2025, from https://www.fiafoundation.org/media/hr3fmhin/school-streets-report-pages.pdf
20. Freiburg City Council. (2008). *Endbericht zum Verkehrsentwicklungsplan 2020 (Final report on the traffic development plan 2020).* Retrieved January 21,

2025, from https://www.freiburg.de/pb/site/Freiburg/get/documents_E1105209077/freiburg/daten/verkehr/vep/Endbericht.pdf

21. Geertz, C. (1973). *The interpretation of cultures*. Retrieved from https://people.ucsc.edu/~ktellez/geertz1973.pdf
22. Gössling S, Schröder M, Späth P, et al. (2016) Urban space distribution and sustainable transport. *Transport Reviews* 36(5): 659–679.
23. Habitat III. (n.d.). Turning roads into streets: Road space allocation and public space resilience. *Habitat III*. Retrieved from https://habitat3.org/the-conference/programme/all/turning-roads-into-streets-road-space-allocation-and-public-space-resilience/
24. Hensher, D. A., Ho, C. Q., Mulley, C., Nelson, J. D., Smith, G., & Wong, Y. Z. (2020). What is MaaS and how it fits into the transport landscape. In D. A. Hensher, C. Q. Ho, C. Mulley, J.
25. Honey-Rosés, J. (2023). *School streets create healthy and social environments*. CityLab BCN. Retrieved December 22, 2024, from https://citylabbcn.org/school-streets-create-healthy-and-social-environments/
26. Ikeda, E., Hinckson, E., Witten, K., & others. (2019). Assessment of direct and indirect associations between children's active school travel and environmental, household, and child factors using structural equation modelling. *International Journal of Behavioral Nutrition and Physical Activity, 16*(1), 32. https://doi.org/10.1186/s12966-019-0794-5
27. Jacobs, J. (1961). *The death and life of great American cities*. Random House.
28. Jones, I. (2014). Road space allocation: The intersection of transport planning, governance and infrastructure (Doctoral dissertation, RMIT University).
29. Jones, P., Boujenko, N., & Marshall, S. (2007). Link & Place-A guide to street planning and design.
30. Jones, P., Marshall, S., & Boujenko, N. (2008). Creating more people-friendly urban streets through 'link and place' street planning and design. *IATSS Research, 32*(1), 14–25. https://doi.org/10.1016/S0386-1112(14)60196-5
31. Lefebvre, H. (1991). *The production of space* (D. Nicholson-Smith, Trans.). Blackwell.
32. Lefebvre-Ropars, G., Morency, C., & Negron-Poblete, P. (2021). A needs-gap analysis of street space allocation. *Journal of Transport and Land Use*, *14*(1), 151–170. https://doi.org/10.5198/jtlu.2021.1808
33. Liverpool Express. (n.d.). *Blog: Like many simple ideas, school streets tick a lot of other boxes.* Liverpool Express. Retrieved January 21, 2025, from

https://liverpoolexpress.co.uk/blog-like-many-simple-ideas-school-streets-tick-a-lot-of-other-boxes/
34. Luyten, S. (2019, February 25). *Park met slechte reputatie? Deze 'openbare toog' kan daar verandering in brengen*. Nieuwsblad. https://www.nieuwsblad.be/cnt/dmf20190224_04203995
35. Milieudefensie. (2017). "Van Wie Is De Stad?" Retrieved from https://milieudefensie.nl/actueel/van-wie-is-de-stad-pdf
36. Nello-Deakin, S. (2019). Is there such a thing as a 'fair' distribution of road space? *Journal of Urban Design, 24*(5), 698–714.https://doi.org/10.1080/13574809.2019.1592664
37. Nozick, R. (1973). Distributive justice. *Philosophy and Public Affairs, 3*(1), 45-126.
38. Pereira, R., Schwanen, T., & Banister, D. (2016). Distributive justice and equity in transportation. *Transport Reviews, 37*, 1-22. https://doi.org/10.1080/01441647.2016.1257660
39. Protegim les escoles. (2023). *Protegim les escoles: La transformació de l'espai escolar a Barcelona* [Report]. Retrieved December 22, 2024, from https://ddd.uab.cat/pub/estudis/2023/a3ae16cf28cf/141223_Protegim_Les_Escoles_Report.pdf#page=6.15
40. Respire. (n.d.). *Tout ce que vous voulez savoir sur les rues aux écoles*. Retrieved December 22, 2024, from https://respire-asso.org/tout-ce-que-vous-voulez-savoir-sur-les-rues-aux-ecoles/
41. Sapere Ambiente. (n.d.). *Parma, città delle strade scolastiche: Intervista a Tiziana Benassi*. Retrieved December 22, 2024, from https://sapereambiente.it/parma-citta-delle-strade-scolastiche-intervista-a-tiziana-benassi/
42. Sen, A. K. (1994). Well-being, capability and public policy. *Giornale degli Economisti e Annali di Economia, 53*, 333-347.
43. Stadsarchief Amsterdam. (n.d.). *Verkeerscirculatieplan Amsterdam 1978*. Retrieved December 21, 2024, from https://archief.amsterdam/archives/pdf/5476.ead.pdf
44. Stad Gent. (n.d.). *Wasstraat wordt schoolstraat en autoluw*. Retrieved January 15, 2025, from https://persruimte.stad.gent/164071-wasstraat-wordt-schoolstraat-en-autoluw
45. Stad Gent. (2020, July 10). *Wijkmobiliteitsplan Dampoort – Oud-Gentbrugge* (Version 2). Stad Gent. Retrieved from https://stad.gent/nl/mobiliteit-

openbare-werken/plannen-en-realisaties-mobiliteit/wijkmobiliteitsplannen/wijkmobiliteitsplan-dampoort

46. Stad Gent. (2023). *Mobility policy Ghent: Focus bicycle* [PDF]. https://stad.gent/sites/default/files/media/documents/20230905_PR_Mobility%20policy%20Ghent_Focus%20Bicycle_EN.pdf

47. Taylor, M. C., Lynam, D. C., & Baruya, A. (2000). *TRL Report 421: The effects of drivers' speed on the frequency of road accidents*. Transport Research Laboratory. https://trid.trb.org/View/651648

48. *Torino Today. (2023). Dove sono le zone scolastiche a Torino. Retrieved December 22, 2024, from https://www.torinotoday.it/attualita/dove-zone-scolastiche-Torino.html*

49. Transport for London. (n.d.). *Safety of schoolchildren on London's roads: Report.* Retrieved January 21, 2025, from https://tfl.gov.uk

50. United Nations. (n.d.). *Goal 11: Sustainable cities and communities*. The Global Goals. Retrieved December 21, 2024, from https://www.globalgoals.org/goals/11-sustainable-cities-and-communities/

51. United Nations Framework Convention on Climate Change (UNFCCC). (n.d.). *The Paris Agreement*. Retrieved January 21, 2025, from https://unfccc.int/process-and-meetings/the-paris-agreement

52. VanHoose, K., & Bertolini, L. (2023). The role of municipalities and their impact on the transitional capacity of city street experiments: Lessons from Ghent. *Cities, 140*(4), 104402. https://doi.org/10.1016/j.cities.2023.104402

53. van Sluijs, E. M. F., Ekelund, U., Crochemore-Silva, I., Guthold, R., Ha, A., Lubans, D., Oyeyemi, A. L., Ding, D., & Katzmarzyk, P. T. (2021). Physical activity behaviours in adolescence: current evidence and opportunities for intervention. *Lancet (London, England)*, *398*(10298), 429–442. https://doi.org/10.1016/S0140-6736(21)01259-9

54. Verloo, N. (2020). Urban ethnography and participant observations: Studying the city from within. In N. Verloo & L. Bertolini (Eds.), *Seeing the city: Interdisciplinary perspectives on the study of the urban* (pp. xx-xx). Amsterdam University Press. https://books.google.it/books?id=YKDXzQEACAAJ

55. Verlinghieri, E., & Schwanen, T. (2020). Transport and mobility justice: Evolving discussions. *Journal of Transport Geography, 87*, 102798. https://doi.org/10.1016/j.jtrangeo.2020.102798

56. Ville de Paris. (2023). *57 nouvelles rues aux écoles dans Paris.* Retrieved January 10, 2025, from https://www.paris.fr/pages/57-nouvelles-rues-aux-ecoles-dans-paris-8197
57. von Kries, R., Kohne, C., Böhm, O., & von Voss, H. (1998). Road injuries in school-age children: Relation to environmental factors amenable to interventions. *Injury Prevention*, *4*(2), 103–105. https://doi.org/10.1136/ip.4.2.103
58. Wien zu Fuß. (n.d.). *Schulstraße*. Retrieved December 22, 2024, from https://www.wienzufuss.at/schulstrasse/
59. Zheng, N., & Geroliminis, N. (2013). On the distribution of urban road space for multimodal congested networks. *Transportation Research Part B: Methodological, 57*, 326-341.

Annex

Survey Poster Specimen: