Ain Shams University
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The Impact of Streets' Physical Characteristics on Children's Independent Mobility

A Case Study from New Cairo, Egypt

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A Thesis submitted in the Partial Fulfillment
for the Requirement of the Degree of Master of Science
in Integrated Urbanism and Sustainable Design

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Abstract

In developing countries, children face various socio-spatial problems in their neighbourhoods that influence their physical and mental well-being. Our built environment is the giant cloche containing tangible and intangible means that affect the children's freedom of movement within their neighbourhoods' streets. This research focuses on the streets' physical characteristics that impact children's independent mobility (CIM). The research also takes into consideration demographic and sociocultural variables that could influence CIM.

The research focuses on Egypt's new cities that are built to attract residents away from the centre with their modernist urban design. The case study is in New Cairo, one of the most functioning new cities. The study focuses on 9-13-year-old children from mid to low-income families. The study is built on qualitative data that is divided into two phases. Phase one collects data from the children and their parents through a semi-structured questionnaire, drawings, and map activity workshops for the children in their classrooms. It aims to identify the CIM frequency within the neighbourhoods through walking, cycling, or public transportation. The parents' perception of their neighbourhood was also considered through a questionnaire sent with each child. Phase two is concerned with the observations of the most used streets by children independently. The results provide the influence of the most used streets' physical characteristics on the CIM and investigate their relation to the parents' perception of their neighbourhood.

At last, an analysis of the streets' physical characteristics' impact on the CIM range and licence was conducted. It presented the influence of the considered variables on CIM. This analysis concluded that the urban's tangible and intangible characteristics are intertwined. Any development actions shall investigate the lead reason of influence and its relation to the context.

Keywords: Children's Independent Mobility (CIM) – Streets' Physical Characteristics – CIM Licence – CIM Range – Socio-economic Status.

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List of Acronyms

CIM	Children Independent Mobility
UNICEF	The United Nations Children's Fund
UNESCO	The United Nations Educational, Scientific and Cultural Organisation
NACTO	National Association of City Transportation Officials
CUULS	Childhood Use of the Urbanizing Landscape
LPI	Leading Pedestrian Intervals
DAIT	Children's Discretionary Activity Independent Time
MOHUUD	Ministry Of Housing, Utilities & Urban Development
GOPP	General Organisation for Physical Planning
JICA	Japan International Cooperation Agency

Chapter 1: Introduction

1.1 Background:

The urban changes in new cities and roads reflect all the citizens benefiting from and being affected by these development changes. In developing countries, children make up a more considerable percentage of the total population negatively affected, as they are not considered in the design process. (Hillman, Adams & Whitelegg, 1990; Handy, Cao & Mokhtarian, 2008; Aerts, 2018; National Association of City Transportation Officials, 2020; Sleem Mandour & Diab, 2022).

According to the UNICEF-Shaping Urbanisation for Children handbook (2018), studies were made on children's views about their equity and rights in urban planning. The study included 35,000 children from 65 countries and revealed that children understand the significance of the built environment and that they require more than playgrounds to thrive. It conveyed tangible and intangible problems that children face in the built environment. According to the survey, 65% of the children do not feel safe in their neighbourhoods, 50% feel victimised and separated from the planning process, 40% verified that their environment is neither healthy nor resilient, while 30% confirmed they do not have access to services (Aerts, 2018).

Because of these problems, the urban dilemma shows that cities today are only good for a few. While the physical surroundings of a city are developed by adults for their own needs to meet their daily demands (Nooraddin, 2020), children are frequently put in the most disadvantageous situations. The advantages of an

advanced urban design are lost on children, while the disadvantages might significantly influence them. According to Nooraddin, due to sustainable city trends and child-friendly city efforts in the early 1900s, new implications were introduced to urban design in the 1960s to acquire livable spaces for children. However, studying modern cities can provide a compelling argument that modern cities still need to comprehend suitable urban requirements for children and how design may accommodate them (Nooraddin, 2020).

Nevertheless, rapid changes in the built environment and enhanced motorisation influence the actual physical surroundings; they impede the children's ability to move independently (Aerts, 2018). These issues are gathered by UNICEF and categorised under environmental health, protection, and participation constraints. These constraints affect the children's mental, psychological, and physical health. In addition, they negatively impact the freedom of movement that a child requires at an early age (Aerts, 2018; Marzi & Reimers, 2018).

In many nations, a decline in children's independent modes of transportation, such as walking and cycling to school, is observed while rates of car usage increase (Hillman et al., 1990; Chaudhury, Oliver, Badland & Mavoa, 2015; Shaw, Bicket, Elliott, Fagan-Watson & Mocca, 2015; Marzi & Reimers, 2018; Qiu & Zhu, 2021). The primary reasons cited by parents for driving their children to school are "road hazards and fear of attack". Moreover, with the expansion of modern cities, children's leisure activities are no longer within the acceptable range for children to walk or cycle. In addition to the highly motorised streets that cities promote now, children are only coping with the distances planned (Fyhri, Hjorthol, Mackett, Fotel, & Kytta, 2011).

According to Hillman, a troubled connection exists between children and their environments. Over the past two to three decades, children's independent mobility has been steadily declining (Hillman, 1997; Kytta, 1997; O'Brien, Jones, Sloan & Rustin, 2000; Prezza, Pilloni, Morabito, Sersante, Alparone & Giuliani, 2001; Malone & Rudner, 2017; Marzi & Reimers, 2018). The loss in children's independence and development has been linked to several factors, including the rise of private vehicles, the decline of walkable neighbourhoods, and parental fears for their children's safety (Malone & Rudner, 2011).

This study focuses on the streets' physical characteristics of Egypt's new cities that could affect the children's independent mobility within an acceptable range of their neighbourhood.

1.1.1 Children's Independent Mobility (CIM) definition

Hillman, Adams, and Whitelegg developed the children's independent mobility (CIM) definition in the 1990s as the independence in free travel by walking or

cycling, and the freedom of engaging with the outdoor environment safely (Hillman et al., 1990), without the need for adult supervision (Heurlin & Norinder, 1996; Schoeppe, Duncan, Badland, Oliver & Browne, 2014).

In 2009, Mikkelsen and Christensen implemented a study in suburban Denmark and stated that “Independence” should be re-defined. They defined independence as not being dependent on, controlled by, or disconnected from people, things, or "invisible actors" like friends, pets, and sometimes animals. They also added that CIM should be considered along with gender (McMillan et al., 2006), home range and surroundings (Gill, 2006), and the city planning process (Karsten & van Vliet, 2006; Mikkelsen & Christensen, 2009). Even communication through technology decreased the gap in parents’ monitoring of their children. Thereby, these factors should be included in the definition of children’s independent mobility (Chaudhury et al., 2015).

At last, UNICEF concludes that "Independent Mobility" is the ability to walk, cycle, and take public transportation, which is essential for children to develop a sense of independence and freedom.

1.1.2 Importance of CIM

Children exploring public areas independently allow them to build confidence in their social abilities, relationships with people, and physical environment (Hillman et al., 1990). Moreover, providing children with the characteristics they need in their neighbourhoods to grow socially, ethically, spiritually, and physically in a healthy, normal manner while enjoying freedom and dignity is the core of growing an independent human (Peleg, 2019).

Therapist Janet Gambitsky explains at the Henry Viscardi School in Albertson, New York, that children who can move around independently benefit in several ways. It helps them participate actively in their learning and leisure activities. It affects their behaviour favourably because children sometimes act out of frustration when they are not able to do things independently or acquire the things they want. It also facilitates more involvement in one's academic, social, and community life. It highlights the importance of problem-solving as a developmental skill and improves the child's social behaviour. It helps them prepare for school, play, and the transition to adult life. It allows for a more in-depth investigation of their environment by allowing children to approach and handle objects physically. Lastly, it develops their sense of awareness and spatial relations as they learn to avoid hazards and identify potential drop-off places, such as stairs and curbs.

CIM can help with a child's intellectual, social, and physical growth (Qiu & Zhu, 2021; Riazi, Brussoni, Vertinsky & Faulkner, 2021). Physical exercise, such as walking to and from school and playing outside without adult supervision, is important for children's growth, including motor skills, bone health, and weight control (Bento & Dias, 2017). In addition, CIM can help children's intellect and social lives prosper and develop (see-Figure-1) (Marzi & Reimers, 2018). More research illustrates that children who can go around their neighbourhoods without an adult are more likely to make friends, learn more about their community, and become better navigators as adults (Bento & Dias, 2017; Qiu & Zhu, 2021). On the other hand, children who were not allowed as much freedom of movement or unsupervised outdoor play tended to feel more negative emotions like loneliness. Researchers have stated that this reduction is causing concern because it can significantly affect children's relations with their social and constructed surroundings (Kyttä, 2004). While studies by Prezza and Pacilli found that children who were more mobile and played out in public more often had a better sense of community as teenagers (Prezza & Pacilli, 2007; Qiu & Zhu, 2021).

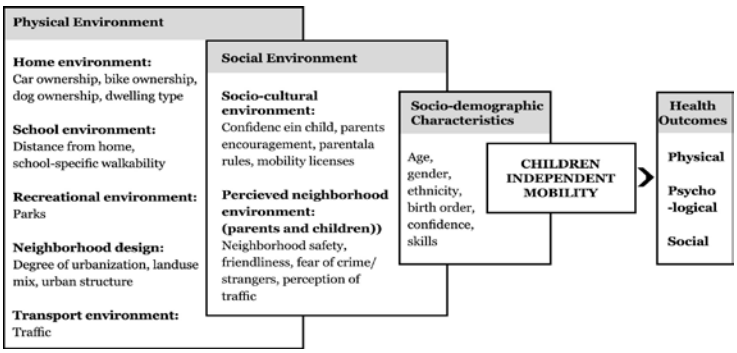


Figure 1- CIM relations based on Sallis Socio-ecological Model of Active Living. Source: Marzi & Reimers, 2018.

Finally, Monsur adds that two factors are disobliging for the child's appropriate development: a lack of autonomous movement and little or no opportunities for playing outdoors. Hence, the street's design has the potential for both its role in perpetuating the problem and its possible role in alleviating it (Monsur, 2012).

1.1.3 Current Children's Independent Mobility Status

Children today have less independence than their parents did at the same age because of the wide generational gap in their ability to travel freely and independently. Few studies have discovered strong correlations between CIM and social variables through independent non-school travel and unattended outdoor activity among children. Significant outcomes have been reported for

socioeconomic status, age, gender, parental involvement, the standard of education, and parents' occupation. For instance, independent travel by children to parks or stores was shown to be less common when parenting social standards did not allow such activity. On the contrary, greater perceptions of social cohesiveness and neighbourhood connectedness were shown to predict increases in children's independent travel. As a result, the unsupervised or parental approval of outdoor activity can positively influence CIM (Qiu & Zhu, 2021).

Along with the social connectedness within the community, the streets' physical characteristics can contribute to the parents' views that their children are secure in the neighbourhood. Although, Prezza and colleagues found no research explicitly links these characteristics to children's independent mobility (2001). However, Marzi and Reimers recognised a shift in the travel habits of children and a reduction in CIM. Their study confirmed that this reduction is due to the physical environment, cultural changes following urban development, and the ensuing rise in vehicle ownership (2018).

1.1.4 Research Problem

Children's development and interaction with the urban environment are affected by their inability to interact fully with the urban spaces. The reason could be the absence of independent mobility in their neighbourhood. Because of the streets' inappropriate physical characteristics, children cannot meet the required frequency of independent mobility.

According to the results of the UNICEF study in developing countries, this research focuses on the physical characteristics and issues in the streets that could hinder the freedom of movement of a child within the built environment. The barriers in focus include:

- Infrastructure is not designed for children.
- Low-quality and deficient streets' physical elements.
- Outdated urban services.
- Not accessible services.
- Unsafe roads.
- Deficient standards for urban realities in the form of physical barriers.

These barriers lead to a decline in CIM within a neighbourhood. Hence, Children do not have the reasonable CIM frequency required for healthy development at the beginning of their mid-childhood.

Few studies have investigated the influence of physical environment elements on independent mobility for destinations other than schools. As a result, several

contextual factors- such as traffic control, a sense of belonging to a community, and street harassment- have been observed to influence children's parents' autonomous perception of travel to non-school destinations (Qiu & Zhu, 2021).

1.1.5 Research Question

Accordingly, this research focuses on all of the mentioned physical factors with respect to the social factors mentioned in previous studies that can influence CIM. Thus, the main research question is:

What are the Street's physical characteristics that would influence a child's independent mobility in Egypt?

Sub Questions

- What is the relation between streets' physical characteristics and the frequency of a child's independent mobility?
- How do the streets' physical characteristics affect the children's street choices?

1.1.6 Research Aim

This research mainly focuses on defining the impact of the streets' physical characteristics on children's independent mobility in Egypt.

Sub Objectives

- Investigate the quality of travel in the streets for children.
- Detect the physical elements in the most used streets by children to reach their destinations.
- Explore other factors that would affect the streets' quality for children.

1.1.7 Scope of Study

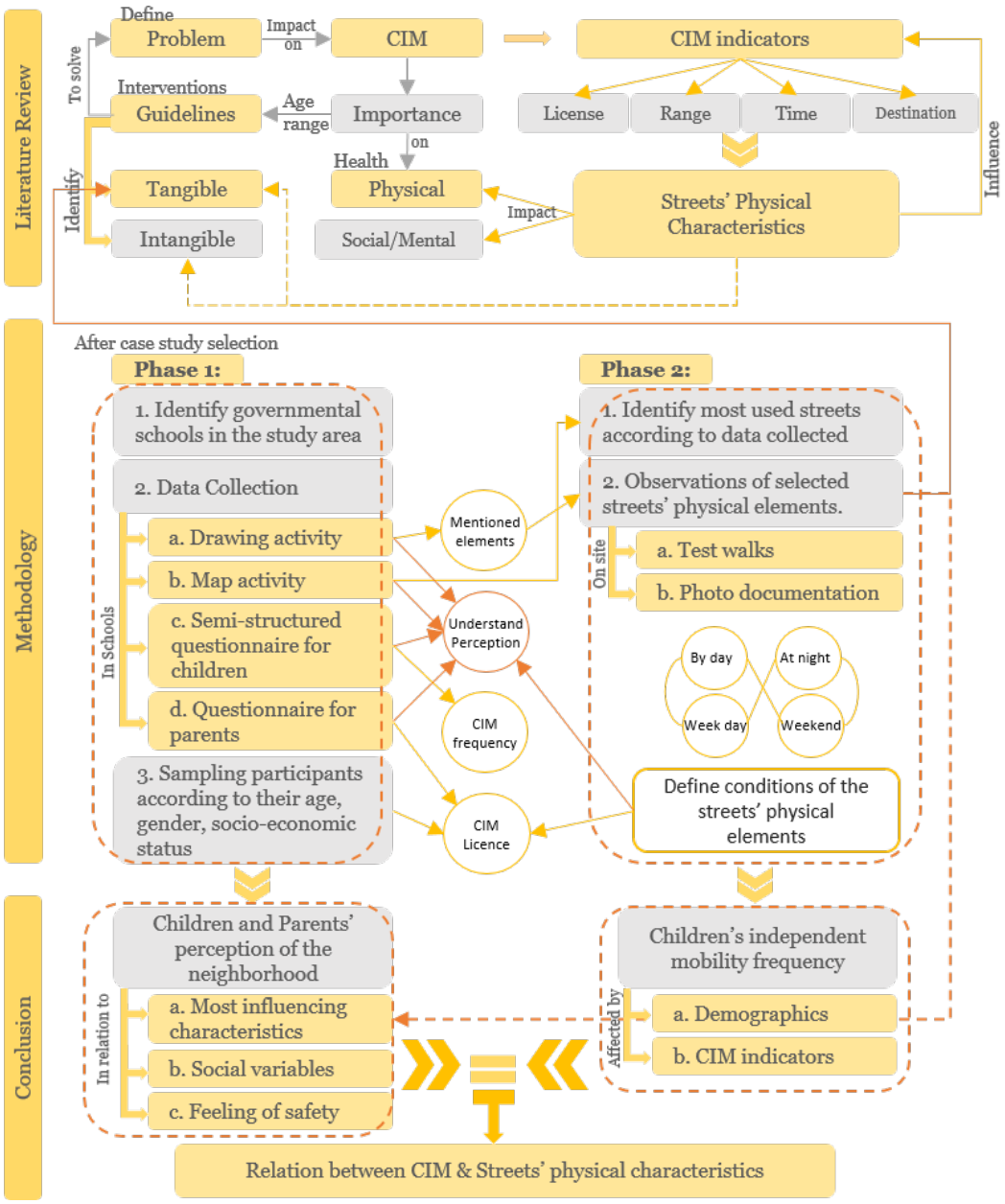
The research focuses on mid-childhood children, ages 7 to 13 years old. According to numerous literature studies, this is when children begin leaving their homes and start interacting with the community. It is the age when they begin to explore their surroundings in pursuit of education and experience (R. Moore & Young, 1978; Hillman et al., 1990; Shaw et al., 2015; National Association of City Transportation Officials, 2020). According to previous studies, CIM is peripheral in high-income families, as they can drive their children even to nearby destinations. Thereby, this study focuses on low and mid-income families. (Bhuyan & Zhang, 2019; Tyagi & Raheja, 2021).

1.2 Research Methodology

First, a pilot study was conducted to select an appropriate case study to achieve the research aim. After that, a qualitative approach was adopted, which comprised two phases. The first phase consists of three stages. The initial stage located the schools in the study area so that children could be reached securely. The second stage categorized and chose the schools based on their socioeconomic status. Finally, the data collection phase was initiated, which consisted of drawing and map workshops for the children and questionnaires for the children and their parents. Phase two defined the most used streets by children independently from the map workshops. Afterwards, the observation process started via test walks and photo documentation to evaluate the condition of the streets' physical characteristics mentioned in previous studies that influence CIM.

Lastly, an analysis of the collected data took place to associate the streets' physical characteristcs and their influence on the social aspects, contributing to the frequency of CIM.

1.3 Research Framework



1.4 Research Outline

The first chapter of the introduction here identifies the definitions of CIM and states its importance according to researchers and pioneers studying children's behaviours. It also includes the research questions and objectives for investigating the relationship between CIM and the physical environment.

Chapter 2 tackles the literature review of CIM indicators, the challenges children face, and the children's needs from the streets. Moreover, it inspects the relationship between physical and sociocultural factors. Chapter 3 introduces the methodology this research followed to collect the data required for the study. Starting with an introduction to the case study selected and explaining the two phases it pursued to reach its findings through questionnaires and workshops for children and their parents, in addition to the study area observations.

Chapter 4 is about the results and analysis of the data collected through charts, tables, and diagrams like the "Place Standard Tool" by the Scottish Government and National Health of Scotland that simplifies the perception of the environment by the participating children and their parents. Chapter 5 will delineate the relations between each factor mentioned in this study and the CIM to measure which is the most and least influencing of them. In the final chapter, the conclusion encapsulates the findings of each phase and presents their relevance to the underlying theoretical frameworks, giving suggestions for future CIM studies.

Chapter 2: Literature review

In “Growing Up in Cities” by Kevin Lynch, he starts to alter minds by suggesting that children should not be considered just as a part of the family but as an individual of his/her own. They have yet to be considered during planning processes, especially with all the major changes and initiatives in the last decades. Instead, they were considered “non-producers”, a concept that suppresses a child’s qualities in a city (Lynch & Banerjee, 1977; Carmichael, 1979).

Later, in 1978, Colin Ward illustrated in “Child in the City” how children of the 1970s were in a better position than those of the 1920s due to modernism. Despite the additional restrictions they had compared to nowadays. The researcher remarked that the children of the 1920s explored the streets, whereas the children of the 1970s wandered. This issue is not just owing to the altered constructed environment and speedy vehicles but also because children nowadays can explore their surroundings less frequently. Due to parental supervision, subjective fears, a lack of understanding of how to travel the streets safely, and the accessibility to public transportation, CIM is declining. He elaborates at the end that he is not calling for a “Disney-like city” but for a neighbourhood where a child can comprehend the surroundings the same way an adult can (Ward, 1978).

This chapter will tackle the indicators and factors that influence CIM, the children’s challenges in their neighbourhoods, and their needs from the streets to grow in a suitable environment.

2.1 What's the proper age for Children's Independent Mobility?

Ages 7 to 12 are the stages when children start leaving their houses, reaching out to the community, and exploring their neighbourhoods on a small scale independently in the quest for learning and exploring (R. Moore & Young, 1978; Hillman et al., 1990; Nooraddin, 2020; Shaw et al., 2015; Tyagi & Raheja, 2021). According to studies made in 16 countries in Europe, Asia, and Africa by Shaw and his colleagues, the spectrum of freedom in CIM increases from the age of 7 and with each year older. However, most restrictions were on children under 11 years old, but even older children have some movement restrictions. In some countries, children can travel to nearby destinations or services within walking distance of their homes or cycle alone by age 7. By the age of 8 years old, they can start crossing main roads alone, travel to school and back, and independently meet their friends after dark. By 9 years old, they should be able to cycle on main roads alone if traffic is well maintained, and by the age of ten, they can start using public transportation. On the other hand, some other countries start granting this kind of freedom later than mentioned before, starting from 11 - 15 years old (Carver, Panter, Jones, & Sluijs, 2014; Shaw et al., 2015).

According to Joshi and Maclean, 7 to 9-year-old children are more likely to be accompanied than older children. Most likely because of what the parents noted in the questionnaire as "stranger danger" (Joshi & MacLean, 1995). Moreover, other researchers declare that around the ages 8 - 13, children often start taking the first steps towards greater autonomy, described as the "running point" (Moore, 1986; O'Brien et al., 2000; Prezza et al., 2001; Prezza & Pacilli, 2007), by doing things like biking or riding the bus to school on their own. They are capable of going further on foot or by bike. They may also start taking care of younger relatives or other children their age (Kytta, 1997; Monsur, 2012; National Association of City Transportation Officials, 2020).

2.2 CIM Indicators

Marzi and Reimers mentioned four distinct CIM indicators: CIM licence, CIM range, CIM time, and CIM destination. The first indicator is the mobility permits parents give their children, known as the CIM licence. The second indicator, the CIM range, reflects the geographical range, often represented as the distance from a child's home that he/she takes alone. The third indicator, the amount of time a child spends independently away from home, is also considered a CIM indicator. Lastly, CIM destination is used to ascertain a child's actual mobility because there may be a discrepancy between the areas in which children are permitted to roam and the areas in which children roam. Therefore, this indicator

is to identify children's independent travel to specific locations, such as the neighbourhood store, school, or a friend's house.

Although these four indicators can theoretically be determined, they overlap in studies, mainly between the CIM license and the other indicators. For instance, parental questionnaires assess parental approval for independent travel to particular locations, as parental licences play a crucial role in CIM (Sharmin & Kamruzzaman, 2017; Marzi & Reimers, 2018).

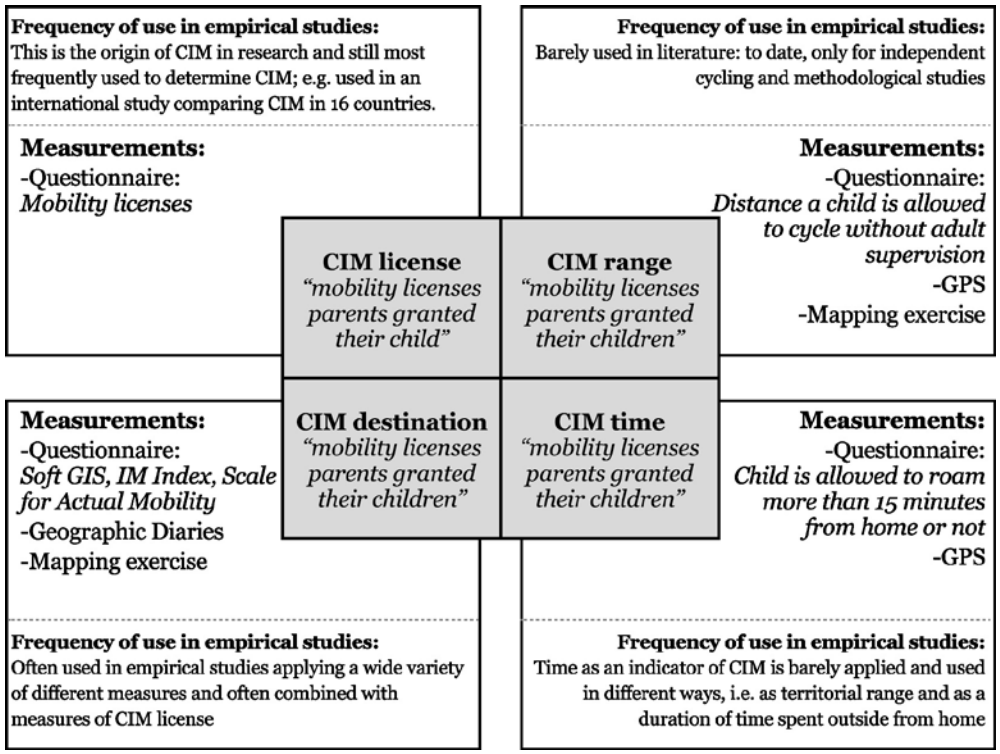


Figure 2- Definitions, measures, and frequency of application in empirical projects of four children's independent (CIM) indicators. Source: Marzi & Reimers, 2018

2.2.1 CIM license

CIM may be negatively impacted by environmental variables such as crossing busy roadways without adequate infrastructure for walking. It could also be affected by destinations like schools and others not at an appropriate distance for children. These variables result in an un-walkable neighbourhood (Merom, Tudor, Bauman & Rissel, 2006; Bere, Van der Horst, Oenema, Prins & Brug, 2008; Panter, Jones, Sluijs & Griffin, 2010; Villanueva et al., 2012). Also, high-

traffic roads, unsafe routes in the neighbourhood (Panter, 2010; Trapp et al., 2012), and the "no eyes on the streets" issue decrease the feeling of safety in children and their parents. In addition, they influence the CIM negatively by decreasing the flexible range of a CIM licence (Panter, 2010; Morris et al., 2001).

2.2.1.1 The Impacts of Age, Gender & Socio-economic status on CIM license

According to Lin and his fellow researchers, CIM licence is measured on three scales: social cohesion, social connection, and neighbourhood safety (2017). Social cohesion is the level of trust, respect, and engagement within a community (McNeill, Kreuter & Subramanian, 2006). On the other hand, social connection concerns the quality and quantity of interrelationships between adults and children living in the same neighbourhood. Correspondingly, neighbourhood safety is about how well the neighbourhood design is associated with being safe for children's daily activities and inviting the adults to bring up their children in that community (E.-Y. Lin et al., 2017; Tyagi & Raheja, 2021). However, if a constant-appropriate value for each of the previous scales is put in a graph compared to a child's age, the ratio should increase (Kyttä et al., 2015; Bhuyan & Zhang, 2019; Tyagi & Raheja, 2021).

In previous studies, it was evident from the surveys' rates of CIM that the parents' permission for their children to move independently depends on how the child will deal, at a certain age, with the neighbourhood's physical and social factors. Parents' perception of their neighbourhood's quality could also affect their CIM licence.

Despite all the factors mentioned that would change a parent's licence for his/her child, the family's financial background shows a different influence on the CIM licence. Aside from the range travelled, car ownership increased the average number of people who drive and pick up their children. Thereby, low-income and a ratio of mid-income families show a wider scope of the CIM licence (Sleap & Warburton, 1993; Tyagi & Raheja, 2021). Another common pattern Mackett highlighted was the impact of the increase in the number of children with mobile phones. He portrayed that it allowed children to be left alone with the assurance that they could contact their parents if they were lost or felt threatened. It also portrays that the children could contact their parents to pick them up by car, which may have increased private vehicle usage (Fyhri et al., 2011; Mackett, 2013).

On the other hand, gender plays an important role in deciding on a CIM licence. In numerous studies, there was an obvious difference in the number of girls with

a CIM licence at each age compared to the boys (Coates & Bussard, 1974; Moore & Young, 1978; O'Brien et al., 2000; Kerr, Frank, Sallis, Chapman, 2007; Brown, Mackett, Gong, Kitazawa & Paskins, 2008; Handy et al., 2008; Page et al., 2009; Broberg, Kytta & Fagerholm, 2013; Zarghami & Bagheri, 2020; Zhou, Wang, Lin & Qian, 2022; Hamad, Moustafa & Khalil, 2022).

Tcymbal and colleagues started to measure and evaluate the built environment characteristics on both genders and found that each gender is affected vastly by certain characteristics. For example, open spaces were found to be more effective in improving the movability of girls. At the same time, the boys' mobility was more affected by the density of road intersections in the studied area (Tcymbal et al., 2020). Moreover, Hoefer and colleagues recorded a higher number of parents concerned with driving their daughters by car, while Sallis and colleagues recorded a greater fear of traffic among parents for girls over boys (Hoefer, Mckenzie, Sallis, Marshall & Conway, 2001; Gomez, Johnson, Selva & Sallis, 2004; Evenson et al., 2006; Carver et al., 2014; Sallis et al., 2016).

2.2.2 CIM Time, Range & Destination

Determining the amount of time spent outdoors requires objective approaches such as GPS, accelerometers, transport datasets, the CIM range, or single questions can be employed. On the other hand, mapping activities (Broberg et al., 2013), trip diaries, greatest distance from home (K. Villanueva et al., 2012), street range (Koohsari et al., 2017), go-along interviews, and other modified questionnaires are presented to quantify CIM range and destinations (Marzi & Reimers, 2018; Zarghami & Bagheri, 2020).

In studies conducted at the neighbourhood scale, the street range and the furthest distance from the residence are utilised, whereas the mapping approach is employed at the urban scale (Zarghami & Bagheri, 2020). According to Qiu and Zhu's study results, the proportion of authorised CIM decreases considerably with increasing distance, most likely because of rising safety concerns when children go further from home. However, the findings of parental permission for the CIM range, compared to a previous study, found that 62% of parents of 8- to 12-year-old children would restrict their autonomous movement to locations within 500 metres (Qiu & Zhu, 2021).

Time, range, and destinations are three factors that, according to previous studies, depend on each other. Whether by the time a child can spend at or take to reach a certain destination or by the range a child has to travel to reach a specific facility. Eventually, a cycle links the CIM indicators to the social and physical factors of the surroundings.

2.3 Streets for children

A child-friendly city is a safe city for everyone. Children should be encouraged to use public transportation, walk, or ride a bike without parental supervision and feel safe doing so. Besides, by recognising streets as public spaces, it can be ensured that they are not merely passageways but also places to pause and socialise. Streets can provide children and their parents with possibilities for outdoor play, inspiration, personal growth, and interpersonal interactions (National Association of City Transportation Officials, 2020). According to the Global Designing Cities Initiative guidebook by the NACTO, "Streets for Children" should be safe and healthy, comfortable and convenient, inspirational and educational.

It is important to remember that children typically have needs specific to their age and the environment they live in. However, there are also universal needs that the streets can offer to cover a healthy growth process for children. Recognising streets as public spaces helps make them more than just passageways. It makes them places to linger and socialise. A street is a place where children and their parents can go to play, get ideas, grow, and meet new people (National Association of City Transportation Officials, 2020)

According to Monsur, the research findings provide empirical evidence of a connection between the design of streets and children's independent mobility (CIM). The findings provide empirical support for the hypothesis that street layout influences CIM. Crossing the street correlates significantly with the average distance a child walks on his or her own each day. The number of crossings and the types of streets also play a role in how independently a child can get to and from school (Monsur, 2012). Moreover, Children's Discretionary Activity Independent Time (DAIT) was strongly associated with street type and width, as determined by both multivariate and bivariate linear regression analysis and binary logistic regression.

2.3.1 Identifying Challenges

According to the “Global Designing Cities Initiative”, children face various challenges in their daily travels, especially if they move independently (National Association of City Transportation Officials, 2020). Challenges like lack of mobility options, when children cannot get where they need to go without being driven, make them increasingly reliant on cars and less likely to engage in physical activity. The availability of public transportation, cycling infrastructure, and inexpensive leisure centres has been demonstrated to significantly increase children’s likelihood of engaging in physical exercise.

Poor visibility of pedestrians and bicycles by vehicles is caused by factors such as a lack of proper illumination and blind spots. These factors result from subpar street design and inadequately placed or absent markings. Moreover, heavy traffic, frequently induced by roadway designs prioritising vehicles and permitting high speeds, dramatically increases the likelihood and severity of crashes.

The urban heat island effect refers to the phenomenon whereby large amounts of asphalt and other impermeable surfaces in urban areas lead to higher temperatures. In areas with inadequate shade, this problem becomes especially vulnerable and even more severe for children in warmer countries.

Poor water management is also a challenge for children, especially in the winter. Poor infrastructure and abundant impervious surfaces are potential sources of water management problems, including overflow (ex., after rain). Poorly managed water can make it difficult for children to walk or bike.

Lack of exposure to nature means that streets with no or extremely few trees and green spaces lack shade and deny children the opportunity to interact with nature. Exposure to nature has been shown to improve physical and mental health.

Lastly, lack of maintenance; children are more likely to encounter street objects. They can be negatively affected by a lack of general street cleaning and trash collection, sewage drains, street pavements, and light structures and furniture maintenance.

2.3.2 Children's Needs from Streets

Safe streets and convenient transportation alternatives are essential for residents, adults and children alike, to have easy access to all of a city's essential amenities. The health and safety of children (under 15 years old), who are 40% of the total population in developing countries (Schuff & Kielgast, 2019; UN Population Prospects 2017), 35% of the total population in Egypt (World Bank, 2022), should be prioritised in the planning and construction of our city's streets. Safe and healthy streets have features like uninterrupted walkways for pedestrians, bike lanes and public transportation, reduced speeds for drivers, plenty of trees and greenery, places to exercise, and sufficient lighting (National Association of City Transportation Officials, 2020). On another level, places to sit for rest or social interaction, accessible public transportation with clear signage and timetables, climate-appropriate shade and shelter along sidewalks and at transit stops, and basic amenities like water fountains and bathrooms all contribute to making streets more pleasant places to spend time.

However, while it is essential to stay safe, it is also critical that children and their parents have the chance to thrive. Avenues designed for children and their parents should be engaging and instructive. Even roadways are more than mere thoroughfares; they are also points of interest in their own right. According to Moore, access and street diversity are important characteristics of a successful child-environment policy (Moore, 1986; Kyttä, 2004).

Creating inspiring and instructive spaces for children is essential during the formative years, as a child's environment can significantly impact his or her development (National Association of City Transportation Officials, 2020). Examples include the presence of sidewalks, traffic density and speed, distance to and design of venues for physical activity such as playgrounds, parks, and schoolyards, crime, safety, and weather conditions that make up the physical environment. Even though crime and safety are not technically aspects of the physical environment, they are still considered. They are linked to many aspects of the physical environment, such as lighting, buildings' condition, and trash. They also cause instability in the surrounding area, such as a reputation for unsafeness in certain neighbourhoods(Davison & Lawson, 2006).

2.3.2.1 Reliable Mobility Choices

With more options for off-peak and multi-stop travel that are safe, dependable, and integrated, children, parents, and families may easily reach the places they need to go and use the services they rely on every day. Children must learn how to navigate their immediate surroundings successfully to grow, develop, and achieve self-assurance and a sense of agency. All children, including those with disabilities, benefit from learning to move around on their own as early as possible (National Association of City Transportation Officials, 2020).

Davison and Lawson carried out 33 studies on the relationship between the characteristics of the physical environment and children's physical activity. They mentioned that, according to Ewing et al. and Boarnet et al., children's rates of walking or cycling to school favourably correlated with street sidewalks. Moreover, Jago and colleagues started getting into the details of the impact of sidewalk conditions such as distance, the height of trees shading over the sidewalk, and sidewalk materials and type on the intensity of the children's physical activity (Davison & Lawson, 2006).

Later, further studies were conducted to consider different streets' physical characteristics, such as street light fixtures, crosswalks, traffic speed, and traffic lights. These characteristics affect the parents the most, impacting their choice of allowing their children to move freely. Parents and their children have unique

mobility requirements and may require more facilitated journeys. Infrastructure and mobility choices that allow for many stops and modes on a single trip are more beneficial. Improving access to the city will make it a more egalitarian and desirable place for all residents by prioritising sustainable alternatives over using private cars. Alternatives include frequent, efficient, reliable transit modes, bike sharing, safe cycling facilities, and an accessible pedestrian network.

2.3.2.2 Places to Pause and Stay

Urban streets must serve as public places and effective transportation platforms. “Pause and stay” spaces let children and adults eat, relax, interact, or be engaged. These areas may be fun, instructive, and sociable if planned appropriately. They can help parents feel more involved in the city’s rhythm and may allow residents to enjoy urban street life if there are areas for them and their children. In addition to the feeling of safety, that can influence the children’s independent mobility.

“Pause spaces” are unspecified. They can be pockets and recesses along building edges, clear places near crossings, trees, columns, and utility poles, and off of the sidewalk way. “Sit spots” make travelling easier for children and their parents. They include seats along sidewalk furniture zones and the residential area’s edges. “Stay areas” may be local centres for gathering and playing and accommodate many activities. They include pedestrian plazas, pedestrian-only streets, shared roadways, broad walkways, and central medians. Hence, pause, sit, and stay areas can improve children’s and parents’ physical and mental well-being (National Association of City Transportation Officials, 2020).

In the “Gehl People” initiative towards child-friendly cities, they collaborated with “KaBOOM!” a non-profit organisation that designs communities with play spaces for children, to develop a “Play Everywhere” programme to motivate and direct municipalities towards the goal of transforming everyday hangout spots for children into interactive spaces. Play may easily be included in daily activities on the sidewalk, at a bus stop, or in a small park. It increases the accessibility of play and the opportunities for all children in a community to be physically active (Schuff & Kielgast, 2019).

2.3.2.3 Social Interaction

Every experience children have with their surroundings and other people causes new neural connections to emerge in their brains. If streets are planned well, they can serve as a platform for children, adults, and communities to share in shared rituals and experiences that foster deeper bonds and friendships (National

Association of City Transportation Officials, 2020). Through the programming of spaces and their connections to local culture and society, cities can offer various experiences and truly build a sense of identity for their inhabitants.

Including cultural, historical, or playful identities in urban areas produces an opportunity for education, strengthening children's connections with one another, and the emergence of children's natural interactions with their parents. It stands to reason that when children have healthy relationships, a sense of connection to place and community, and a sense of belonging, they will have a lower risk of developing feelings of alienation and inequality as they mature. The evidence that social isolation and loneliness are increasing in cities worldwide is mounting. There is a growing possibility that forming strong connections among children can have long-term significance towards creating a more connected society (Schuff & Kielgast, 2019).

2.3.2.4 Play and Learning

Play is a crucial component in the growth and development of children, as it boosts physical activity, aids in the development of motor skills, fosters socialisation, and fosters creativity. Whether strolling along a sidewalk or waiting at a bus stop, children can take advantage of the opportunities presented by the streets to include learning and play into their routine lives. Unstructured play results from children's purposeful interactions with their surroundings, in which they regularly engage.

It fosters the growth of children's imaginations, cognitive abilities, and resiliency by enabling children to take the initiative and make choices (Schuff & Kielgast, 2019; National Association of City Transportation Officials, 2020).

2.3.2.5 Visibility

Improving the overall urban visibility in a neighbourhood that lacks any service may make it easier for children living there to have consistent access to the nearest public services possible. Child-focused visibility increases the child's comfort level in a space. When the streets of his/her community are readable, they aid in having unfettered views of the outdoor spaces and green areas, reflecting the feeling of safety in the street. In addition to enhancing access to public areas through improved street lighting and visibility, the distribution of social and commercial services along sidewalks results in an increase in social cohesiveness (Aerts, 2018).

2.3.2.6 A safe environment

There is a strong correlation between the parents' perspectives and beliefs, and their outcomes on the children in their care. If the parents think they are in danger while using the streets, they are less inclined to allow children to move freely on their own or go outside with them. A parent's impression of safety is significantly impacted by a variety of crucial characteristics, including the state of cleanliness, the speed of vehicles, the layout of the roadway, and the level of safety afforded by a busy but not unduly crowded sidewalk or public place (National Association of City Transportation Officials, 2020).

Children are especially susceptible to the effects of their surroundings since their bodies and brains are still developing. In order to thrive, they require a setting free from the dangers of the street, such as violence, air pollution, and excessive noise, yet with the possibility of being rich in educational and social opportunities (National Association of City Transportation Officials, 2020). Moreover, a safe environment should have social and urban safety. Social safety is when people are on the streets or with a clear line of sight to the streets from their homes can help keep the community safe. Children would feel protected in this manner. Jacobs emphasised the connection between pedestrian movement and community security by saying, "A properly used street is a safe street", and the more eyes on the street, the fewer people fear crime (Jacobs, 1992; Gencer, 2017). While urban safety indicates child-friendly cities, according to Derdiman and Gencer, safe cities can be defined as those in which crime is actively combated. Criminals have nowhere to hide, opportunities to commit crime are scarce, slums are absent, and residents demonstrate a desire to rise to the level of modern civilisations. (Derdiman, 2014; Gencer, 2017).

2.3.3 Designing on different scales

As discussed earlier in the "Proper Age for CIM", most researchers declare that children from 8 to 13 years old can start walking, cycling, and using public transport. They can also start taking care of their younger siblings (Moore, 1986; Kytta, 1997; Prezza & Pacilli, 2007; National Association of City Transportation Officials, 2020). It was also mentioned earlier in "Streets for Children" how the needs change with age. Accordingly, UNICEF presented a diagram (figure-3) that differentiates between those mobility needs on three scales: street, neighbourhood, and city scale. It exhibits the physical requirements and destinations in each scale while independently identifying the appropriate age to reach and use those facilities within suitable proximity.

According to the diagram, children from 6 to 9 years old can walk distances up to 300 m, while those from 10 to 12 can walk and cycle up to 400 m, and those older than 12 can cycle and use public transportation up to 1200 m.

Thenceforth, NACTO elaborated that the physical design will be one of many solutions to the problem of making streets suitable for children and parents. Child-friendly streets combine geometric design, operational adjustments, and infrastructure management and are supported by comprehensive development control, goal-oriented programmes, and design guidelines (National Association of City Transportation Officials, 2020). They considered all the aspects that impact the neighbourhood scale, like sidewalks, crossings, plazas, cycling lanes, transit stops, etc. In comparison, the block and detail scales are improved through five street design strategies. “Upgrade” the streets to meet minimum criteria for safety and access. “Protect” using urban street design and public policy to reduce vehicle speed to an acceptable level. “Reclaim” space from private vehicles to boost the street’s capacity. “Activate” to include play and learning along the street, not only at playgrounds. Finally, “Extend” to incorporate surrounding areas through the “Activate” process.

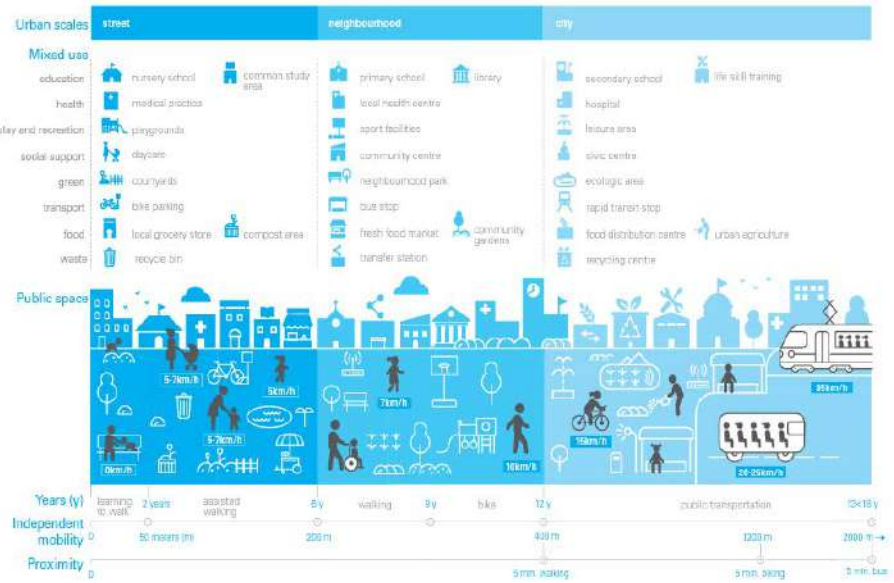


Figure 3- Urban Mobility Measurements. Source: UNICEF

2.3.3.1 Neighborhood scale

hen planning streets at the neighbourhood scale, it is important to consider how easy it is for children and their parents to get to and from important places like schools, daycares, playgrounds, and parks. It also entails locating potential

within existing street networks to develop fresh, high-calibre public areas near people's residences. Streets are the veins that run through a community, making it even more important that they are redesigned to fit the specific requirements of each area.

There are several types of streets found in every community, each with its size, layout, purpose, and, in some cases, priority. Designing the network of streets to provide pedestrians, cyclists, and public transportation riders preferential treatment over drivers of private automobiles is a top priority. Locate streets or locations that can be made "pedestrian-only" by closing them to private vehicles or restricting access to those areas, and do so. As a result, traffic safety, environmental noise and air pollution exposure, and access to new local businesses will all be enhanced (National Association of City Transportation Officials, 2020).

2.3.3.2 Block scale

Block-level street planning allows for more detailed considerations of the local environment to guide design decisions. The design of a single street may change from one block to the next within a city or neighbourhood to accommodate varying building densities and uses, pedestrian and vehicle traffic volumes, commercial loading requirements, water management issues, and public space requirements.

How the street's space is divided between various uses depends on the right-of-way (the whole area between the property boundaries). Nearby major destinations and local enterprises, such as schools, daycares, healthcare facilities, shops, restaurants, and parks, heavily influence the architecture and functioning of a certain block. Placement of pedestrian crossings, curb management at different times of day, the introduction of shared or pedestrian-only streets, and prioritising transportation and cycling in areas with constrained resources are all potential decisions that must be made.

2.3.3.3 Detail scale

When designing on a human scale, one should focus on the details. Because of children's lower height and faster pace, they notice more detailed elements in their everyday streetscapes than do adults. Correct execution of the finer points of street design is beneficial at the city, neighbourhood, and block levels. Children should not use a sidewalk without a pedestrian crossing or ramp. On the other hand, a detail as fine as a new mural on a blank wall could spark a conversation

with a parent, a strategically placed bench could provide a welcome respite, and a series of markings on utility poles could aid a child in learning to count.

2.3.4 Street Design Elements

In various studies, the results show more signs of the impact of the social and demographic criteria than the physical aspects (Kerr et al., 2007; Bere et al., 2008; Brown et al., 2008; Alparone & Pacilli, 2012). However, in other studies made in Asian and African countries, it was proven that the results correlated with the local community's physical characteristics more than the sociocultural characteristics (Aerts, 2018; Tcymbal et al., 2020; Qiu & Zhu, 2021). The physical environment comprises traffic; distances travelled, vehicle ownership, population density, urbanisation level, urban layout, and neighbourhood design, among other factors (Marzi & Reimers, 2018).

Moore and Young's study introduced three main headlines: "territorial range, pathway, and place". They were later categorised into specific elements that were classified from the surveyed children's drawings.

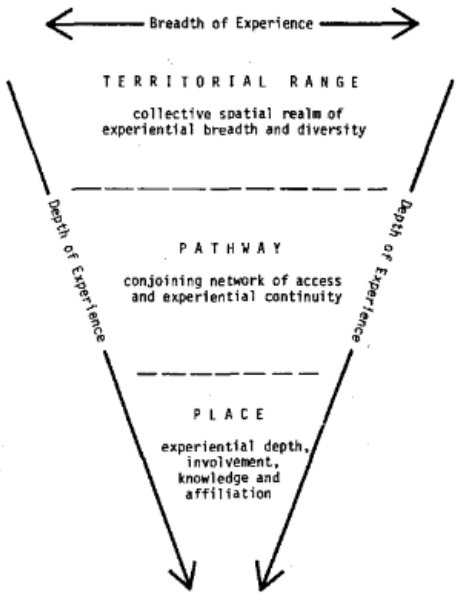


Figure 4- Components of the phenomenal landscape.
Source: Moore & Young

"Territorial range" is the collective geographical sphere of experiencing local range and diversity. "Pathway" highlights the mobility experience and continuity while defining the conjoining network component, tying place and territory together. While "Place" is about experiencing the depth of the location and the

involvement of the user, as well as that it is the source of knowledge and allegiance (Moore & Young, 1978).

Moore and Young categorised the "Place" elements according to the number of mentions in the children's drawings: home site, people, vegetation, pathways, community facilities, open space, sports facilities, animals, fences, traffic, and aquatic features. According to their investigation of previous studies, they showed the differences in mention distribution between different locations. Even though there is a broad variety of demographics, built environments, and cultural environments, the findings are consistent (Moore & Young, 1978).

For streets to operate well, it is important to know where different streetscape features and functional areas are. Children's mobility and experience on the street may be vastly enhanced by focusing on design elements. Clear pathways and accessibility modifications such as pedestrian ramps, seats, play components, landscape, transit stations, garbage cans, pedestrian crossings, and cycling infrastructure improve the public realm for children (National Association of City Transportation Officials, 2020).

2.3.4.1 Amenities (lighting-signage-trash cans-public toilets-drinking fountains)

Street elements, including streetlights, trash bins, and signage, are crucial to the safety and accessibility of roadways. Additional amenities, such as public toilets, drinking fountains, and Wi-Fi, facilitate city travel and encourage children and their parents to spend time on urban streets. The heights and abilities of children shall be considered while planning and installing these amenities.

Street lighting promotes safety and allows children to play and remain outside for longer periods of time. Using signs, maps, coloured graphics, and visual clues assist children in determining their location and navigating to their destination through horizontal and vertical surfaces. Moreover, children benefit from having "landmarks" in their community, ranging from works of art to sewage covers. At the same time, trash bins shall be in appropriate locations to assist in maintaining a clean and pleasant pedestrian environment. They could be close to clean routes near corners, vendors, and crossings.

2.3.4.2 Sidewalks

Sidewalks form children's and adults' transit networks. Their design should reflect their function as a right-of-way and a public area where children are likely to spend time. Clear sidewalks satisfy accessibility and pedestrian volume demands. A good sidewalk can accommodate numerous people walking together. It has enticing building edges, shaded spaces for strolling, playing and socialising, and navigation systems. In addition, secure and comfortable walkways are well-lit at night.

According to NACTO, a good sidewalk has eight layers. A frontage zone adjacent to the buildings on the street, mostly for pause and play for children, should be at least 0.5 m. A clear path zone, the main unobstructed walkway area, should be at least 1.8–2.4 metres wide in residential areas. A street furniture zone is a buffer for children and people from the cycling lanes, parking areas, and moving vehicles. It allows benches, lights, bicycle parking, kiosks, play, and learning without interrupting the path. This zone's trees, pots, and landscaping provide shade, wildlife interaction, and street enclosure. A buffer zone is an extra buffer to protect from traffic accidents and car exhaust pollution, and parents feel safer letting their children move alone. However, if the sidewalk needs to be wider, this zone can be added to the furniture zone.

Moreover, Davison and Lawson mention, according to Ewing and colleagues, how they discovered that the fraction of roadway kilometres with sidewalks was positively correlated with the number of children walking or cycling to school. In addition to Boarnet and colleagues, an evaluation of the implementation of the "Safe Routes to School" programme discovered that children who passed sidewalk-equipped areas were more likely to walk or bicycle to a school than those who did not pass such regions. Also, Jago and colleagues found that objectively measured sidewalk characteristics such as the range from the sidewalk, average tree height, and sidewalk material and type were related to increased intensity of physical activity, like slow walking, among children (Davison & Lawson, 2006).

2.3.4.3 Nature and Landscaping

Children who live in communities with more trees and vegetation have superior motor and intellectual abilities and enhanced brain growth and memory functioning. Their presence promotes more imaginative play. Further research demonstrates that individuals who live near nature have stronger relationships with their neighbours and a greater sense of safety than those who live in areas

with fewer trees. Moreover, trees provide shade for seating, walkways, bike lanes, and plazas, which is crucial in warmer climates.

Choices of plant species on walkways are crucial for areas with high densities of children. As heights of shrubs shall be considered for visibility, toxic or spiky plantations should be avoided for safety. Lastly, trees of appropriate height and trunk width should be used to provide the desired shade without increasing the walkway width.

2.3.4.4 Pedestrian Crossing

Unlike adults, children travel slower and cover a shorter distance in the same period. They may be particularly susceptible at junctions that are collision spots because they may be less visible. Hence, some guidelines shall be considered when designing streets' crossing points, especially for children. Sidewalks can be broadened, curbs can be extended, and pedestrian buffer platforms on three-lane roadways or more can be provided to decrease crossing distance. Buffer platforms should be at least 1.8 metres wide and ideally 2.4 metres wide to accommodate families, strollers, and wheelchairs. It protects pedestrians from turning vehicles with a median between two-way streets. A permeable walking network requires crossings every 50 to 100 metres in high-volume pedestrian zones or no more than 200 in all cases.

Key destinations should also align with crossings for easier manoeuvring, where they follow the sidewalk's visible course. Speed bumps lower vehicle speeds near crossings and in areas with many children. Crossing markings should be highlighted with zebra stripes or other bright colours and interesting patterns that can be used with calming traffic tactics. All crossings need pedestrian ramps. Children should cross at grade level or up to the sidewalk level. Align pedestrian ramps with crossings, clear walkways, and ramps on the opposite sidewalk. However, underpasses and pedestrian bridges restrict accessibility.

Children must be visible to drivers and cyclists and also clearly see the surroundings. So, parking within 6–8 metres of crossroads shall be prohibited. Curb extensions shall be provided where possible, stop signs shall be at least 3 metres from crossings, and sight obstacles shall be removed within 3–5 metres of crossings. Moreover, countdown signals showing the remaining seconds shall be provided to increase predictability. Walk signals should be audible and vibrotactile, prioritising pedestrian circulation and keeping waiting times under 40 seconds. Leading Pedestrian Intervals (LPI) offer a head start over turning

cars, making children at crossings more apparent to drivers (National Association of City Transportation Officials, 2020).

2.3.4.5 Cycling infrastructure

Neighbourhoods where cycling is a safe and appealing mode of transportation meet children's demands. Well-designed cycling networks offer children the opportunity for autonomous movement and a great deal of independence while giving parents the feeling of safety to increase their children's IM licence.

A safe cycling route must include a buffer zone between it and both the pedestrian path and the road; signage that indicates directions and when to stop for pedestrian crossings or car turns; spaces for cycle racks, in addition to a corner refuge island that offers cyclists a physical shelter at junctions.

2.3.4.6 Seating & Transit Stops

Street furniture can be used to build informal socialisation spots in urban areas at little expense, which is important for children's social and emotional development. Seating areas and elements must consider various locations, forms, and colours for the children's visual interaction and materials that are easy to maintain. Seating can be divided into fixed individual seating, fixed social seating, or flexible seating. On the other hand, transit stops are essential to enhance transportation for children and adults. A transit stop should be accessible for children visually and digitally (public transportation's arrival time), provide appropriate seating, and provide essential shelter during heat waves or windy and rainy days. Moreover, transit stops can be integrated with pause and play areas by adding facilities like bike racks, trash bins, and engaging games or artwork for children.

2.4 Claim point in Egypt

Unfortunately, none were found concerning the characteristics or guidelines of the streets that would affect children's independent mobility in Egypt. However, as mentioned by Shafik and colleagues on Egypt's participation in the United Nations Convention on "The Rights of the Child" in 1990, no investigation or analysis was done by the government to support child-friendly communities (Shafik, Mansour, Kamel & Morcos, 2021). Further investigation proved that Egypt withdrew its signature in July 2003 concerning articles 20 and 21, which do not match Egypt's regulations (United Nations, 2023).

2.5 Relation between Streets' physical characteristics and CIM Frequency

It is becoming more common knowledge that the built environment, often known as the way humans construct and plan cities and neighbourhoods, can be used as a reliable indicator of both psychological and physical health (Dannenberg, Jackson, Frumkin, Schieber, Pratt, Kochtitzky & Tilson, 2003; Villanueva, 2011).

It would indicate that both the child's and the parent's perceptions of the built environment are essential for determining children's travel behaviour. Although studies have shown that children's perceptions of their local neighbourhood are more positive than their parents' (Timperio, Crawford, Telford & Salmon, 2004; Villanueva, 2011). Parents' influences play a major role in the mode of transportation choice of children up to 12 years old, as children's behaviours are likely to be shaped by their parents' perceptions, principles, and ideologies. Because parents are considered the 'gatekeepers' of their children's activities (McMillan, 2005; Villanueva, 2011), and ultimately have the power to decide whether or not their children will walk or ride bicycles. Therefore, their parents' perspectives regarding their social and physical environments may hugely affect children's decisions regarding their modes of transportation. This suggests that the factors influencing children's mobility may differ from those observed in adults and other groups.

In addition, there are some notable exceptions (Alton, Adab, Roberts & Barrett, 2007; Villanueva, 2011). The vast majority of studies have concluded that the presence of neighbourhood destinations favourable to children's active transportation, such as parks, playgrounds, sports activities spaces, or amusement areas, is associated positively (Timperio et al., 2004; Carver et al., 2005; Evenson et al., 2006; Kerr et al., 2007; Villanueva, 2011).

A conceptual framework McMillan established shows that parental decision-making is important in the interaction between the built environment and children's active transit to school (2005).

For instance, the built environment's qualities might affect the actual or perceived level of safety in the neighbourhood, which in turn influences the choices made by parents (Villanueva, 2011).

Street crossings may be convenient for cars, but they do little to help children go around independently or be safe. Technical professionals like traffic engineers prioritise the needs of cars and the flow of traffic over the needs of pedestrians, including children, when planning the layout of roadways. Even in developing nations, research has shown that many residential streets prioritise car safety

over human safety, leading to faster driving speeds. As a result, parents feel additional pressure to keep their children off the streets to protect them, which further compromises child safety (Tranter & Doyle, 1996; Monsur, 2011).

According to Davison and Lawson, several studies found that public investments in recreational infrastructure, such as parks and public transportation, are associated with increased rates of physical activity among children; due to the presence of sidewalks and controlled intersections, access to destinations, and public transportation. Children's lack of activity is also linked to local conditions like area deprivation, transportation infrastructure like the number of roads to cross, traffic density, and vehicle speed (Davison & Lawson, 2006).

2.6 Conclusion

The previous studies suggest that more safe and appealing neighbourhood attractions may need to be where children can independently travel or play without proper supervision. The current neighbourhood destinations in different communities may lack child-friendly features and safety that would make parents more comfortable with allowing independent mobility or unsupervised play.

Future studies were recommended to investigate the connection between housing's physical, residential, and neighbourhood factors and CIM. Due to the significance of parents' perceptions of their place on the CIM, this research will also focus on cultural and socioeconomic status. Lastly, it is essential to include all the possible physical factors mentioned in previous studies that proved to have an impact on CIM and the elements that might be distinctive in Egyptian neighbourhoods.

Chapter 3: Research Methodology

This chapter reviews the empirical work to investigate the children's independent mobility variables and the streets' physical characteristics in New Cairo. New Cairo is one of Egypt's new governmental cities; it is close to Cairo to reduce the population density. It is taking advantage of the capital city's workforce and the available services to draw in people, activities, new job opportunities, and economic factors (Stewart, 1996; Sutton & Fahmi, 2001; Ellahham, 2014).

This chapter illustrates the case study selection, the sampling process, the data collection tactics, and the aim of each method in which children and parents participated.

3.1 Research Procedures

The research methodology depends on qualitative data distributed between the two phases of the empirical study.

The first phase is concerned with the physical and social factors of the residential area, which were implemented through workshops and questionnaires. The first workshop is to define their perception of their neighbourhood through a drawing that reflects how they see their journeys in the streets. The second is to define their journey across the neighbourhood's streets on a map of their area. Two questionnaires were distributed, one for children and the other for their parents, to confirm the data collected from the children and to fully understand the parents' point of view of their community.

The second phase is also divided into two parts. The first is to identify the most used streets by the children according to the data collected from Phase 1. The second is to observe the streets' physical characteristics in the selected area that are essential in affecting children's mobility and defining their conditions.

3.2 Pilot Study

This study aims to investigate CIM in new satellite cities for the following reasons:

1. Egypt's new governmental residential projects represent a typical residential neighbourhood design nowadays.
2. Those residential neighbourhoods were designed to attract people away from the centre with more developed opportunities.
3. It differs in its socio-demographic profile, giving a wider range in the usage of different modes of transportation and, hence, affecting children's independent mobility.
4. According to Abdellatif & Hammad, 1993, 56% of the surveyed residents were ready to move to the new cities.
5. Besides, people surveyed characterised new communities with: a) good planning, b) including basic needs, c) lower housing costs for a lower residential density than the capital city, d)a better way of living, and e) clean and calm environment (Abdellatif & Hammad, 1993).
6. To investigate the CIM frequency in Egypt's new cities, which is promoted to be a healthier place to live.

A theoretical comparison between 1st, 2nd, and 3rd generation cities in Egypt was conducted based on previous studies and the literature review to reach the appropriate options that would serve the focus of this study. Which is a case study that:

- Encourages walkability, not car-oriented.
- Represents a typical residential neighbourhood design in the new Egyptian satellite cities.
- Its neighbourhood's number of residents has grown through the past decade.
- Balance between the residential area and its service proximity.

After comparing and finalising the appropriate new cities, theoretically, for this study, the pilot study took place from November 12th to 23rd, 2022, to choose between Obour City, New Cairo City, 10th of Ramadan City, and Shorouk City.

3.2.1 Case studies background

Table 1 shows the comparison between the selected new cities.

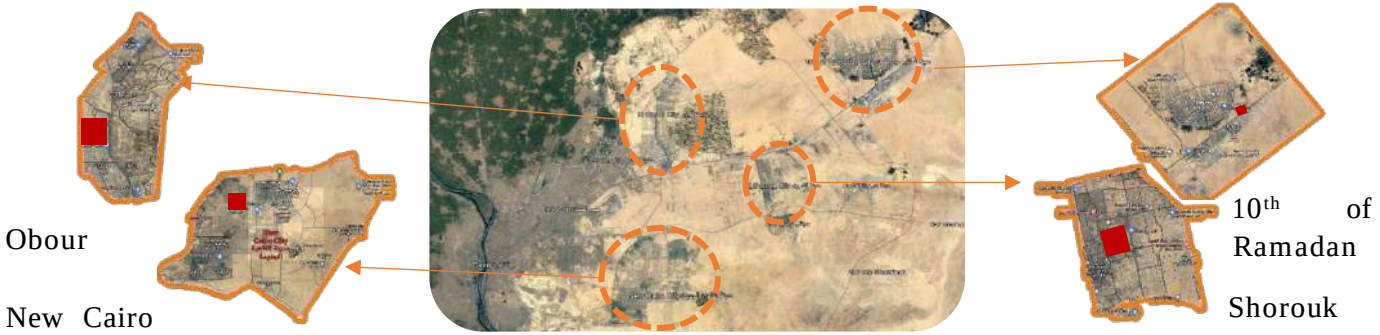
Background	Obour city	New Cairo city	10th of Ramadan	Shorouk city
Generation	2nd generation	3rd generation	1st generation	3rd generation
Map				
Map of Study area	9th district 	New Cairo Settelment 	Ordonia, 7th & 8th district 	
Population & Area	600,000 in 132.3 km² (Kenawy, 2017)	102,000 on 312 km2 (MOHUUD, GOPP, & JICA, 2008)	420,000 on 412 km2 (MOHUUD, GOPP, & JICA, 2008)	155,000 on 47 km2 (MOHUUD, GOPP, & JICA, 2008)
Price per sqm	5,700 EGP	6,000 EGP	4,000 EGP	5,000 EGP

Table 1- Case studies comparison. Source: Author

3.2.2 Case study selection

Obour City is one of Egypt's second-generation satellite cities from the 1970s urban planning initiative. In 2021, an initiative to introduce un-motorized mobility plans, like walking and cycling lanes, was implemented on Obour's main road for its residents. However, the closest district (9th district) to these new walking and cycling lanes was not eligible as a residential neighbourhood for this study. As shown in figure-5, it lacks proper sidewalks, and there was road construction work within the neighbourhood.

Figure 5- 9th district's streets in Obour City. Source: Author

10th of Ramadan City is mainly built as an industrial city, with light and medium-sized industries built within the neighbourhoods, services accumulating on the main spine, and heavy industries on the city's boundary from the Cairo-Ismalia desert roadside (Tipple, 1986). Therefore, the 10th of Ramadan City was disregarded as it does not serve the required guidelines for this study.

Shorouk City was also disregarded as a similar study was implemented about "Middle Childhood Home Ranges in Two Different Socio-Physical Settings, Shorouk City". Further studies were recommended to take place in different new settlements for confirmation of its findings within different contexts in Egypt (Hamad et al., 2022). In addition, its residential livability status did not match the criteria of this research.

However, justifying the choice of this study in New Cairo is as follows:

1. It inherits the reasons for the focus of this study, as mentioned earlier.
2. New Cairo settlements have shown more success as a new city than other generations' satellite cities of its strategic location to the New Capital City and the various business sectors that have successfully attracted different social levels to the city, which enhanced its livability.
3. Ease of access.

3.3 Introduction of Case Study:

The selected study area in New Cairo was initially called the “1st settlement” in the urban planning process. It was one of the first districts to be established in New Cairo, which introduced stable, vibrant neighbourhoods for this study. It consists of 11 neighbourhoods of mixed residential typologies between governmental and private housing projects, which support a variety of socio-economic ranges.

3.3.1 Location

Figure 6- New Cairo development map. Source: Arcelia developments. Edited by: Author.

The study area is located on the northwest edge of New Cairo. It is close to two of the main roads surrounding New Cairo: Suez road and Ring Road, and directly lie between Moustafa Kamel Axis and Ahmed Shawki Street, which makes it one of the easiest and fastest districts to be reached.

3.3.2 Zoning & Proximity of Services

The study area is divided into 11 neighbourhoods; some have similar building typologies, while others differ between private and governmental housing projects. In this case study, there are three different governmental housing

projects distributed between the neighbourhoods, resulting in three different building typologies, besides, the privately owned residential buildings.

Figure 7- Zoning of the study area. Source: Google maps. Edited by: Author.

North and South youth housing projects' prototype consists of 5-floor levels, walkways within garden areas in-between the buildings and several services repeated every four buildings. It had good lighting quality at night, matching the lively neighbourhood, as most services and commercial areas surround it.

The 2nd, 3rd, 4th and 7th districts combine private units of 3 to 4 floor levels and government-residential buildings of 6-floor levels (Typology 1). Services and public green areas are only found within the government-residential area. Moreover, the 3rd and 7th districts have the main service areas of the study area.

Figure 8- Private residential housing typology sample. Source: Author.

Figure 9- North & South youth housing typology. Source: Author.

The 5th district is a private residential area that consists of buildings with 3–4 floors and three main public green areas. In comparison, the 6th district is a mixed residential typology between private and government housing projects (Typology 2). The 8th, 9th, and 10th are mixed units but with different governmental housing units (Typology 3).3.4 Phase 1: CIM in New Cairo

Figure 10- Typology (1-2-3) of governmental housing projects. Source: Author.

Phase one includes the drawing and map activity workshops for children to identify the streets they travel and their perceptions of those streets' quality. It also includes a semi-structured questionnaire for the children and a questionnaire for their parents to investigate the CIM frequency in the study area.

3.4 Research Procedures

3.4.1 Sampling Strategy

After choosing the target schools based on their socioeconomic level, the researcher used a random sampling method for the participating children. Except for 7- to 9-year-olds, chosen by their teachers to accommodate the research scope. This began with retrieving the list of New Cairo's schools from the New Cairo Educational Administration with the authorities' permission and the acceptance of the Central Agency for Public Mobilisation and Statistics on the distributed questionnaires. According to the list, only three schools were suitable for the study. The rest were either international (Cairo Modern International School, Global Paradigm International School, and Al. Afak Al. Gadeda International School), boys-only schools (Ali Mosharafa School for Boys and Field Marshal Ahmed Ismail Secondary Boys School), or not easily accessed for safety reasons (Huda El Sharawy School).

The selected schools are one Arabic government school (Asmaa Bint Abi Bakr) and two English government schools (Dr. Magdy Yacoub and El Shaheed El Refaey School). A target of at least 30 children is to participate in this study, as mentioned by Gravetter and Wallnau that if n= 30 or higher, it does not significantly increase the sample's ability to reflect the population (Gravetter & Wallnau, 2017).

3.4.2 Participants

56 schoolchildren from the study area, ages 7 to 14 (31 girls and 25 boys), participated in this study. This is the age range when children are more prone to experience the streets independently and go on individual journeys in an appropriate range from their homes (R. C. Moore, 1986; O'Brien et al., 2000). However, since most studies agreed on the CIM age starting at 9 years old, the 7-year-old children who participated in the study were selected by their teachers to guarantee their understanding of the questionnaire.

3.4.3 Data Collection

The data collection process of phase one is divided into three stages: a drawing workshop, a map identification workshop, and finally, the children's and parents' questionnaires. Each process has its objective, which is explained in detail below.

The next step was to approach the three chosen schools: Dr. Magdi Yacoub Official Language School, El Shaheed Ibrahim El Refaey Official Distinguished Language School, and Asmaa Bint Abi Bakr School for Basic Education, according to the New Cairo Educational Administration.

Since the three schools mentioned bear students from the selected area and the surrounding areas, with the permission of the schools' principals, the student councillors of each school were contacted and familiarised with the purpose of the study to help identify the students who live in the selected study area.

By the third week of December 2022, two schools had been visited in one day. 9 students from Asmaa Bint Abi Bakr were selected by the school counsellor in a class after their break time to guarantee the level of education and understanding required to participate in this study. In comparison, 16 students from El Shaheed Ibrahim El Refaey were selected randomly. Each class in each school took twenty to thirty minutes, depending on the process of answering their questions and helping them finish the collected data. After the workshops and questionnaire, the students were given their parents' questionnaires with a paper attached introducing the researcher and the aim of the study and asked to collect them the next day.

On the second day, the last day of classes, two classrooms from Dr. Magdi Yacoub's school were visited. In Dr. Magdy Yacoub School, a longer period was possible as they finished their curriculums. Teachers helped give some time off their classes for this study. Each class took thirty-five minutes, which helped in giving time for elaborating on the aim of the study, selecting the students living in the study area, and more time for their drawings and map activities.

Initially, the data was collected on paper to avoid any technological interference. The students were given blank drawing papers and colours for both workshops. Both questionnaires were also printed to ease the process, with some animated pictures in the students' questionnaire to relate to the questions explained verbally by the researcher.

However, extra data was needed after the samples were collected and filtered. The principal of Dr. Magdi Yacoub School was contacted and asked for permission to contact children and their parents after the exam period to collect more data. Since there were no more classes, the students were accessed only during break time or after exam time in the school playground. In contrast, the parents' data had to be collected digitally for easy access. Further explanation was given to the administrators of the fifth and sixth primary students. A broadcast message was sent to the parents of the specified age through groups on social media applications. The parents were asked to use their participating children's

names or a code given to both parties to investigate the two questionnaires together.

3.4.3.3 Children's questionnaire

The third process consists of two questionnaires, one for the children and one for the participating children's parents. It adopted Hillman's questionnaire to examine the level of CIM and the children's travel patterns. Originally, the questionnaire was for schoolchildren ages 7–14 years. However, the age range was refined to fit the aim of the study, as explained earlier. The questions were also refined to adapt to the study area in New Cairo. It includes their mobility choices to school from home and vice versa; their independent mobility to other destinations than a school; more questions about their freedom of mobility according to their parents' decisions; and finally, questions to define their socio-demographic states like sex, age, and owning a mobile phone. For the full questionnaire reference, please check Appendix-A, page-117.

The process started with handing the participating students and parents questionnaires, with a letter attached to the parents' questionnaire, explaining the survey's aim and the study and taking permission to participate in this study.

The researcher reviewed each questionnaire's question with the class one at a time to avoid misunderstandings. However, during this process, students were curious and asked, "Why are we filling out this questionnaire?" which was explained by the researcher elaborating on the importance of understanding the impact of the physical environment on their choices of mobility and their parent's acceptance of the range, time, and destinations they visit. It also resulted in truthful answers and rethinking some of the answers twice.

Additionally, the Place Standard Tool (PST) wheel added at the end of the children's questionnaire included animated photos as a visualisation factor to help the participating students understand and compare those photos to reality. The PST wheel aims to identify the children's perception of their neighbourhood on a scale of 1 to 3, where 3 is the highest quality, and 1 is the lowest (figure-11). The bigger the shaded area in the wheel, the better the neighbourhood is from the participant's point of view, and vice versa.

The PST usually comes in a separate questionnaire; however, to make it more alluring for children, the researcher narrated the questions with each photo. Three sections of the wheel were excluded, as shown in figure-11, as they did not serve the focus of this research.

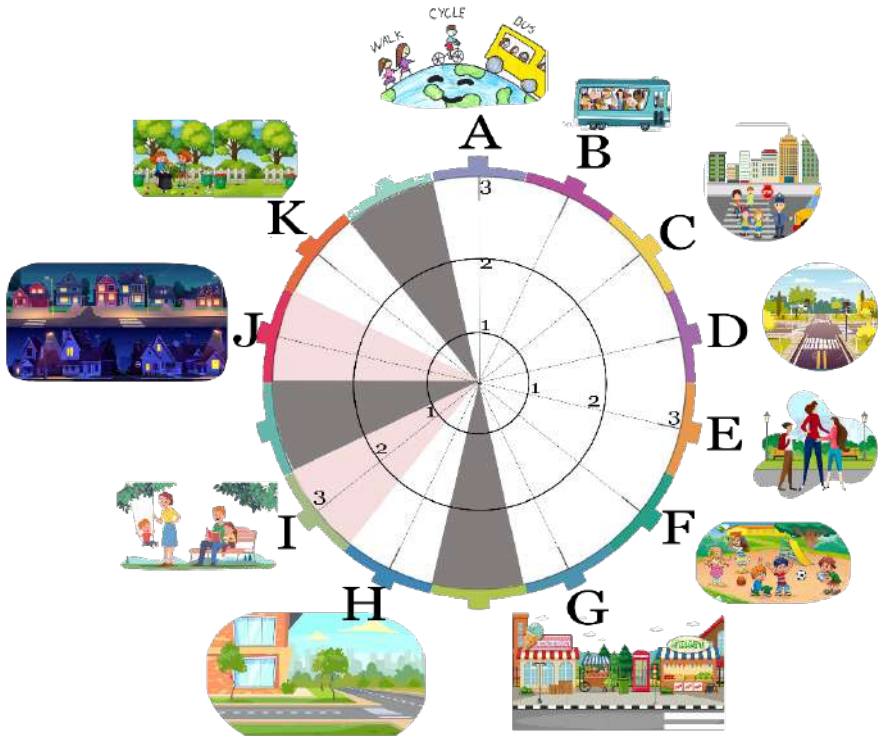


Figure 11- Place Standard Tool for children. Source: Play in Scotland & APIC. Edited by: Author

The refined questions divided into 11 sections were narrated to the children as follows:

a) Walking & cycling: “How convenient is it to get where you need to go on foot or by bike? You should ask yourself, Can I get to school and other places where I play by walking, wheeling, cycling, or scooting? How can I make walking and cycling to school and around my neighbourhood more convenient and secure? How convenient is walking or riding a bike here compared to other places? Furthermore, how could it be improved so that everyone could move around freely and get where they needed to?”

b) Public transportation: “How often do I need to take a bus or other public transportation? Every day? Every week? Every month? What improvements could be made to public transportation to make my life easier? Do I feel safe and

secure when taking public transportation? Am I happy, scared, or frustrated when taking public transportation?"

c) Traffic & parking: "When pondering the question, how does traffic in my area affect me when I'm out during the day? You may wonder: Can I cross the road safely? Have there been many accidents in my area recently? Where are the dangerous roads? Why are they dangerous? How can we make them safer?"

d) Streets, squares, & buildings: "Can you imagine the layout of the streets, plazas, and buildings where you live? Consider whether or not you can easily find your way around and whether or not the streets, squares, and buildings have a pleasant, familiar feel. How can we improve the town square and the buildings? Is there anything else you need to recognise about the roads, plazas, and structures near you?"

e) Nature- parks, trees & animals: "How close and accessible is nature to where I live? You should ask yourself questions like, Can I see and access my needs on a daily basis when I am outside? How simple is it to find a pleasant natural area to relax among trees at other parks? Are grassy areas and other natural spaces well maintained? Could perhaps my place require more plants, some trees and shrubs around here?"

f) Places to play: "What opportunities exist for me to play and have fun near my residence? Where are the playgrounds? Are they sufficient? What are the worst aspects of playing there? What are the advantages of playing there? What else is significant about play and other activities I engage in during my leisure time in that play area?"

g) Schools, shops & other services: "How are the schools, stores, and locations where I can acquire what I need like? Do I have to go far to consult a doctor? Are there locations where I may find clubs and pursue hobbies? How are the retail stores in my area? Can I obtain the majority of my needs without travelling too far?"

h) Home, friends & neighbours: "How well do the residences in my area accommodate my family's and my needs? Does my residence satisfy my needs? Do the houses in my neighbourhood appear nice? What would make them more appealing? What types of dwellings would I like to see in my neighbourhood? What modifications could we make to improve my neighbourhood? Are people courteous in my community?"

i) Meeting & talking with people: "How pleasant are the neighbouring areas where I may meet friends and people I can trust? Are there enough places? What

would make them more desirable if I frequently encountered them outside of school? What else is significant about meeting individuals in these spaces?"

j) Feeling safe: "Do I feel safe in my place? What makes me feel safe or unsafe? Do I ever feel scared in my place? Are there areas where lots of people feel unsafe? Are some places less safe than others? Where are they, and when are they unsafe? What could change to make me feel safe in my place all the time? What else is important about feeling safe in my place? "

k) Fixed, clean & looking nice: "Is my property tidy and well-maintained? What modifications could be made so that they always seem clean? Does neglecting your property ever make it hazardous for others? What do you and others do to maintain your community?"

3.4.3.4 Parents' questionnaire

The parents' questionnaire is divided into four sections: three sections follow Hillman's survey, with slight changes to suit the context of New Cairo. The fourth section is about their views of their neighbourhood.

Section one is to identify the socio-demographic characteristics of the participant and his/her family, like age, gender, area of the dwelling, dwelling unit, car ownership, and their child's 1st name with an identification symbol that was written with both the child and his parents, in order to relate and compare both questionnaires.

In section two, parents were meant to explain more about their child's independent mobility licence and how they allow their child to get to school and other places. The same question asked the children about their mode of transportation for every day of the week was added to confirm the validity of the answers. They were also asked if they let their children go to and come from school independently, what age they started to allow their child to do so, and if not allowed, they were requested to elaborate why. More questions about street crossing and if they have any suggestions for safer streets, an after-dark licence, and their child's use of public transportation were added to the end of that section.

Section three requested more details about the visited destinations, like the distance from home and the time it would take to reach them by different modes of transportation, such as walking, cycling, a private car, or public transportation.

Lastly, it has been argued that employing a combination of both subjective and objective measures of the environment may be necessary (Sallis et al., 2004; Lin

& Moudon, 2010). So, in section four, the PST wheel was also refined for the parents in the form of questions only. It was presented in its original scale for adults, from 1 to 7, where 7 is the highest quality, and 1 is the lowest. It aims to differentiate between the reasons that affect a child's independent mobility, as both the physical environment and how it is perceived can influence CIM. Moreover, monitoring both subjective and objective measures differentiates the children who do not move independently for their parents' perception of the neighbourhood from those affected by the physical environment characteristics.

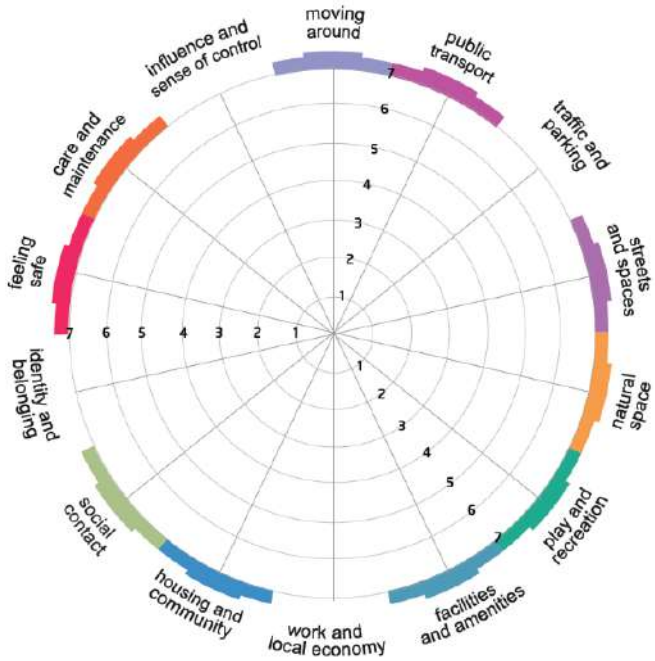


Figure 12- PST for adults. Source: NHS, IS, Architecture & Design Scotland, & Scottish government.

Subsequently, this reveals how to plan suitable interventions for children. Whether to apply changes to the physical environment or people's perceptions need to be altered.

3.4.3.1 Drawing Workshop

The drawing workshop aimed to be an introduction between the children and the researcher as a fun activity to explain the aim of the study and the importance of their understanding of the different streets' physical characteristics and to obtain the data required. The drawing workshop was meant to define the participants'

ideal pathways or barriers they go through daily in their neighbourhood streets through their perception and experience.

The workshop took place by the end of their semester and the end of the school day, so their curriculum schedule was not interrupted. However, for the children to feel at ease, no instructions were given to them, only an introduction by the researcher after familiarising them with the objective of the visit and encouraging them to use their imaginations to form their perception of the relevant pathways and barriers in their neighbourhood's streets.

The workshop was conducted in one class of each of El Shaheed Ibrahim El Refaey Official Distinguished Language School (16 students) and Asmaa Bint Abi Bakr School for Basic Education (9 students) in one day. The workshop for Dr. Magdi Yacoub Offical Language School (31 students) was conducted on a separate day to compensate for the school's hours system. However, after filtering the data collected, more data were required. As it was the start of exams, as mentioned earlier, 9 responses were collected in the school's playground between the exams (figure-13), and 6 responses were collected online.

Figure 13- Students of Magdy Yacoub School during drawing workshop. Source: Author.

3.4.3.2 Map Identification Workshop

The map identification workshop aims to define the most used streets by the students to investigate those streets' physical characteristics by documenting the numbers and placements of the streets' physical elements, paths, activities, and the density of users, as well as the attractions, nodes, and edges of those streets.

Therefore, after collecting the drawings, the participating students were familiarised with a visual map that included pinpoints and icons of the area's main landmarks, explaining the school's location, orientation, and the study area boundary. However, even after explaining, some students expressed their concern about being unfamiliar with how to define the streets and their homes

on a map, so only 31 out of 56 participating students, managed to read the map and draw their journey as a line from their homes to the school and some other destinations.

Figure 14- Students of Magdy Yacoub School during map identification workshop. Source: Author.

3.4.4 Limitations

The first limitation that came across was the long process to gain permission to access the schools. The data were retrieved in the last two days of school. Some data was collected instantly, and some were collected the week after. However, to reach an acceptable range of participants, the rest of the questionnaire data had to be resolved online during the exams period by both students and their parents.

The second limitation was the time limit for the drawing and map activity workshops, which had to take place during break time, between exams only, or in the schoolyard instead of a classroom. This resulted in some incomplete drawings and difficulty regulating all the students in the schoolyard. The third limitation was accessing the same students again to collect their parents' questionnaires as it was the end of the semester, in addition to losing some data from the accessed students who lost or forgot about the questionnaire.

3.5 Phase 2: Streets Physical characteristics

Based on the previous chapter, the following physical characteristics are to be considered for enhancing the quality of the streets and creating a safe environment for children. Streets' lighting quality, vegetation and green pockets, shade and temperature quality, urban visibility, physical barriers, sidewalks' width and quality, cycling lanes, speed breakers, signage, seating and transit stops, vehicular variety and movement, road sections and hierarchy.

3.5.1 Observations

For phase two, observations through test walks and photo documentation were recorded manually on different days to examine the streets' physical

characteristics quality and the various activities that take place on the neighbourhood's streets on schooldays and weekends at different times of the day and night.

3.5.1.1 Test walk & Photo Documentation

On the morning of the 25th of December 2022, some general observations of the study area's urban quality (with an average temperature of 20 degrees) were collected, as shown in the following figures: stray dogs between residential units, cleanness of inside pathways, and cleanness of green areas between residential units (figure -15).

Figure 15- Study area general observations. Source: Author.

In addition to investigating the accessibility quality within the residential areas. Water drainage problems after rain, blocking one of the ways to the building entrance, the slope of the ramps for bikes or trollies, and the absence of ramps beside the stairs in different areas (figures-16).

On the 9th of January, after analysing the data collected from the workshops and the questionnaire, the most-used streets were highlighted for further investigation. Characteristics like the barriers the children meet on their daily journeys were identified and categorised (figure-17), as sidewalks characteristics, speed breakers and signage, and the public transportation variety on site. There was a change in the weather on the same day that is apparent in the following

pictures, showing different barriers that could face the children with the weather changes in the streets, if it is not designed to avoid natural phenomena.

Figure 16- Study area-Barriers observations (1). Source: Author

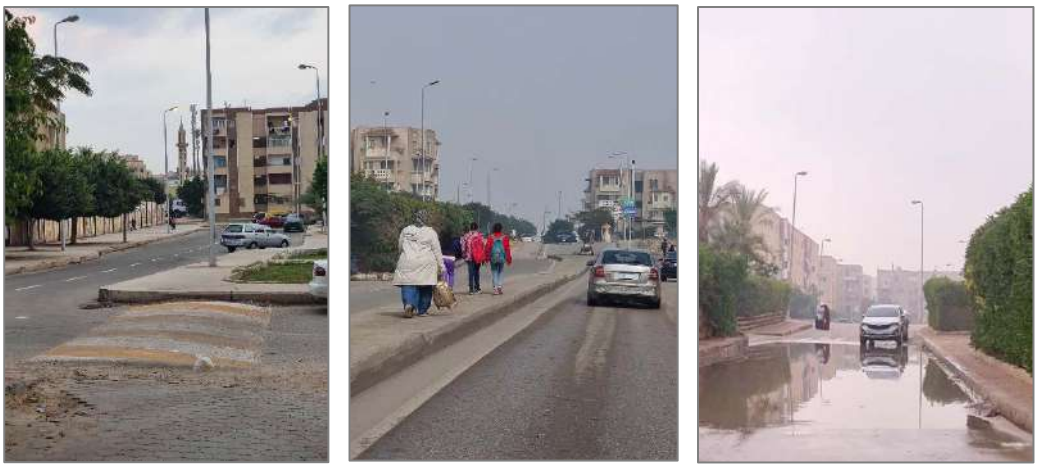


Figure 17- Study area-Barriers observations (2). Source: Author

Further investigation of the quality of the streets at night (figure-18) was essential to relate to the questionnaire question, "If children are allowed to go out after dark?" So, on the 12th of January 2023, the most used streets were visited at night for lighting quality, mobility, and social life at night.

Figure 18- Study area at night observations. Source: Author

Chapter 4: Results & Analysis

This chapter shows the results and analysis of the primary data from phases one and two. Phase one collected data from the drawing and mapping activities for children ages 9 to 13. Unrelated data was filtered, and some children's drawings and map activities were presented. Their drawings and maps were analysed manually by categorising the elements they drew and mentioned. The number of mentions of each street characteristic is presented in a table to be compared with the observations from phase two. In addition, the questionnaires for the children and their parents were organised on a Google Excel sheet, which was presented through diagrams and charts to convey the difference in ratio between the variables of each question.

Further analysis was done manually after categorising the participants according to their age, gender, and socio-economic status. This information is presented in a table summarising the common answers to the questions concerned with CIM and translating them into a numerical value ready for comparison. Phase two collected data on the most used streets' physical characteristics from the observations and test walks. Then they were presented on maps, documented by day and night photos from the study area. Moreover, each street's physical characteristics mentioned in the literature were solely analysed. Finally, observations were used to determine the influence of their conditions on the overall quality of the streets.

4.1 Phase One Results

4.1.1 Children and Parents' Questionnaires

The results of the children's and parents' questionnaires are organised into seven sections. Each section discusses a factor that can influence CIM frequency. The demographic section of the parents' questionnaire was designed to determine the family's socioeconomic status based on the parents' occupation, home and vehicle ownership, as detailed in Table 2 below. In addition, the PST section illustrates how the children and their parents perceive their environment.

Parents' Age Range		
<30	5 %	
30-45	70 %	
>45	25 %	
Parents Employment status	**Mothers**	**Fathers**
Full time	32 %	80 %
Part time	8 %	20 %
Not Employed	60 %	0 %
Car ownership		
Car	91 %	
No Car	9 %	
House ownership		
Owned	70 %	
Rented	30 %	

Table 2 Participating parents' demographics. Source: Author.

Children's age range	**Girls**	**Boys**
7-8 years old	3	3
9-10 years old	6	9
11-12 years old	13	8
13-14 years old	9	5
Total	**31**	**25**

Table 3 Numbers of participating children according to age & gender. Source: Author.

4.1.1.1 CIM Licence

After providing demographic information, parents were asked whether they permitted their children to walk or cycle alone. The result shows the percentage of parents who allow and do not allow their children to travel unaccompanied

(figure-19). They were also asked at what age they permitted that (figure-20). Moreover, the parents who said they did not allow it were asked to explain their decision (figure-21).

According to the results, 6 out of 10 parents confirmed allowing their children to move independently (figure-19), while 7 out of 10 mentioned that 10 – 12 years old is the appropriate age to begin issuing a CIM licence (figure-20).

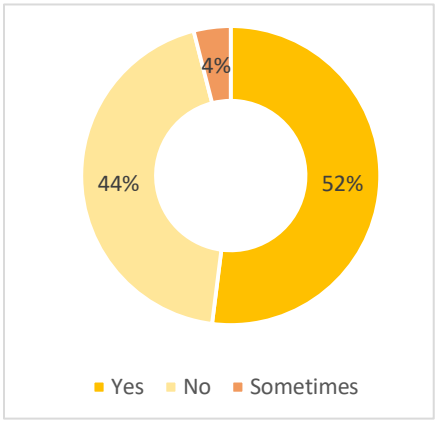


Figure 19- Parents asked if they let their children move independently. Source: Author.

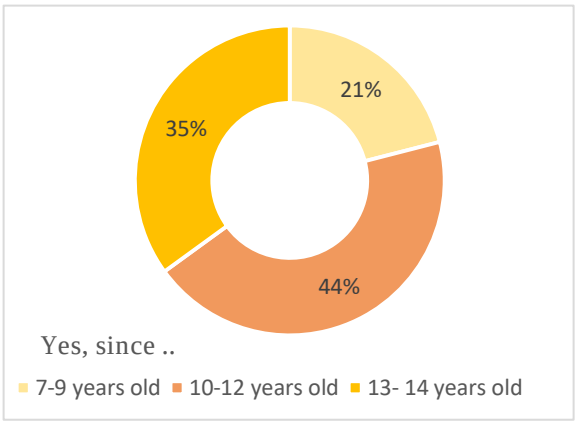


Figure 20- Parents asked at what age they allowed their children to move independently. Source: Author.

However, the parents who clarified that they do not allow their children to travel alone primarily pointed out two reasons. 4 of 10 parents fear an adult will attack their child, while 2 of 10 believe their child is too young to go out alone. The remaining reasons are not compared with the initial two ratios: fear of traffic, fear of stray animals, and bullying, respectively (figure-21).

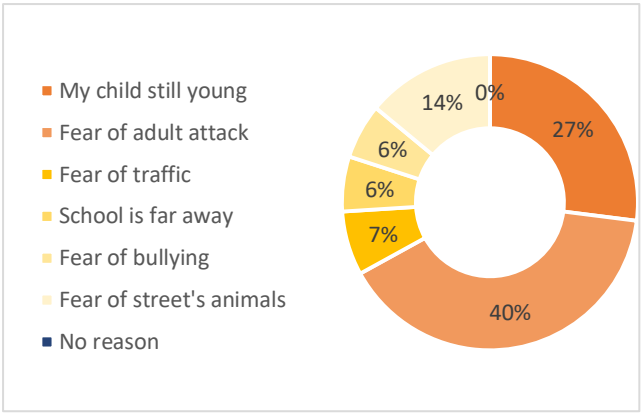


Figure 21-Parents asked to mention the reasons why they don't allow their children to move independently. Source: Author.

4.1.1.2 CIM Frequency to School

According to Hillman's questionnaire, children and their parents were asked two questions regarding the CIM frequency to school. They were asked to indicate how the child travelled to and from school each day of the week in a table (figures 22 - 23).

Compared to “bicycles” and “public buses”, the results indicate that "private vehicles" are used more frequently, followed by "walking alone", "walking with a friend or sibling", "walking with an adult", and “tuk-tuks”, respectively (figures 22-23). However, adding the frequency of CIM trips to school via walking, cycling or public transportation, half of the children travel independently.

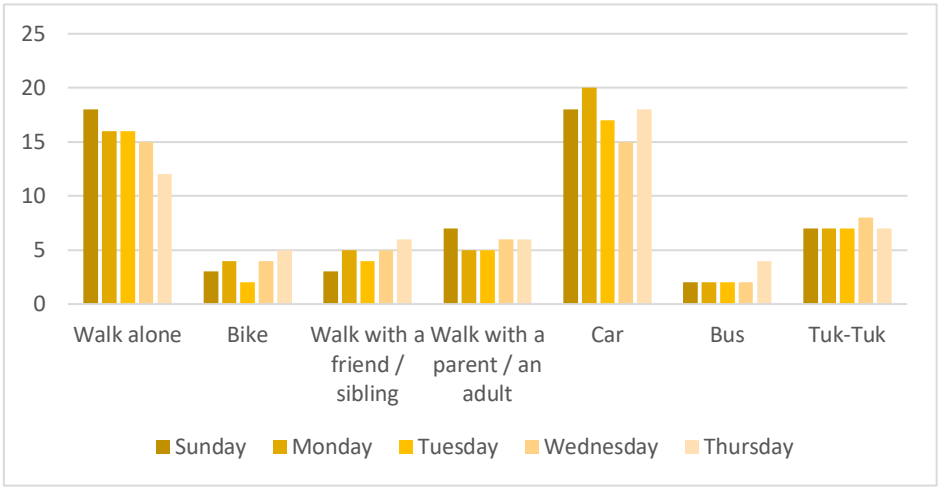


Figure 22- Mode of Transportation frequency per week from home to school. Source: Author.

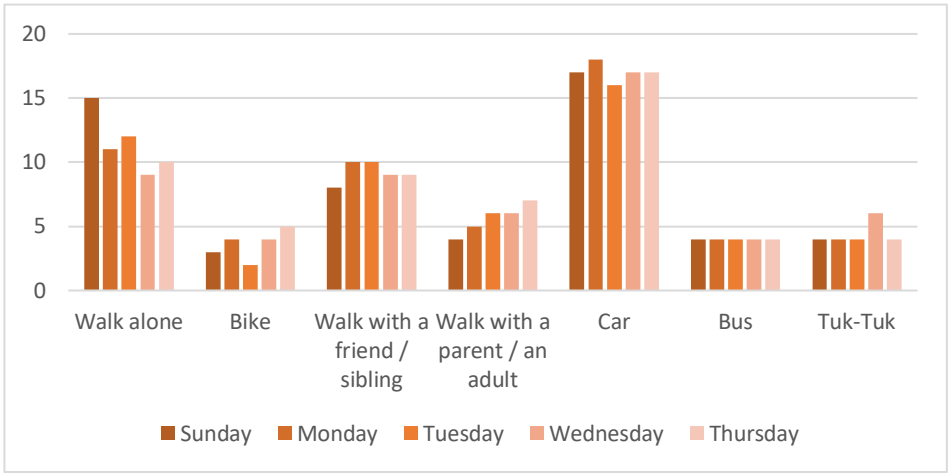


Figure 23- Mode of Transportation frequency per week from school to home. Source: Author

4.1.1.3 CIM Frequency to Destinations other than Schools

The second aspect of the questionnaire that revealed the extent of freedom parents granted their children to travel independently was CIM to leisure or other destinations. According to Hillman's questionnaire, which was modified to suit the study area in Egypt, the following destinations were listed as options: friends' and relatives' homes, parks and playgrounds, shops, malls and markets, sports venues, private education centres, and places of worship. This aspect was separated into three questions. Primarily, the children were asked how they typically travel to destinations other than their schools (figure-24). Slightly less than half of the children reported that they could travel independently. This result substantiates the minor distinction between CIM frequency to school and other destinations.

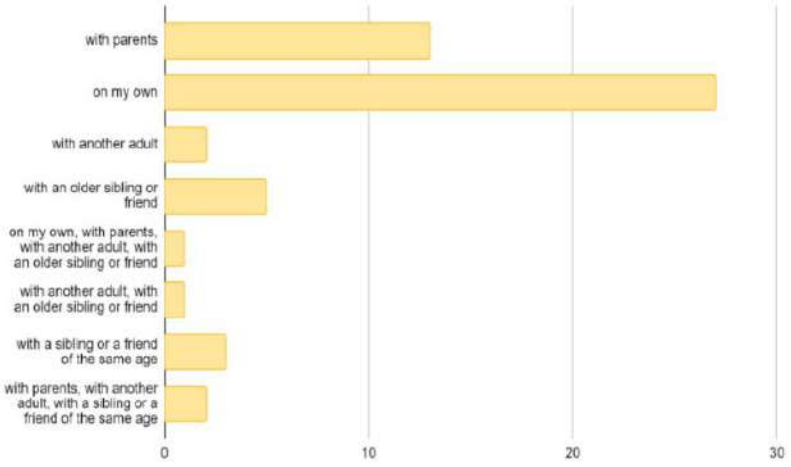


Figure 24- How children generally go to nearby destinations. Source: Author.

For additional information, they were asked how frequently they independently travelled to (figure-25) and from (figure-26) the mentioned destinations that week via walking, cycling, or public transportation. The charts show that faith places get the most visits on Friday, while local stores and supermarkets get the most visits every day. After that, sports venues, parks and playgrounds, friends' and relatives' homes, shopping malls, and private lesson centres, respectively.

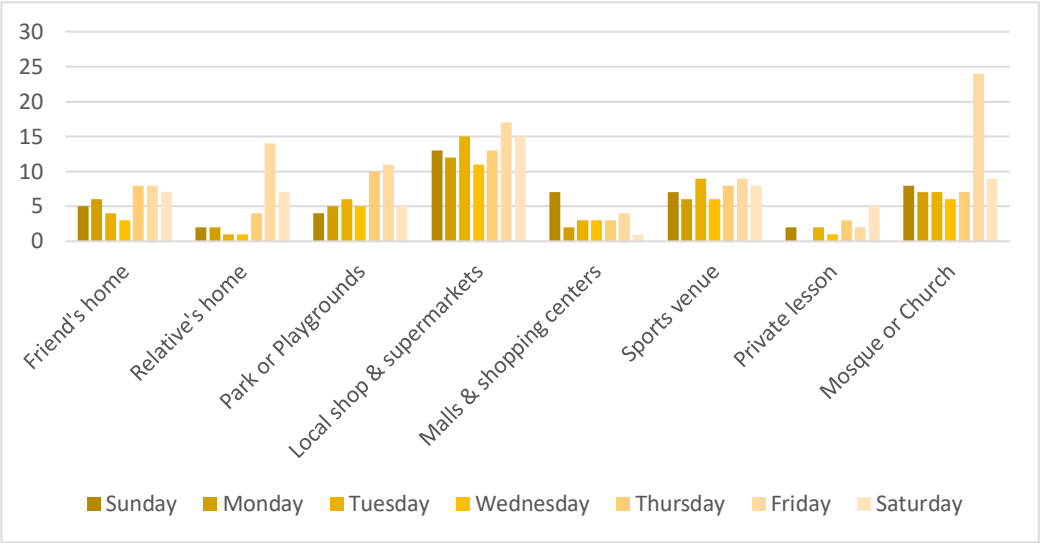


Figure 25- Children's mode of travel to the mentioned destinations. Source: Author.

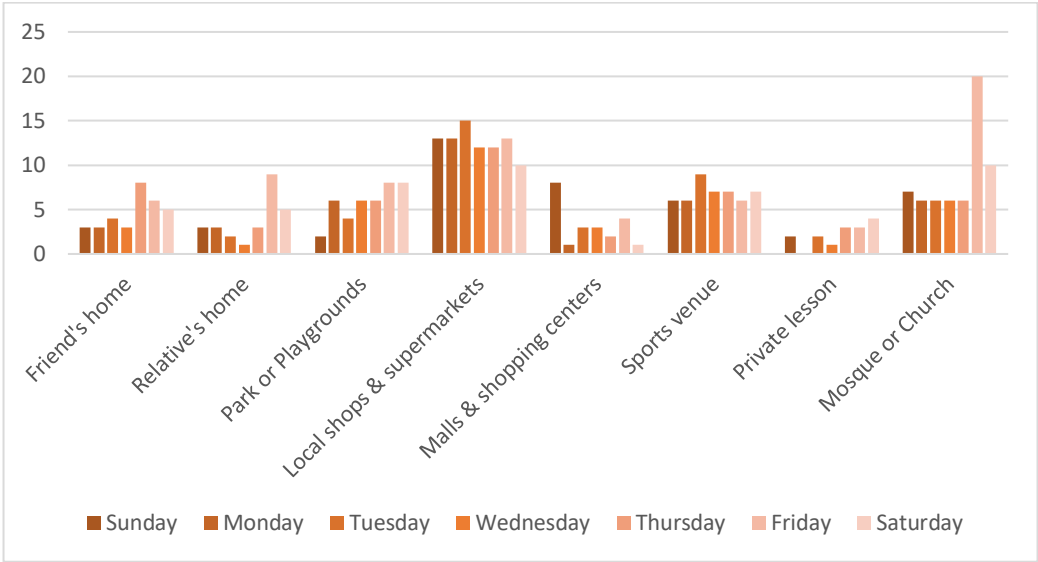


Figure 26- Children's mode of travel from the mentioned destinations. Source: Author.

Further investigation into the frequent visits to local shops and faith places will be discussed with the CIM range and time.

4.1.1.4 CIM Range and Time to Different Neighborhood Destinations

The range of various destinations was essential to be investigated to put away the possibility that certain destinations are more difficult for children to reach alone. According to UNICEF guidelines for children ages 9 to 13, they should be able to walk up to 400 metres, cycle up to 1200 metres and take public transportation independently up to 2000 metres. Accordingly, the following chart (figure-27) reviews the parents' answers, showing the range of various destinations that the children can visit on their own.

As shown, schools, local shops, and faith destinations have the highest rates of being within walking distance. Sports facilities rank second regarding children's ability to walk or cycle there. Finally, the lowest rates are for play areas and entertainment destinations. As shown more explicitly in the next PST figures 39 - 40, they rate the lowest score, as, according to the observations, they are uncommon in the study area.

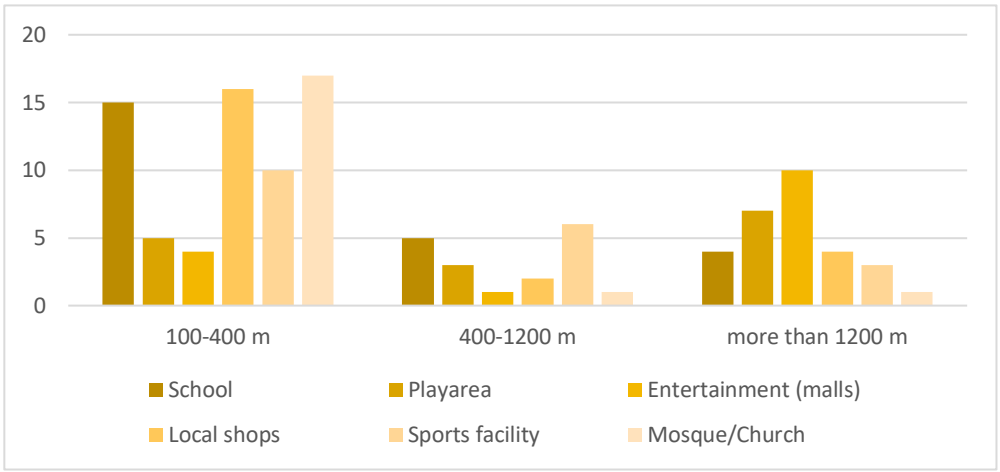


Figure 27- Range of destinations visited by children. Source: Author.

Howwever, a destination could be on a close range but needs much time to reach due to obstacles or traffic on the road. Therefore, parents were also asked to report the amount of time it takes them and their children to reach these destinations via different modes of transportation: walking (figure-28), cycling (figure-29), driving (figure-30), taking public buses (figure-31) or riding a tuk-tuk (figure-32). Comparing the CIM range and time can rule out any inherent hazards associated with the journey.

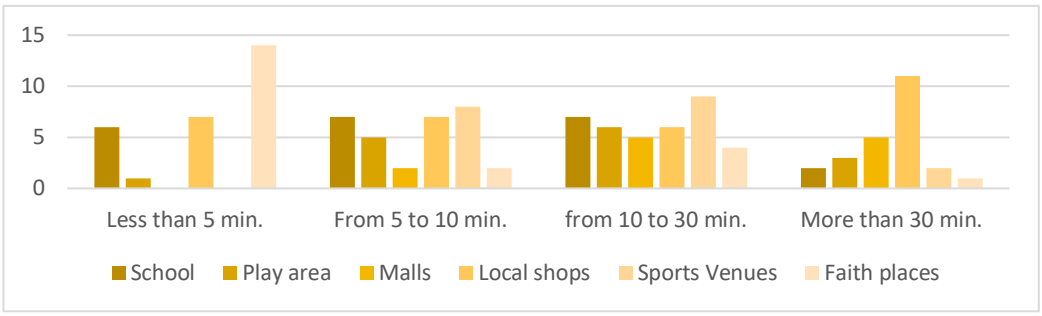


Figure 28- Time needed to reach the mentioned destination by walking. Source: Author.

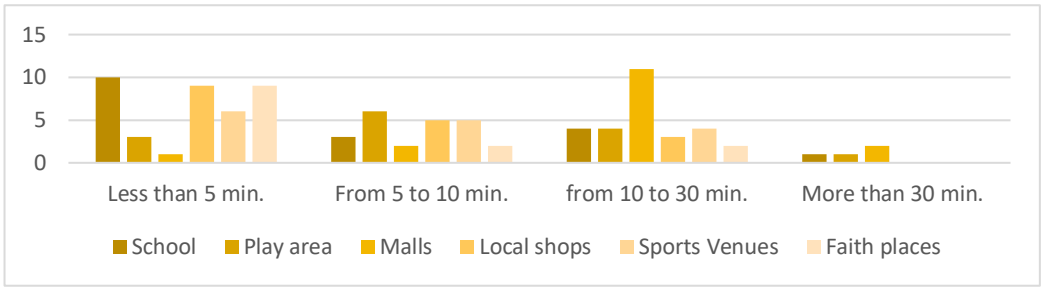


Figure 29- Time needed to reach the mentioned destination by cycling. Source: Author.

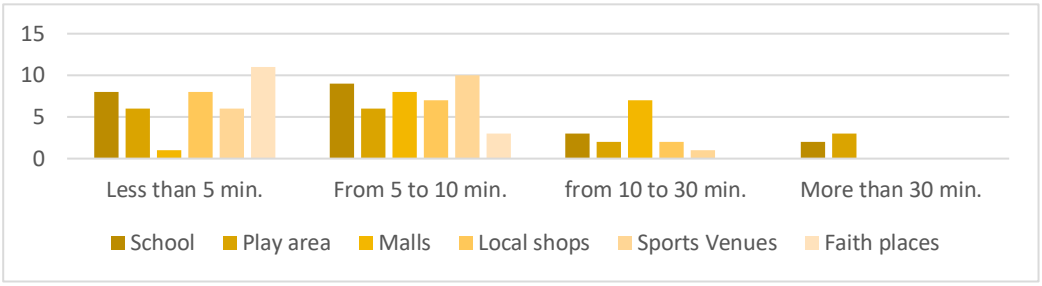


Figure 30- Time needed to reach the mentioned destination by car. Source: Author.

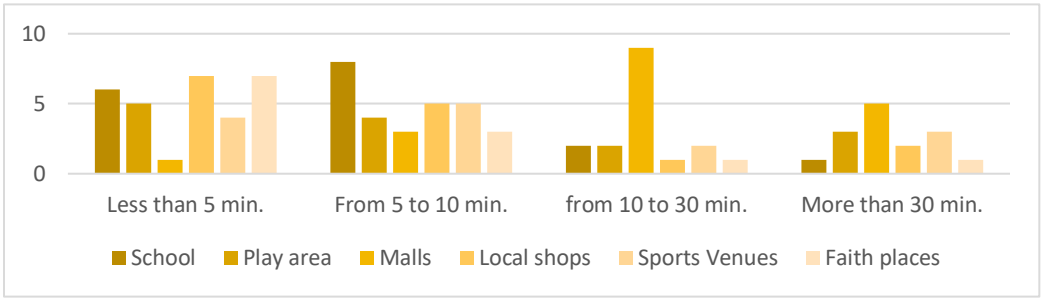


Figure 31- Time needed to reach the mentioned destination by public buses. Source: Author.

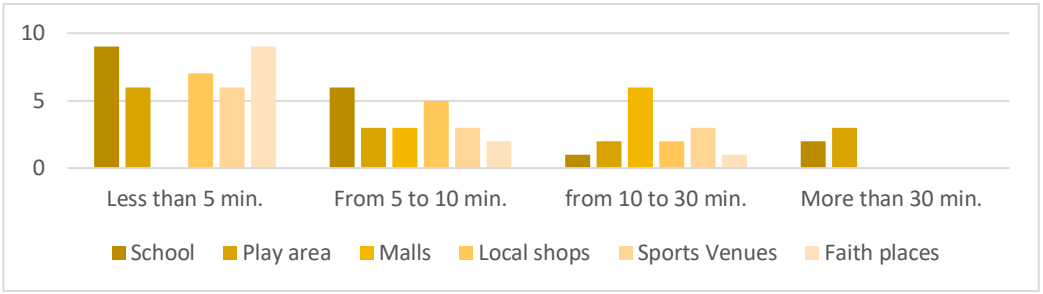


Figure 32- Time needed to reach the mentioned destination by tuk-tuk. Source: Author

As demonstrated, the majority of participants are 5 to 10 minutes away from the aforementioned destinations via most modes of transportation. In contrast to other modes, public buses take longer than 30 minutes to reach the same destinations due to the number of stops they make.

Schools and faith places are found to be the closest and most accessible. In contrast to other destinations, malls are located at a greater distance from the participants' homes, which was also confirmed by their range (figure-27). Due to the fact that the time required to reach the aforementioned destinations coincides with their distance, children accompanied by their parents are not affected by traffic or street hazards.

4.1.1.5 CIM Frequency VS Crossing Roads and After Dark Licence

Crossing streets and leaving after dark are two essential factors that influence CIM. Parents were asked in the questionnaire how they would like their neighbourhood to feel more comfortable allowing their children to move independently at a younger age. Many parents mentioned that streets in New Cairo have become more car-oriented.

However, when children and parents were asked if children are allowed to cross main streets alone, the majority said “Yes” (figure-33), while when asked if they are allowed to go out after dark, more than half said “No” (figure-34).

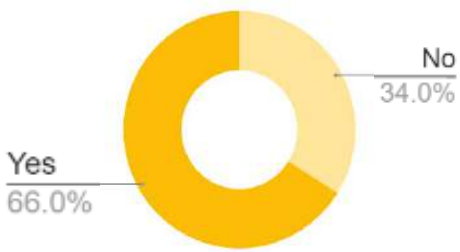


Figure 33- Parents allowing their children to cross main streets. Source: Author.

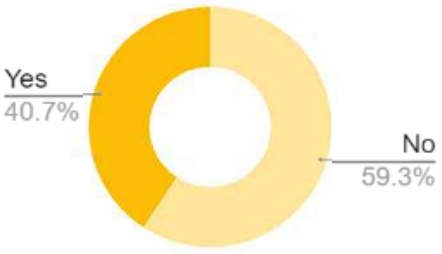


Figure 34- Parents allowing their children to go out alone during the night. Source: Author.

Parents who confirmed allowing their children to cross main roads alone were asked about the age at which they allowed them. The majority agreed on 10 to 12 years old (figure -35). However, participants who selected “No” were asked to mention why, and more than half selected “Fear of traffic accidents” (figure -36).

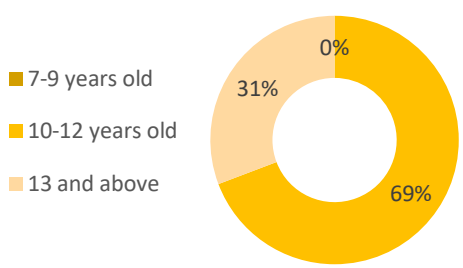


Figure 35- At what age parents allow their children to move independently. Source: Author.

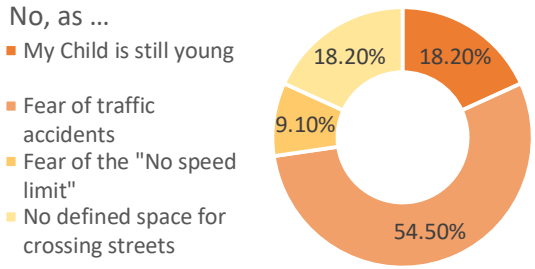


Figure 36- Reasons why parents let their children go out at night. Source: Author.

The parents were asked about the changes that they can recommend to the current streets’ situation to feel safer leaving their children to travel independently, and they stated the following:

- To solve street animals problem
- To install traffic lights & surveying cameras
- Create street crossing zebra lines for children
- Install speed limit signage
- Create a cycling lane
- Presence of some security between residential areas

4.1.1.6 Cycling and Public transportation usage

In addition to neighbourhood walkability, cycling and public transportation play an essential role in CIM. In the questionnaire, children and their parents were asked whether the children could cycle on the road or use public transportation to reach further destinations.

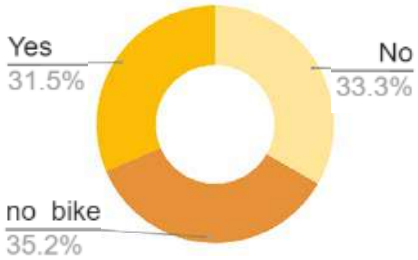


Figure 38- Percentage of children allowed cycling alone. Source: Author.

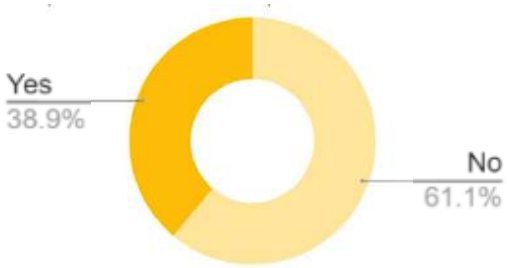


Figure 37- Percentage of children allowed to take public transportation on their own. Source: Author.

The results show no significant difference between the children who can or cannot cycle on roads, aside from those who do not own a bike. On the other hand, more than half of the participants mentioned that they are not allowed to use public transportation independently.

4.1.1.7 Children's perception of the neighborhood (PST)

The Place Standard Tool (PST) wheel was added at the end of the children's questionnaire to evaluate their perception of the neighbourhood. As mentioned earlier in the methodology chapter, the PST was presented with pictures beside each point to make it easier for the children to visualise the questions narrated and explained in the class. After the children rated each point, the data were collected and categorised according to age. As shown in figure-39, all ages agreed that services like schools and local shops are of good quality and at a reasonable distance from their houses. Conversely, an aspect like the ease of walking and cycling within the neighbourhoods rated the highest score for 13 and 14-year-old children while scoring average for younger ages.

Some other points like public transportation, traffic, street quality, places to play, and places where they can meet others scored the minimum for 9- and 10-year-old children. This score highlights what was mentioned in the literature; that children's needs from the streets differ from one age group to another. Nonetheless, the overall children's perception of their neighbourhood is average.

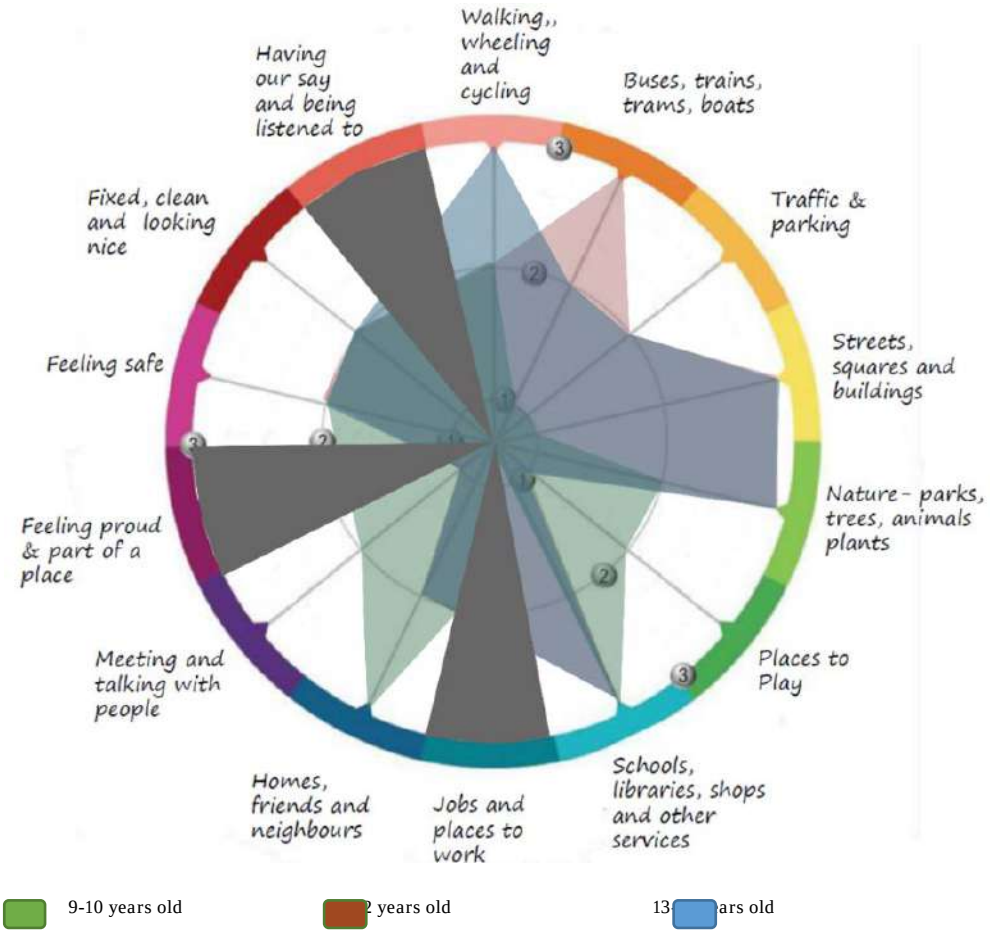


Figure 39- PST wheel, children's results. Edited by: Author.

4.1.1.8 Parents' perception of the neighborhood (PST)

As the parents' perspective of their neighbourhood can influence the CIM licence, it was necessary to consider how the parents perceive it. The "PST" was added to the parents' questionnaire as a series of questions to be rated from 1 to 7, with 1 being the lowest score and 7 being the highest. After obtaining the data, it was sampled according to the highest votes of each factor. The results were applied to the PST wheel (figure-40) to demonstrate how the parents perceive their neighbourhood.

The wheel represents less than the average level of parental satisfaction of their neighbourhood. According to the literature, this result can influence their decisions regarding CIM licence.

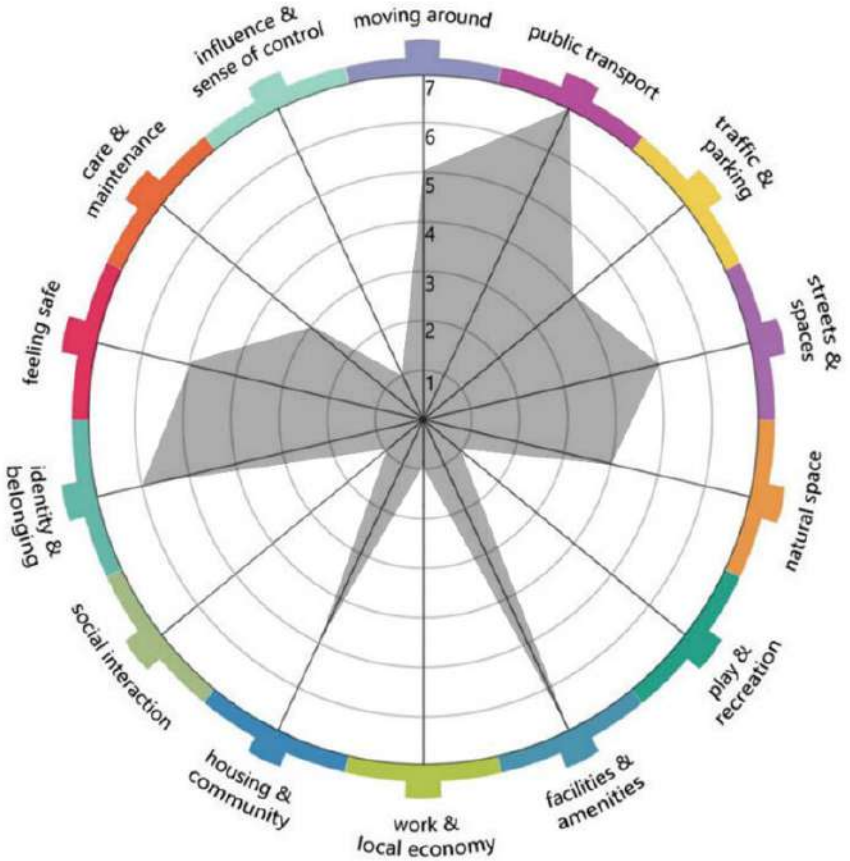


Figure 40- PST wheel, Parents' results. Edited by: Author

4.1.2 Drawing activity

The students' drawings show the street from each child's viewpoint, which investigates the quality of their independent mobility (the first research sub-objective). Samples are presented to emphasise the street features that children observe while walking. The building typology, trash bins, sidewalks, and green elements are some of the street's physical characteristics that are evident in many drawings. The drawings reveal the significance of natural elements to the child on the street, as they are featured in almost all of the drawings. Moreover, some drawings show proper street sidewalks, while others do not. This reflects the differences from one street to another in the study area.

One of the drawings shows only a fence along the street with green elements inside, presenting a different pathway according to where the child lives. This reflects what was mentioned in the preceding chapter, how each neighbourhood has a different building typology and street characteristics than the others.

Furthermore, extra details and data extracted from the drawings are each mentioned next to its figure.

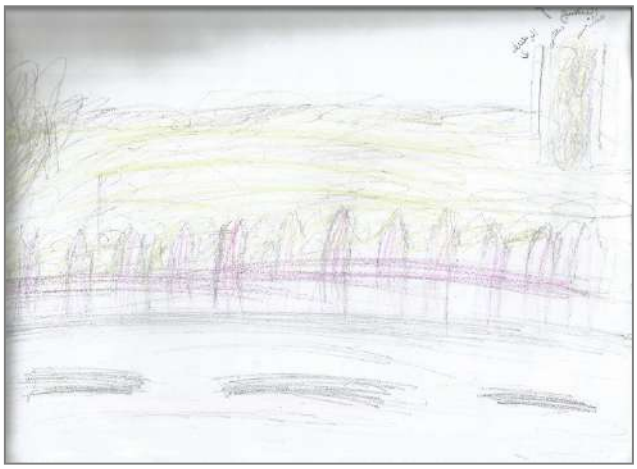


Figure 41- An 11 year-old girl's drawing about the street in her neighborhood how she sees it. After the girl handed in the drawing, she illustrated that there are many barriers that she faces on her journey. Sidewalks to be cut by fences to enclose the private areas, even if they are gardens as presented in the drawing is the biggest barrier for her.

Figure 42- A 9-year-old girl's drawing about the street in her neighborhood how she sees it. The drawing illustrated different buildings colors. And when asked "Are the buildings in your neighborhood really have different colors?" The girl answered "No, I just want them to look colorful." Which reflects the effect of the environment color selection on the children living in it. It also shows the girl walking on the street not the sidewalk. Which was multiply observed for people to walk on the street when the sidewalk is not suitable or has any kind of barrier.

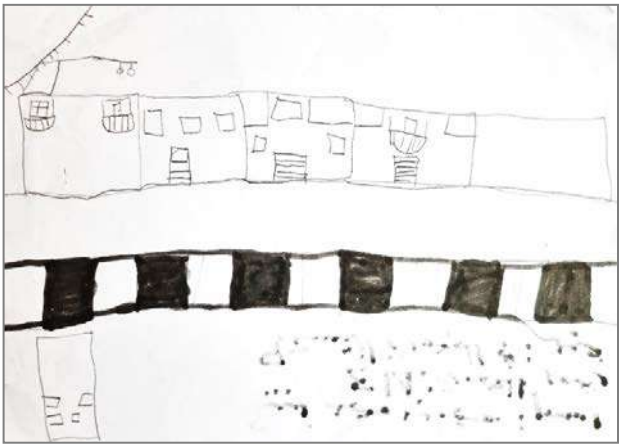


Figure 43- A 12-year-old boy's drawing about the street in his neighborhood, how he sees it. It shows a different typology of buildings than other drawings which represents the private residential areas that could be 2 floors only like in his drawing. It also illustrates his perception of the disappearance of the sidewalks in the private residential areas while presenting only the middle walkway.

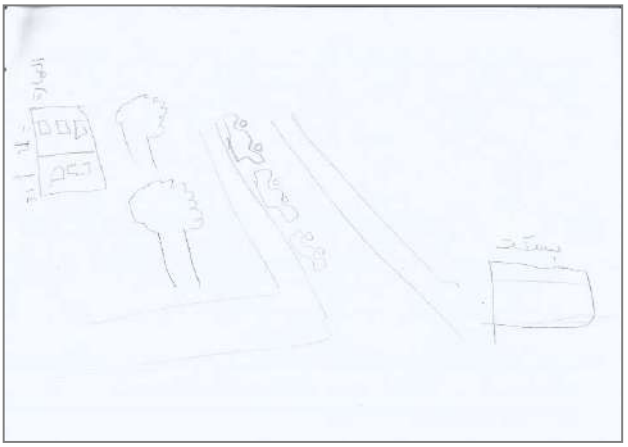


Figure 44- A 10-year-old boy's drawing about the street in his neighborhood how he sees it. It illustrates one of the elements that was mentioned in many drawings; the trash bins. They act as a barrier when people get down from the walk away to avoid the smell. They were presented in many drawings on the sidewalk or on the street beside the sidewalk.

Figure 45- A 10-year-old girl's drawing about the street in her neighborhood how she sees it. The drawing reflects the buildings clustering and typology. the buildings have similar windows for the whole block and the same skyline. A relatively wide space in front of the buildings to walk. The drawing also shows the importance of the green element in their perception, even if she wrongly placed it.

Figure 46- An 11-year-old boy's drawing about the street in his neighborhood how he sees it. The drawing reflects the same building typology as the previous drawing, however, this drawing shows the street in a different design. When asked "Which one is the sidewalk in your drawing?" The boy answered "The two middle lines." And as shown later in the observations in figure-54-55, one of the most used streets, the usable walkway, is only in the middle of the street.

4.1.3 Mapping Activity

The maps illustrate the landmarks of the study area and the routes that the children drew, showing the route from their homes to school or other destinations like a friend's house, a green area to meet friends and play, sports facilities, super markets, a private lesson, and faith places like a church or a mosque.

For the huge variety in movement depending on where each child lives, some samples were chosen from all the maps (the results are in the appendix) to not only highlight the used routes but also to share their opinion on those streets' conditions.

Figure-48 (2nd map) shows how the participant shared her opinion about all of the streets she uses in her route to go to school or other destinations from her home.

Figure 47- , An 11-year-old boy, illustrating his route from his house to his school. Elaborating that he walks with his friends through the inside residential areas till they reach a different building typology (private area) that have no sidewalks, then they start heading to the main road, which is the fasted to them.

Figure 48- A 14-year-old girl, illustrating the different routes she takes on her way to school, supermarkets or her friends' houses. And, after she drew her routes, she asked if she can use words to describe these streets and mentioned the following: darkness, stray dogs, garbage and flies spreading around it, broken walkways that pushes her to cross the street but the reasonable car speeds make it safer to cross.

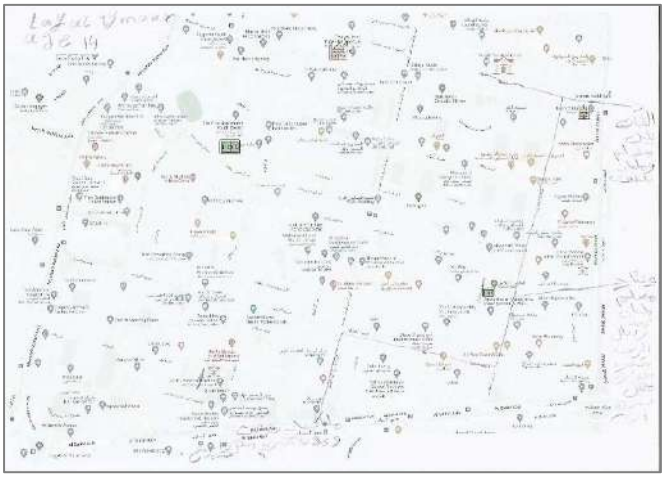


Figure 49- Two 11-year-old girls, illustrating their routes from their houses to school and other destinations. When asked why the choice of these specific streets, when they can reach their destinations through shorter routes, the answer was that these are the most used routes with people which makes it more vital in addition to the landmarks that make it easier to them to know when to take turns.

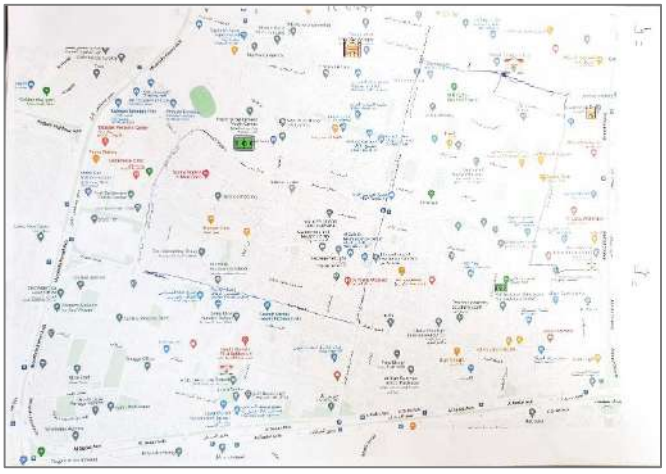


Figure 50- A 14-year-old boy, illustrating his route from his school to his house. Using the main road within all the neighborhoods, as it is the most direct, most used by people and suitable for him.

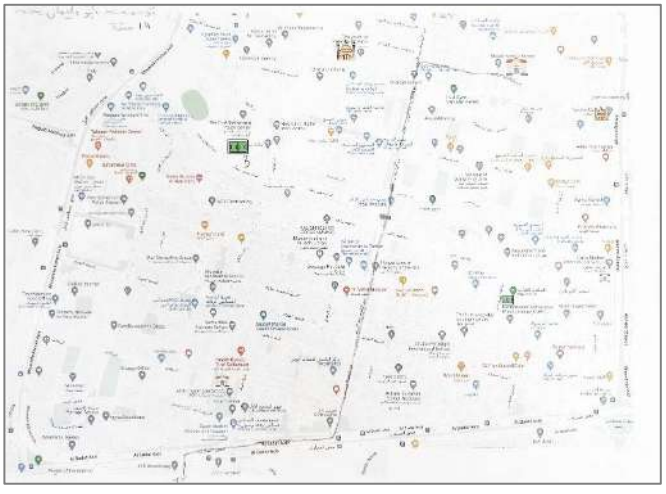


Table 4 represents the physical elements and characteristics mentioned by the participating children from both the drawing and map activities, by the number of mentions of each element.

Place elements Identification	No. of mentions in "Drawings"	No. of mentions in "Maps"	%
Natural Elements			
Trees	15	N/A	
Garden	12	N/A	
Street animals	4	11	
Smell	0	10	
Flies	0	10	
Pathway Elements			
Trash pins	13	3	
Fences	9	8	
Light posts	5	9	
Sidewalk condition	13	7	
Traffic			
Cars	14	3	
Buses	12	11	
Tuk-Tuk	14	10	

Table 4- Mention Rates of Place elements by the children in Rank Order. Source: Author.

4.2 Phase 1: Analysis

As mentioned earlier, a child's age and gender, in addition to his/her family's socioeconomic status, all have significant effects on CIM (Kerr et al., 2007; Handy et al., 2008; Tcymbal et al., 2020; Zhou et al., 2022; Hamad et al., 2022). Therefore, the demographics of the participating children had to be analysed beside the streets' physical characteristics to determine which was more influential (Phase 2).

Table 5 shows a significant variation between both genders in terms of the CIM licence rates within the same social class. Girls scored higher in some cases due to the variation in the number of participating children of the same age and social class. For instance, for 9 to 10-year-olds at a mid-income level, 4 girls scored 0.33, while 2 girls scored 0.83. On the other hand, 3 boys scored 0.5, and 4 boys scored 0.75. Nevertheless, the total score of the boys (1.25) is still higher than that of the girls (1.16) combined, which conveys the effect of the parents' licence on CIM.

A sudden drop is noticed in the 11- to 12-year-old girls that rise again after 13 years old. Girls of ages 13-14 scored 1.1, while 11-12 years old scored 0.74. This difference was also observed when most middle-schoolgirls (13 years old and above), identified by a yellow uniform, came and left alone or with friends. While primary school students (below 13 years old), identified by their blue uniform, had to wait inside the school for their parents to pick them up (figure-51).

Age	Gender	Family socio-economic background	no. of participants	most used mode of transportation	Frequency of going to/coming from school	Frequency of going to/coming from near by destinations	Allowed to cross streets alone	Allowed to cycle	allowed to use public transportation	Allowed to get out after dark	total out of 1
7-8 years old (6)	Girls	Low-income	2	walk with parent	low	low	no	no bike	no	no	0
		Mid-income	1	walk with parent	low	low	no	no bike	no	no	0
	Boys	Low-income	2	walk alone	medium	low	yes	no bike	yes	yes	0.58
		Mid-income	1	walk with parent	low	low	no	yes	no	no	0.16
9-10 years old (15)	Girls	Low-income	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Mid-income	4	car / with parent	medium	medium	yes	no	no	no	0.33
			2	walk alone / friends	high	high	yes	yes	yes	no	0.83
	Boys	Low-income	2	tuk-tuk	high	high	yes	yes	yes	yes	1
		Mid-income	3	walk alone / friends	high	high	yes	no bike	no	no	0.5
			4	Car / bus	medium	high	yes	yes	yes	no	0.75
11-12 years old (21)	Girls	Low-income	2	walk alone / friends	high	high	yes	no bike	no	no	0.5
		Mid-income	3	car	medium	low	no	no bike	no	no	0.08
			3	with parent	medium	medium	no	no	no	no	0.16
			5	alone	high	high	yes	no	no	no	0.5
	Boys	Low-income	2	tuk-tuk	high	high	yes	no bike	yes	yes	0.83
		Mid-income	2	with parent	low	low	no	no	yes	yes	0.33
			4	Walk alone/ friends	high	high	yes	yes	no	no	0.67
13 years old and up (14)	Girls	Low-income	2	tuk-tuk	high	high	1:01	no bike	yes	1:01	0.77
		Mid-income	5	car	low	low	3:02	no	no	1:01	0.33
			2	walk alone / friends	high	high	1:01	no	yes	yes	0.77
	Boys	Low-income	1	tuk-tuk	high	high	yes	yes	yes	yes	1
		Mid-income	4	Car	Low	high	yes	no bike	yes	yes	0.67

Highest CIM Frequency Intermediate CIM Lowest CIM Frequency

Table 5- CIM frequency rates according to age, gender & socio-economic status. Source: Author.

Table 5 shows both genders' highest, lowest and intermediate CIM frequency rates. The highest score for 9-10-year-old girls is 0.83, while the highest score for 9-10-year-old boys is 1. Furthermore, 11-12-year-old girls scored an intermediate CIM frequency of 0.5, while boys of the same age scored 0.83. Lastly, the highest score for 13-year-old girls and above is 0.77, while the highest score for boys of the same age is 1.

Figure 51- Parents waiting for their children outside of Magdy Yacoub school during the exam period. Source: Author.

In conclusion, figure-52 summarises the comparison of CIM frequency according to age, gender and socio-economic status. As shown, boys from low-income families have the highest rates across all classifications, followed by considerable rates of boys from mid-income families. All girls ages 7-8 years old do not move independently, while girls ages 13 and older from low-income families have the highest rates among all girls.

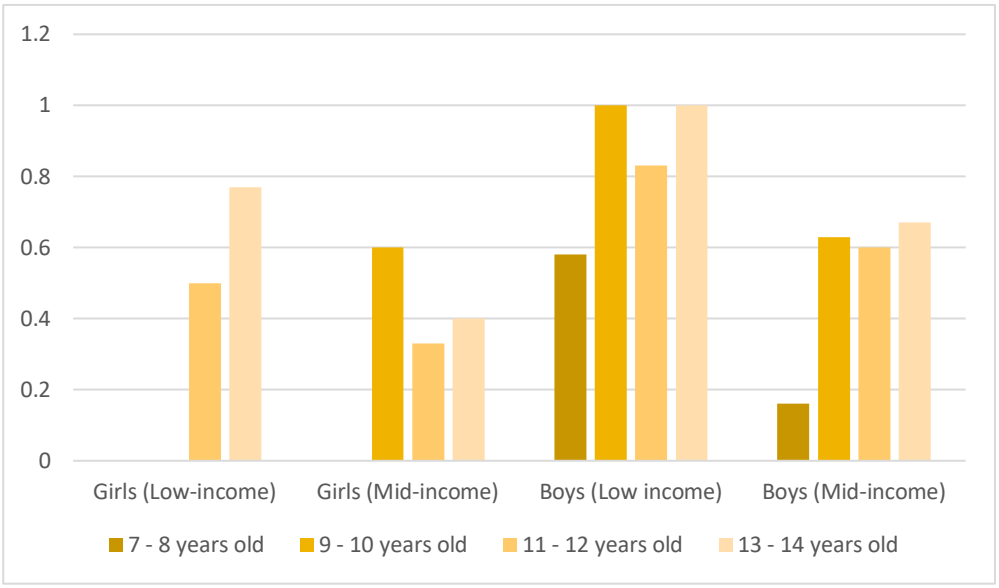


Figure 52- Analysis of CIM frequency according to gender, age & socio-economic status. Source: Author.

4.3 Phase 2: Results

After collecting data from phase 1, evaluation and categorisation of the drawings and map activity workshops took place to identify the most used streets by children. An analysis of each street's physical characteristics was initiated to reach the reasoning behind choosing those streets. This answers the second research sub-objective to detect the physical elements in the most used streets by

children. Three streets were determined based on the children's route selections and frequency of movements on the maps. The map showed some landmarks that the participating students could identify, like mosques, schools, commercial areas, services, and sports facilities.

Figure 53- Study area identification map. Source: Author.

4.3.1 Street 1 & 2

Street One's physical elements and characteristics are barely in good condition, yet it is the most used street by children. It is one of the most vital streets in all neighbourhoods, containing the local shops and supermarkets people use daily.

Vendors use the sidewalks to display their products, and directly after the sidewalk, where people usually walk, is where private-car users park. The middle walkway is dilapidated and blocked by trash and stray dogs along that path. However, the street's morning and nighttime activities attract school-aged children, especially after school. It is also well-lit at night due to the shop's additional lighting, making it a secure location for children to run errands.

Figure 54- Street 1 & 2 physical elements' observations. Source: Author.

Street two was the second most used and mentioned street by the children. It is the main spine of the whole study area, which could be easy for adults and children to use for its perpendicular axes along all the side streets. Nevertheless, unlike street one, its physical elements and characteristics start to show. However, this street goes through all the different neighbourhoods, so its characteristics change with the building typology.

Figure 55- Street 2 physical elements' observation. Source: Author.

4.3.2 Street 3

The third street is the most tranquil, with greater pedestrian walkway continuity, green spaces, and services. However, the light posts are only on the middle walkway, resulting in poorer nighttime illumination. Moreover, this street uses a yellow-bulb lighting system, which has less light intensity than LED white light bulbs. Any broken light post in the street will lead to a dark spot, declining the

Figure 56- Street 3 physical elements observation. Source: Author.

street's quality. However, the service areas are well-lit due to the shop's lighting system, which reflects more light on the street at night..

Figures 54, 55 and 56 show that big portions of the sidewalk areas are diminished within the private residential units through fenced-in private gardens. On the other hand, sidewalks exist within governmental or public residential housing projects and are in good condition, accompanied by public green areas. There is also the middle walkway, constant from the beginning to the end of that street and only cut at the roundabouts. However, these middle walkways are interrupted by vegetation planted in the middle without considering a clear walking area.

The street's width is around 4.5 metres; there are no traffic lights or crossing areas; only speed breakers exist at the roundabouts for car circulation. Trash bins were also observed beside the sidewalks, obliging some people and children to get off the sidewalk to avoid the smell and flies around them. No natural or artificial shades were observed along the walkway; no signs or outdoor seating furniture were observed in the green areas. Some parts of the street are not well lit at night, which changed near service areas as the surrounding area was lit by the shops' lights.

4.4 Phase 2: Streets Physical Characteristics analysis

4.4.1 Lighting

The typology of the residential area mostly determines the overall neighbourhood's street lighting quality. Because the study area is divided into nine blocks between private and governmental housing projects, the physical characteristics of similar residential typologies are similar. At the same time, those of different designs are distinct. Therefore, a child's travel from one point to another depends on changing streets and the block he or she is traversing.

As shown in figure-54, street 1 serves as the main street of the study area, connecting it along a single axis from beginning to end. Its lighting system (white LED bulbs) is distinct from the residential areas (yellow light). In addition, the nighttime illumination quality in areas with commercial markets is more distinguished by the additional lighting system the storeowners use in front of their shops.

However, because the primary light posts are repeated every 30 metres, when one is broken, particularly in non-commercial areas, the light intensity from the adjacent light posts is insufficient to reach the middle area, which causes blind spots for the street users.

Figure 57- Street 2 condition at night. Source: Author.

4.4.2 Vegetation

Many children's pictures emphasise planters and green spaces, which reflect their significance to the children along the streets. The north and south youth housing projects and the public residential projects feature well-distributed green spaces between the streets, improving the quality of the streets. On the other hand, private residential communities tend to contain the green element within their boundaries behind fences, resulting in fewer open public spaces along sidewalks or interior paths.

Figure 58- Vegetation in private residential areas. Source: Author.

Figure 59- Vegetation in governmental residential areas. Source: Author.

4.4.3 Shade

Like the preceding features, shade in the study area depends on the neighbourhoods crossed along a journey. According to the observations, most public residential neighbourhoods have trees that provide good shade spans (figure-60). Moreover, the shade provided by the building clustering creates play areas for children in green spaces surrounding their houses (figure-61) and dead-end parking areas (figure-62). However, by analysing the shade quality in the most used streets by children, it was observed that there are only a few small trees on the route that is not enough to shade the walkways.

There is no discernible artificial shading system for the children. Few light structures were observed, but they were not in good condition and barely existed. So, those who must walk long distances to reach their destinations will experience more setbacks in the summer than in the winter.

Figure 60- Shade along governmental neighbourhoods. Source: Author.

Figure 61- Green spaces surrounding the houses. Source: Author.

Figure 62- Dead-end parking areas. Source: Author.

4.4.4 Barriers

As depicted in figure-63, barriers make up a significant fraction of all pedestrian roadways, not only for children. As indicated by the observations, the children's drawings, and the parents' questionnaire, the physical barriers include private fences obstructing the walkways, shops using sidewalks as display areas for their products, broken walkways, exposed streets' drains, and stray street animals. However, more obstacles that children face along their journeys are the lack of traffic lights, the absence of stop signs and speed signs, and the absence of crossing areas that they must overcome on their daily travels.

Some parents prohibit their children from walking the streets alone to avoid these obstacles, which limit the children's independent mobility.

Figure 63- Barriers in the study area. Source: Author.

4.4.5 Visibility

Visibility is a quality enhanced by other characteristics, such as lighting and landscape design. It is of good quality in some parts of the study area, such as trees of great height, on the corners or in open green areas. Moreover, open green spaces create a sense of openness and visibility. However, the choice of trees with short heights in the middle pathways (figure-66) can interfere with the children's vision along the street.

Good visibility of highways, vehicles, and landmarks, by day and nighttime, enhances security. It also provides that sense of security when the child feels visible. It is shown in the maps' analysis how some streets' corners are missing a sidewalk because of the private gardens or fences, which puts users, especially children, in a position where they cannot see the incoming cars; same for cars. Moreover, Jane Jacobs elaborated on the significance of the "Eyes on the street" concept and how children and their parents feel safer when enough people are on the street. Although the study area accommodated better sidewalks connections within the internal residential streets, they are not used for being secluded and not used with enough people. Hence, it was inferred from the children's map activity and their remarks on the maps that they use the most vibrant streets in their neighbourhood.

4.4.6 Width of walkways

In numerous instances, as depicted in Figures 64, 65, and 66, the width of the walkways varies. People feel safer when the sidewalk is broader, especially when it is adjacent to a narrow street lane, like in the case of this study area. According to NACTO (see Sidewalks, page 26), a child's walkway function should be more than simply walking (2020). Recent research supports the convenient

interventions a sidewalk may offer to make a child's journey more engaging with the surroundings.

Unfortunately, in this case study, walkways could be more efficient. Some blocks lack any sidewalks, and the only accessible route is a linear walkway in the middle of the street (figure-66). Although the sidewalk is 1.5 metres wide, trees are planted in the middle, interfering with the walkway quality (figure-64). In addition, cutouts are repeated every street section with no crossing space for the user. Few walkways are of good width; however it could be broken (figure-65), or light posts cutouts decrease the walkway width like in the case of street "3" (figure-66).

4.4.7 Mode of transportation

The transportation modes a child can use in a neighbourhood add to the quality of the community as more appealing to their parents to increase their CIM

Figure 66- Street 1. source: Author.

Figure 65- Street 2. Source: Author.

Figure 64- Street 3. Source: Author.

licence. In the case study, the existing modes of transportation, according to the observations, are local buses, tuk-tuk, private cars, cycling and walking. However, conforming to the questionnaires, 4 out of 10 children use cars, 6 out of 10 walk, 1 out of 10 cycle, 2 out of 10 ride tuk-tuk and 1 of 10 ride local buses.

4.4.8 Cycling Quality

Cycling is one of the ways of transportation that develops a child's sense of independence (Kost et al., 2019; National Association of City Transportation Officials, 2020). Due to the unsuitable infrastructure in the study area for bicycles, only a tiny fraction of children were spotted cycling. In addition to the questionnaire in which children were asked if they could cycle to nearby destinations, half of the children who own bikes said they were not permitted. This was elaborated on in the parent's questionnaire, revealing that they would feel safer if there were bike lanes on the streets.

Figure 67- Cycling quality in the study area. Source: Author.

4.4.9 Speed breakers & Signage

Speed breakers and signage could be a substitute in narrow streets instead of traffic light (Kost et al., 2019; National Association of City Transportation Officials, 2020). However, the speed breakers signs only exist in some places, they need to be a visual indicator on the roadway to help children determine from which part of the street they can cross. Moreover, based on the observations reported in (figures 54, 55, and 56), there were sufficient speed breakers on the residential and main. This helps the streets achieve a certain speed restriction, in addition to the width of the street, which also contributes to achieving that limit.

Signage could improve the experience of the children's journey from one location to another by directing them along their route, acting as milestones at intervals, and identifying the travelled regions to eliminate the possibility of getting lost (Kost et al., 2019; National Association of City Transportation Officials, 2020).

4.4.10 Seating / Transit stops & Road Hierarchy

According to the observations, the questionnaires and the children's PST diagram, neither the interior pathways nor the residential green areas have any casual seating or resting areas. Alternatively, the transit stops are consistent and are accompanied by benches. However, since the public transportation route goes around the outside perimeter of the study area not through, as indicated in figure-68, no transit stops were spotted along the most used streets by children.

It is also shown on the map, the distribution of primary roads, secondary roads, and boundary. The map shows that the 2nd and 3rd most used streets by children are primary roads, while the 1st most used street is a secondary road.

Figure 68- Transit stops and road hierarchy. Source: Author.

4.4.11 Vehicular movement

A study of the vehicular movement and traffic hours were chosen from google traffic maps, on a Friday (weekend) at 1:30 pm (figure-69), which is after Friday's prayer with the most number of people on street walking or driving, and on a Sunday (weekday) at 1:30 pm (figure-70), the time the students come out of school. There is no significant change in most of the streets, except for the streets in front of or surrounding the schools at the pick up time.

Figure 70- Traffic of study area on a weekend. Source: Author

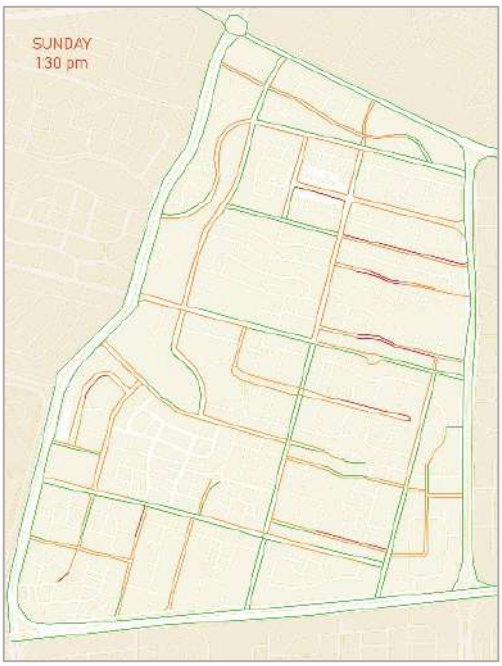


Figure 70- Traffic of study area on a weekday. Source: Author.

4.5 Conclusion

The results of the empirical research highlight the difference of impact between the streets' social and physical characteristics. It also presented how the spread of services and commercial areas into the streets helped to create an appropriate environment for the parents to feel safer for their children by reducing the risk of harm caused by strangers. However, nearly half of the participating parents still fear "stranger danger" and the risks posed by the street environment, such as stray dogs and darkness. The following chapter will discuss these environmental concerns and classify them in order to establish a more direct link with CIM.

Chapter 5: The relations between Streets physical characteristics & CIM

In the preceding chapter, the physical characteristics of the streets were investigated, children's daily travel routines were explored, and children's and their parent's perceptions of their environment were viewed. The data is presented through charts and diagrams that are analysed separately.

This chapter identifies the main research aim by investigating the connection between the two phases' results. It focuses on analysing the CIM frequency compared to the built environment's conditions with respect to various social and physical variables. Finally, it highlights the results that contradict or are consistent with previous studies.

5.1 Streets' Characteristics that Impact CIM

According to the observations, the children's comments, and the parents' recommendations, the streets' physical characteristics in the study area proved their impact on CIM. In addition, as discussed in the previous chapter, one character can influence CIM solely, and another can have a bigger influence when combined with certain ones within the context. Davison and Lawson's study also supported this relationship between the various streets characteristics. They noticed how the CIM improved when proper sidewalks, nearby destinations, and public transportation existed, with few crossings and low traffic (2006).

5.1.1 Obstacles within the CIM Range VS CIM Frequency

In Table 6, the range of three destinations that are considered to be frequently visited by children, according to Hillman (1990), is compared with the parents' reasons for not letting their children travel independently. For instance, of the parents who stated, "My child is still young", two-thirds of them have their children's school within a walkable or cycling range; all of them have supermarkets within a range of a maximum of 400 metres; and half of them have parks within the same suitable range. However, they still consider their children, ages 9–13, too young to travel this distance independently. Same for the parents who confirmed their fear of stranger danger: half of the participants have their children's schools within a walkable range; more than half have services like supermarkets within a walkable range, and all have parks within a walkable or cycling range.

It is important to consider intangible challenges, like "stranger danger," which 40% of parents mentioned. Joshi and MacLean's study results (1995) confirmed that "stranger danger" fear prevents parents from letting their children travel to destinations that are on a walkable range. The results are also consistent with McMillan's (2005) and Villanueva's (2011) conclusions that the parents' perceptions of the surroundings influence children's interaction with their built environment.

Why parents stated they don't let their children to travel independently?	% of Parents	Range of school			Range of Supermarkets			Range of Playareas / parks		
		X	Y	Z	X	Y	Z	X	Y	Z
My child is still young	27%	9.0%	9.0%	9.0%	27.0%	0.0%	0.0%	13.5%	0.0%	13.5%
Fear of Stranger danger	40%	20%	0%	20%	27%	0%	13%	13%	13%	20%
Fear of traffic	7%	0%	7%	0%	0%	7%	0%	0%	7%	0%
Fear of bullying	6%	6%	0%	0%	6%	0%	0%	6%	0%	0%
Fear of street animals	14%	14%	0%	0%	7%	7%	0%	7%	0%	7%
	X= 100 - 400 m				Y= 400 - 1200 m			Z= more than 1200 m		
Recommendations	To have a place defined for crossing streets with stop signs									
	Install traffic lights and put a limit for expanding the streets' width									
	Hiring security and installing surveillance cameras									

Table 6- Comparison between 3 destinations' range and parents' reason for not letting their children move independently. Source: Author.

As for the street's tangible obstacles, according to the streets' analysis, the sidewalks' barriers were dark areas, stray dogs, and vacant streets, which will become more frequent as the range of destinations expands and disturb the continuity of the pathways in the study area. Although 4 out of 6 probable destinations for children to visit scored fairly for a walking or cycling range, the CIM frequency rates in 18 out of 56 cases were less than the average. In addition, 63.6% of the parents would not allow their children to walk alone for fear of accidents while crossing streets. Furthermore, children prominently mentioned additional obstacles in their drawings and maps (Table 4), such as trash pins and

their haphazard locations on the street. It is supported by Davison and Lawson (2006) in how they give the place a sense of instability and a reputation for unsafeness. In addition to more hazards like fences, flies, street animals, and sidewalk conditions that can disrupt the CIM frequency on certain streets. Therefore, it depends not only on the range but also on the presence of various obstacles to reach a certain destination, as confirmed by UNICEF (2018) and NACTO (2020).

Parents were asked to write some recommendations that would allow them to give their children a CIM licence. They declared the following: to have a place defined for crossing streets with stop signs for cars, to install traffic lights and put a limit on urban regulations in expanding streets' width in residential areas, to install surveillance cameras, and to hire street security

5.1.2 Additional Elements to Enhance Streets Physical Characteristics

In addition to the parents' recommendations to enhance the streets' walkability for their children, it was determined that the children required more street amenities. Despite the open green spaces within the neighbourhoods shown in the streets' analysis (figures 54-55-56, pages: 74-76) they are not utilized to serve the children's needs. The results show that children 9–10 years old scored an intermediate rating for "Places to Play", as depicted in the PST wheel (figure-39, page-63). Whereas children 11–14 years old scored the lowest rating, raising questions about the quality of the streets for children and their needs at different ages of their mid-childhood. UNICEF supported these needs in their "Urban Mobility Measurements" (figure 3, page 22) for infants, children, and teens.

NACTO proposed the concept of "Pause Spaces", which allow children to play and socialise in the streets. Likewise, Gehl launched the "Play Everywhere" programme, where children's street hangouts are transformed into participatory spaces. When children routinely engage in meaningful interactions with their environment, unstructured play is the outcome, which is essential for them to thrive (Schuff & Kielgast, 2019; National Association of City Transportation Officials, 2020).

5.2 Variables Affecting CIM

McNeill and colleagues stated that social and cultural-norm values might affect CIM: social cohesion, neighbourhood safety, and engagement within a community (McNeill, Kreuter & Subramanian, 2006). This statement is consistent with the results from the parents' PST wheel (figure-40, page-64), where "social interaction" and "influence and sense of control" scored the lowest rate.

The children's age, gender, and the families' socio-economic level (Hoefer et al., 2001; Bhuyan & Zhang, 2019; Tcymbal et al., 2020) can also change the parents' perception accordingly (Table 5, page-71). Therefore, further analysis of these cultural norms, direct and indirect impacts on CIM, are presented through the next sub-sections: Demographics and parents' perceptions of the built environment.

5.2.1 Demographics

Gender and socio-economic status confirmed their effect on CIM frequency as shown in Table-5 (page-71), which is consistent with previous studies.

5.2.1.1 Gender

The results revealed a significant difference in CIM between males and females. Boys had more freedom in independent mobility from a younger age than girls, which was also observed in front of the school area. The boys had their hangout spots next to the school and were observed walking home alone, while most girls had to wait inside the school for their parents or a family member to pick them up. Even throughout the observation process, more boys were seen strolling alone or with friends of the same age, while girls were only spotted with a group of friends, a male friend, a sibling, or an adult. Hence, a girl's IM frequency depends on the circumstances and schedule of the other individuals accompanying her. This distinction was discussed earlier in the literature chapter and supported by Kytta's study on urban and rural environments, where girls were observed to move in groups only. At the same time, boys had more freedom to move solely (1997).

5.2.1.2 Socio-economic Status

Bere and colleagues (2008) illustrated how children in USA and Portugal from low-income families were more likely to walk or cycle alone than those from high-income families. This study's results are consistent with their findings, as it was confirmed by most parents who own a private car that they drive their children to school. However, the questionnaire revealed an almost equal proportion of children who travelled independently versus those who were driven by private cars. Nevertheless, all of the participants who claimed to own a car used it to reach the majority of the visited destinations, even if they were within walking or cycling distance (Table 6).

Driving children to nearby destinations could be affected by socio-economic status as a variable or a socio-cultural norm generated to cope with the unsuitable

built environment. However, children from low-income backgrounds tend to have more freedom in movement than mid and high-income children.

5.2.2 Parents' Perceptions of the Built Environment

An overview of the whole community's aspects can affect the parents' decision on a CIM licence (Carver et al., 2005; Weir et al., 2006; Panter et al., 2010; Carver et al., 2014). Hence, the parents' perceptions of their social and physical environment were considered in the questionnaire and the PST Wheel (figure-40, page-64). According to the results, parents' perceptions are primarily influenced by their sense of safety within the built environment and their confidence in their children's ability to handle challenging situations.

5.2.2.1 Feeling of Safety

Although parents scored an average of 5 out of 7 in the PST diagram for feeling safe in their neighbourhood and children scored 2 out of 3, comments and scores of the streets' physical characteristics show parents' anxiety about allowing their children to travel alone. According to the results, 36 % require an adult or themselves to be with the child. 72 % of parents feel unsafe leaving their children alone after dark. 76 % do not allow their children to take public transportation independently. 45.5 % do not allow them to walk on the main streets alone. These findings align with the earlier hypothesis that Nooraddin (2020) mentioned in the introductory chapter that urban developments were developed to serve the needs of adults, not necessarily children. Furthermore, the UNICEF study on children in developing countries (2018) supported that 65% of children do not feel safe in their built environment. This percentage confirms this study's results that adults can feel safe in their neighbourhood but not necessarily safe enough, leaving their children to move independently.

For the "Care and Maintenance" factor, it scored 3 out of 7 in the PST diagram (figure-40, page-64). It was also mentioned in the children's drawings about how they pass areas on their journeys that are neither clean nor well-maintained and are filled with stray animals. However, parents' fear of stray animals scored 14% of the answers to "Why do they not allow their children to move independently?"

All these aspects impact children's and their parents' feelings of safety. They influence the overall image of the neighbourhood and drive the parents to reduce their children's independent mobility licence or apply strict restrictions, as supported by Villanueva (2011) and McMillan (2005).

5.2.2.2 "My Child is still Young"

One of the barriers that one of the parents of a 13-year-old child stated was, "I fear that my child will not be able to act well when he faces a problem on his way". 12.5 % of parents mentioned they would never leave their children to move independently by ages 7-14. 32.5 % mentioned how they think their child is still young and that they might allow them to move independently if the streets were modified to be child-friendly. These restrictions show the impact of the parents' perception of their environment on CIM. Hence, many children have no licence to travel alone, despite the relation between the destinations' range and other variables discussed earlier.

This finding presents how parents perceive their environment differently than their children and can decide the rate of development of their children by allowing or not allowing them to travel independently at a certain age (Tranter & Doyle, 1996; McMillan, 2005).

5.2.3 Children with cell phones

Several studies claim that technology now allows parents to know where their children are by calling them on their cell phones or tracking their devices (Mikkelsen & Christensen, 2009; Fyhri et al., 2011; Mackett, 2013). So, the children's questionnaires were compared with their parents to see the impact of technology on the feeling of safety. 29 out of 41 children who own cell phones are allowed to go to nearby destinations by walking or cycling on their own, with a sibling, or with a friend. 18 of the 41 are allowed to go after dark alone, which is less than the number of children who go out after dark. 15 out of 41 are allowed to use public transportation alone, almost half the number of children who use public transportation. Moreover, the parents of the participating children who own cell phones have almost the same results regarding feeling safe (PST Wheel) as those whose children do not.

Analyzing the numbers of children who own and do not own cell phones in this case study compared to the total number of participants does not prove that technology plays a factor in changing the rates of CIM. This result contradicts Mikkelsen and Christensen, Fyhri and colleagues, and Mackett's findings and hypothesis.

Chapter 6: Conclusion & Way forward

This study aims to identify the impact of streets' physical characteristics on children's independent mobility. Based on the literature, various social aspects had to be included to refine the investigation process and improve the results.

Literature has been redefining CIM since the 1990s, and the more researchers look into this issue, the more factors they discover that have distinctive impacts on CIM. Depending on the case study and the culture of that community, the age at which a child should start moving independently was never constant. In some studies, it started at 7 years old and in others, it started at most at 8 - 9 years old, depending on social, cultural, and physical characteristics.

Marzi and Reimers (2018) presented four indicators to measure CIM and correlated each indicator with the others. Later, more studies and initiatives by world-leading research institutes like UNICEF (2018), GEHL (2019) and NACTO (2020) took place to create child-friendly cities—not only places where children can go through independently but also cities to help children thrive. Challenges were identified, and guidelines and programmes were presented.

Constants and variables in both social and physical aspects correlate in different ratios with each case study. Therefore, further studies in different communities

were always recommended in previous research to be able to apply impactful interventions that would influence CIM positively.

This research's sub-objectives were to investigate the quality of travel by detecting the street's physical elements and explore whether these physical elements or other factors can enhance or reduce CIM. It was implemented in two phases; phase one included two workshops, one questionnaire for the children, and one for their parents. Phase two included observations of the most used streets by children while focusing on the streets' physical characteristics mentioned in the workshops and questionnaires by children and their parents.

The empirical work demonstrated how attentive 12- to 14-year-olds are to their surroundings and the elements that make up their streets. However, they need to be aware of the other factors missing in their neighbourhoods—such as pedestrian crossings, cycling infrastructure, etc.—and how they affect their independent mobility.

The results of the case study showed that, of all the physical features of the streets that were looked at, the following were mentioned from the most to least effective respectively: Darkness – physical barriers- cleanliness- visibility - cycling quality – speed breakers and signage - mode of transportation – road hierarchy – transit stops- width of the sidewalk. These factors were reflected through the drawings, maps, and questionnaires. Moreover, green spaces were only mentioned by the children in their drawings. Besides, when asked to be rated on the PST wheel, they reflected an intermediate score according to the participants. The parents did not mention shade and landscape seating areas, and the children barely mentioned them until they were introduced to them on the PST wheel. Green spaces had an intermediate score on the PST for 9–10 years old but the lowest score for 11–14 years old. However, when asked about their importance, no positive reaction was apparent. On the other hand, green spaces, shade, and seating had great impact on CIM in previous studies and were well-considered in the proposed guidelines by UNICEF (2018), Gehl (2019) and NACTO (2020), unlike in this study's case.

The "Eyes on the Street" concept was discussed earlier, as how parents feel safer for their children in streets with high pedestrian density. This study's results were consistent with this concept, with modest attention to the streets' physical characteristics.

Thereby, the most used streets by children were not first identified as having the highest physical characteristics but as the most used streets by adults. The second-most-used streets would be those that scored highly in the presence and

good quality of those streets' physical characteristics, even if they did not include high pedestrian density.

This order reflects the cause-effect relationship between tangible and intangible characteristics of the built environment. It was discussed earlier how the streets' characteristics can enhance overall mobility, which reflects on the parents' feeling of safety, hence, increasing CIM licence.

Furthermore, after analysing the collected data from the questionnaires, CIM rates were found to be higher in low-income families than in mid-income families. Moreover, higher CIM rates were more common in boys than girls. Both factors, socio-economic status and gender, were reflected in the literature by various studies as well. Thus, the research shows that boys have a higher CIM range and time that allows them to reach further destinations and experience the streets at different times of the day.

Moreover, previous research also validated the role of owning a mobile phone. It conveys the increase in CIM frequency, as parents tend to feel safer when they realise their children can contact them in times of emergencies or that they can reach them at any time. However, this factor did not impact children or their IM in this case study.

The results also detected additional outcomes: when parents expressed that they have enough parks and play areas around them, children of different ages (between 9 and 14 years old) stated otherwise. This difference contemplates the children’s needs at each phase of their childhood, and how parents need to be aware of these differences.

Green spaces existed in the study area; adults considered these green areas to be play areas for children of all ages. However, the children's PST wheel shows how the start of the mid-childhood’s needs differ from those of late mid-childhood.

Finally, the influence of the streets' physical characteristics on CIM was analysed in relation to social and physical variables in the previous chapter. It conveyed how these variables and findings speed up the repetitive cycle of a cause-effect process.

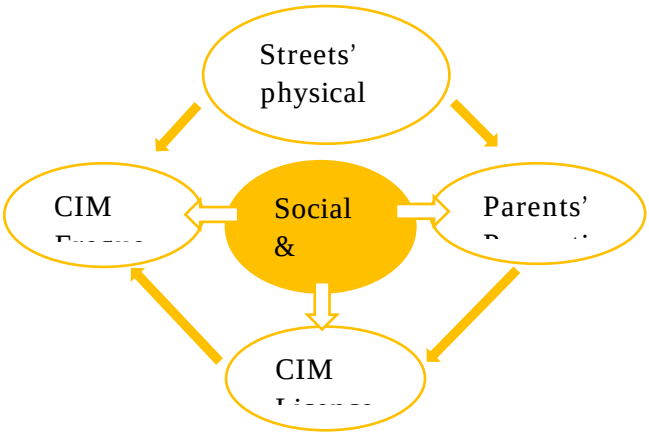


Figure 71- CIM cause-effect relations. Source: Author.

Limitations

Through the empirical work, the research faced certain limitations, as mentioned earlier in the research methodology, like the interference of the research timeline with the end of the semester for the children. This interference complicated the process of reaching the same children again for further investigation. It also created a barrier in collecting the parents' questionnaires, even after contacting them privately. Moreover, because of the schools' regulations, the only time accepted to interact with the children through the exam period was during the break period. However, the children had not enough time to finish their drawings.

As the scope of this study was to focus on low and mid-income families, most low-income families had difficulty reading the questionnaire. Moreover, low-income families could not be reached directly for a one-on-one interview because of one of the schools' regulations. Thereby, the results were reliant on their children's answers only.

At last, the research and empirical work took place in December and January. Therefore, the findings concerning CIM indicators and the street's physical characteristics, like weather, shade, water features, parks and play areas, influencing CIM are limited to the winter season.

Further Studies

For future studies, more research is recommended at different times of the year to study the factors influencing children's independent mobility routine at different periods. Besides, it can consider focusing on a certain age for more specific activities. Finally, the scope of the study was on low and mid-income families, so government schools were chosen. However, investigating CIM in high-income families as a variable can convey distinct findings for CIM within the same study area.

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Appendix A

Children's Questionnaire Template

1- حط علامة (x) فى الجدول قدام الطريقة اللى بتستخدمها و انت رايح المدرسة فى كل يوم من أيام الأسبوع.

من البيت  الى  المدرسة

	الأحد	الاثنين	الثلاثاء	الأربعاء	الخميس
أمشى لوحدى					
بركب العجلة					
بمشى مع اصدقائى					
بمشى مع بابا او ماما					
بعربية					
بالأتوبيس					
توك توك					
أخرى:					

2 حط علامة (x) فى الجدول قدام الطريقة اللى بتستخدمها و انت راجع للبين من المدرسة فى كل يوم من أيام الأسبوع

من المدرسة  الى  البيت

	الأحد	الاثنين	الثلاثاء	الأربعاء	الخميس
أمشى لوحدى					
بركب العجلة					
بمشى مع اصدقائى					
بمشى مع بابا او ماما					
بعربية					
بالأتوبيس					
توك توك					
أخرى:					

3- كم مرة ذهبت من البيت إلى الأماكن اللى فى الجدول لوحدك عن طريق المشى او ركوب العجلة او المواصلات العامة ؟
حط علامة (x) على كل يوم من أيام الأسبوع خرجت فيه للأماكن ديه

 البيت

الأماكن	الأحد	الاثنين	الثلاثاء	الأربعاء	الخميس	الجمعة	السبت
المدرسة							
منزل صديق							
منزل الأقارب							
الحدائق أو الملاعب							
المتاجر والأسواق ومراكز التسوق والسينما أو المطاعم							
الملاعب الرياضية (مثل، ملعب كرة القدم، حمام السباحة)							
أماكن الصلاة (مثل الكنيسة والمسجد)							
أخرى:							

4- كم مرة رجعت البيت من الأماكن اللي في الجدول لوحدك عن طريق المشي او ركوب العجلة او المواصلات العامة ؟
حط علامة (x) على كل يوم من أيام الأسبوع
خرجت فيه للأماكن ديه

الأماكن	الأحد	الاثنين	الثلاثاء	الأربعاء	الخميس	الجمعة	السبت
المدرسة							
منزل صديق							
منزل الأقارب							
الحدائق أو الملاعب							
المتاجر والأسواق ومراكز التسوق والسينما أو المطاعم							
الملاعب الرياضية (مثل، ملعب كرة القدم، حمام السباحة)							
أماكن الصلاة (مثل الكنيسة والمسجد)							
أخرى:							

5- هل مسموح لك بعبور الطرق الرئيسية بمفردك؟
□ نعم □ لا

6- عند الذهاب إلى أماكن أخرى غير المدرسة على مسافة قريبة؟
أذهب عادةً...
□ لا أذهب □ لوحدي □ مع بابا و ماما □ مع شخص كبير/ بالغ □ مع صديق او اخ أكبر سنًا
□ مع صديق او اخ من نفس العمر أو أصغر □ أخرى: .....

7- هل مسموح لك بالعجلة على الطرق الرئيسية لوحدك ؟
□ نعم، امتى بدأت تنزل بالعجلة لوحدك ؟ _____ سنوات
□ لا
□ ليس لدي دراجة

8- هل مسموح لك بالذهاب في مواصلات العامة لوحدك (اتوبيس – توك توك - ميكروباص)؟
□ نعم □ لا

9- هل مسموح لك عادة بالخروج لوحدك بعد ما الدنيا تضلم؟
□ نعم □ لا

10- عندك mobile phone
□ نعم □ لا

11- هل بتروح المدرسة بالموبايل
□ نعم □ لا

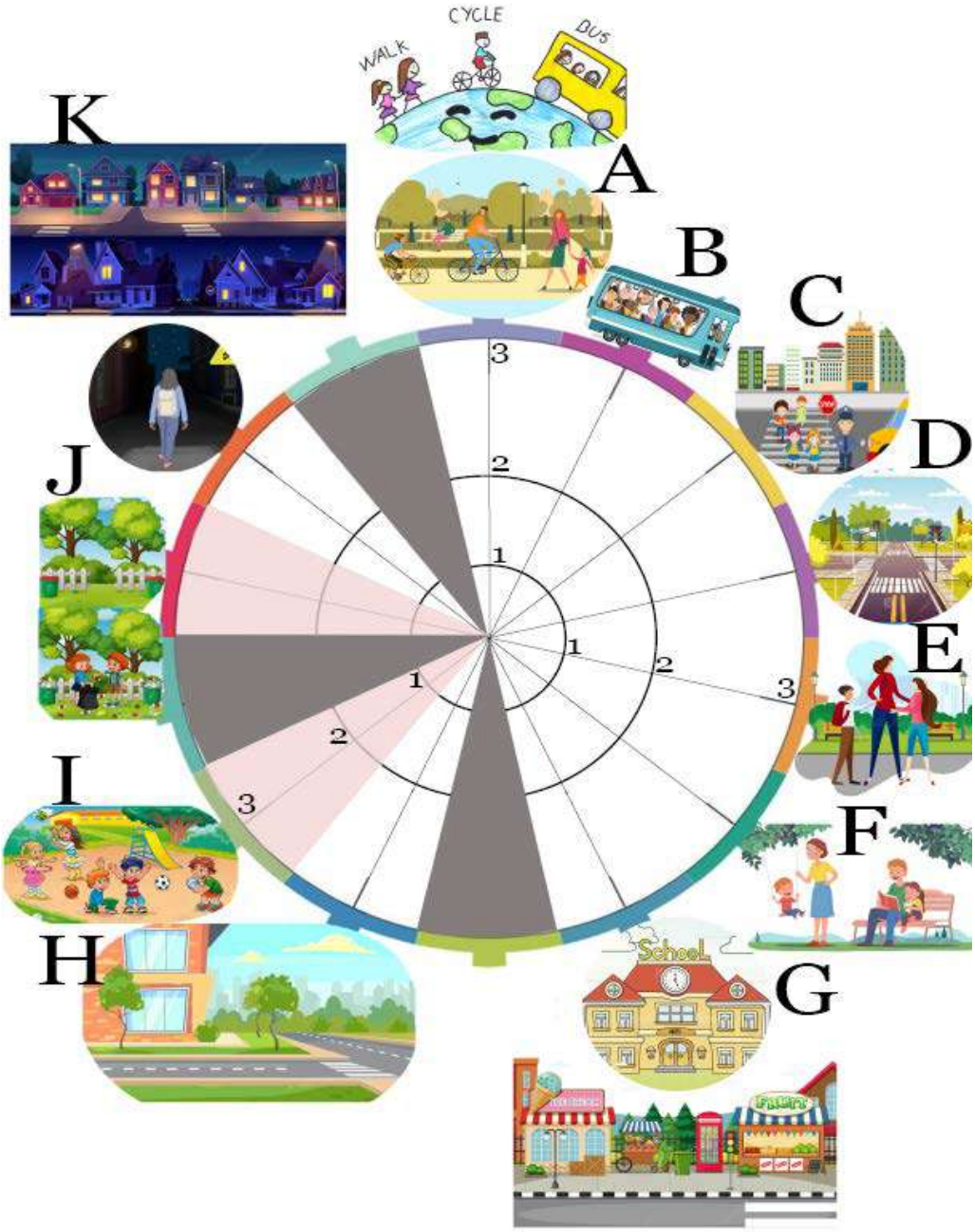
12- اكتب عمرك .....سنة

13- ضع علامة في المربع إذا كنت:
□ بنت □ ولد

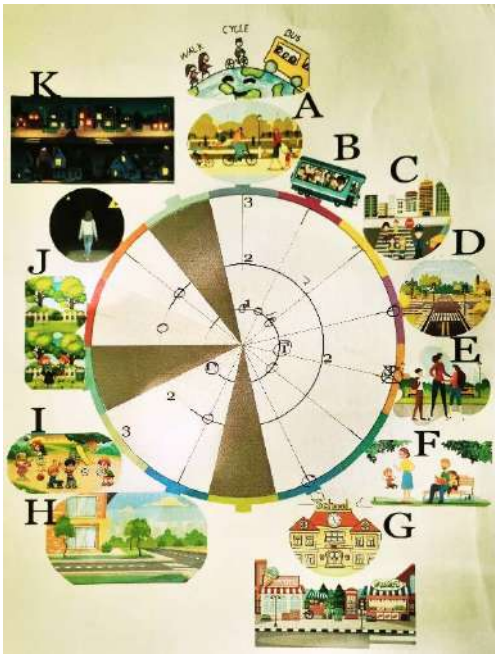
14- اسمك

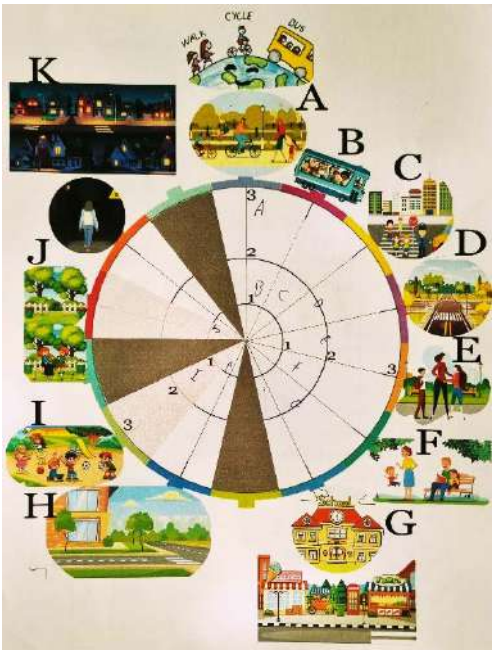
Appendix

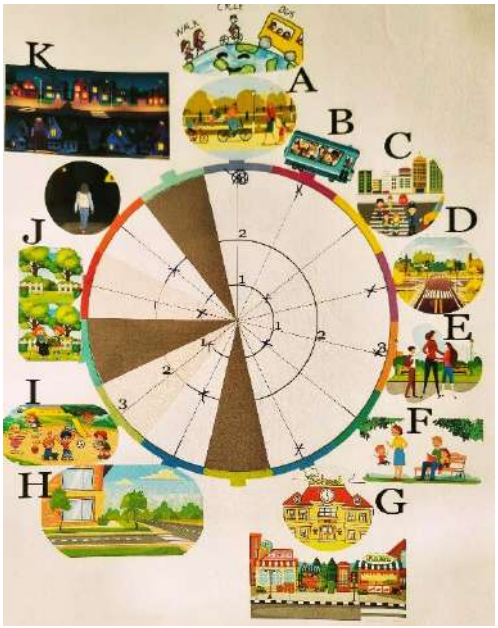
Children's PST Wheel

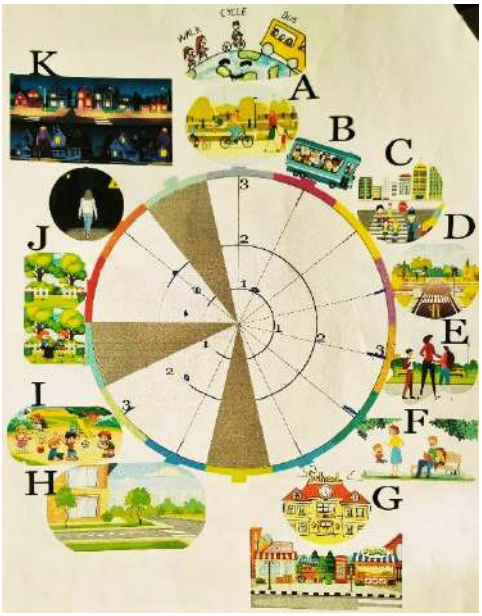


Children's PST wheel activity samples









Appendix

Parents' Questionnaire Template

MSc Integrated Urbanism & Sustainable Design (IUSD)

استبيان للأهالى (سكان التجمع الاول)

1. **الجنس**
□ أنثى □ ذكر

2. **ما هو عمرك؟**
□ تحت 30 □ 30 إلى 44 □ 45 وما فوق

3. **هل منزلك يستخدم سيارة خاصة؟**
□ نعم □ لا

4. **هل تمتلك عائلتك منزلك أم أنه مستأجر؟**
□ تملك منزلاً □ مستأجر

5. **هل تعمل بأجر؟**
الأب
□ نعم، بدوام كامل □ نعم، بدوام جزئي □ لا
الأم
□ نعم، بدوام كامل □ نعم، بدوام جزئي □ لا

6. **ما هو اسم وظيفتك؟**

الأب:..... الأم:.....

7. **اسم طفلك المشارك فى هذا الاستبيان:** .....

8. **هل يُسمح لطفلك بالسير أو ركوب الدراجة إلى المنزل من المدرسة بمفرده؟**
□ نعم – مع تحديد السن الذي تم السماح له بذلك

أصغر من 7	من 7 ل 9 سنين	10 سنين	11 سنه	12 سنه	13 سنه فيما فوق

□ لا – لماذا؟
- □ خطر المرور □ طفلي لايزال صغيرًا □ الخوف من الاعتداء من قبل البالغين
- □ الخوف من التنمر من قبل الأطفال الآخرين □ المدرسة بعيدة جدًا □ لا يوجد سبب
□ أخرى.....

□ لن أسمح أبدًا

9. **عند الذهاب إلى أماكن أخرى غير المدرسة, التى تقع على مسافة قريبة، هل يذهب طفلك...**
□ بمفرده □ مع الوالدين □ مع شخص كبير/ بالغ □ مع طفل من نفس العمر أو أقل
□ مع طفل أكبر سنًا □ لا يذهب بمفرده □ أخرى: .....

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10.هل تسمح لطفلك عادة بالخروج بمفرده بعد حلول الظلام الى اى من (حديقة ألعاب- المناطق الترفيهية مثل مراكز التسوق- الأسواق المحلية- الأسواق المحلية- المسجد / الكنيسة) ؟

□ نعم □ لا

11.هل يُسمح لطفلك عادة بالتنقل في حافلات عامة بمفرده (بخلاف الحافلة المدرسية)؟

□ نعم – مع تحديد السن الذي تم السماح له بذلك

أصغر من 7	من 7 ل 9 سنين	10 سنين	11 سنه	12 سنه	13 سنه فيما فوق

□ لا – لماذا؟

- □ طفلي لايزال صغيرًا □ الخوف من الاعتداء من قبل البالغين
- □ لا يوجد سبب □ أخرى.....

12.ما هى طريقة التنقل الأكثر استخدامًا من قبل طفلك؟

□ السير على طول الطريق □ ركوب الدراجة □ أتوبيس □ سيارة /تاكسى (uber)
□ توكتوك □أخرى .....

13.هل يُسمح لطفلك بعبور الطرق الرئيسية بمفرده؟

□ نعم – مع تحديد السن الذي تم السماح له بذلك

أصغر من 7	من 7 ل 9 سنين	10 سنين	11 سنه	12 سنه	13 سنه فيما فوق

□ لا – لماذا؟

- □ طفلي لايزال صغيرًا للتحديد □ الخوف من حوادث الطريق □ لا يوجد اماكن مخصصة
- □ لا يوجد سبب □ أخرى.....

14.ما مقترحاتك من تجديدات لجعل حركة الاطفال اكثر امانا فى الشارع التى قد تجعلك تترك طفلك يتحرك بمفرده بوسائل مختلفة؟

.....
.....
.....

15.إلى أي مدى تبعد الوجهات التالية عن منزلك ؟

المسافة	المدرسة	حديقة ألعاب	المناطق الترفيهية مثل مراكز التسوق / المول	الأسواق المحلية	المرافق الرياضية	المسجد / الكنيسة	أخرى
أقل من 200 م							
بين 200 و400 م							
بين 400 و1200 م							
أكثر من 1200 م							
أخرى:							

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16.ما مقدار الوقت الذي قد تستغرقه انت و طفلك للوصول إلى الوجهات التالية من منزلك عن طريق وسائل النتقل المحددة فى الجدول؟ -برجاء تحديد الوسيلة المستخدمة للتنقل لكل مكان على حدى
ووضع علامة ✖ بجانب الوقت المستغرق امام الاماكن المذكورة

	المسافة	المدرسة	حديقة ألعاب	المناطق الترفيهية مثل مراكز التسوق (المول)	الأسواق المحلية	المرافق الرياضية	المسجد / الكنيسة	أخرى .....
المشي	أقل من 5 دقائق							
	بين 5 و10 دقائق							
	بين 10 و30 دقيقة							
	أكثر من 30 دقيقة							
	أخرى:							
ركوب الدراجات	أقل من 5 دقائق							
	بين 5 و10 دقائق							
	بين 10 و30 دقيقة							
	أكثر من 30 دقيقة							
	أخرى:							
سيارة / تاكسى (uber)	أقل من 5 دقائق							
	بين 5 و10 دقائق							
	بين 10 و30 دقيقة							
	أكثر من 30 دقيقة							
	أخرى:							
وسائل النقل العام	أقل من 5 دقائق							
	بين 5 و10 دقائق							
	بين 10 و30 دقيقة							
	أكثر من 30 دقيقة							
	أخرى:							
توك توك	أقل من 5 دقائق							
	بين 5 و10 دقائق							
	بين 10 و30 دقيقة							
	أكثر من 30 دقيقة							
	أخرى:							

الأسئلة التالية تدور حول الحى الذى تعيش فيه
أختر ما يلي من 1 إلى 7
1 أسوأ قيمة - 7 أحسن قيمة

17.هل الطرق والمساحات آمنة، بها حركة مشاه دائمة وتستخدم جيدًا في أوقات مختلفة من اليوم وعلى مدار العام؟
□ 1 □2 □ 3 □ 4 □ 5 □ 6 □ 7

3

18. هل المنطقة خالية من السمات السلبية، مثل الممتلكات القارغة أو الجريمة أو السلوك المعادي للمجتمع؟
□ 1 □2 □ 3 □ 4 □ 5 □ 6 □ 7

19. هل تسمح ترتيبات المرور للناس بالتنقل بأمان؟
□ 1 □2 □ 3 □ 4 □ 5 □ 6 □ 7

20. هل محطات الحافلات في أماكن مناسبة وعلى مسافة قريبة من منزلك؟
□ 1 □2 □ 3 □ 4 □ 5 □ 6 □ 7

21. هل هناك ميزات إيجابية مثل المعالم المحلية، أو المباني التاريخية، أو الساحات العامة، أو الحدائق الطبيعية التي تسهل عليك العثور على طريقك؟
□ 1 □2 □ 3 □ 4 □ 5 □ 6 □ 7

22. هل المرافق مثل التسوق أو الأسواق المحلية أو المباني الدينية على مسافة معقولة ويمكن الوصول إليها بسهولة عن طريق المشى أو ركوب الدراجات أو وسائل النقل العام؟
□ 1 □2 □ 3 □ 4 □ 5 □ 6 □ 7

23. هل هناك مجموعة من المساحات الطبيعية المتاحة للناس، ويمكن استخدامها لمجموعة متنوعة من الأغراض؟
□ 1 □2 □ 3 □ 4 □ 5 □ 6 □ 7

24. هل هذه المساحات الطبيعية جذابة ومصانة جيدا وخالية من المخاطر؟
□ 1 □2 □ 3 □ 4 □ 5 □ 6 □ 7

25. هل هناك فرص ومساحات للجميع للمشاركة في اللعب والاستجمام؟ قد ترغب في التفكير في بعض الفئات المحددة مثل المراهقين والأطفال ذوى الإعاقة وكبار السن.
□ 1 □2 □ 3 □ 4 □ 5 □ 6 □ 7

26. هل هناك خدمات أو مجموعات مجتمعية محلية تسمح للسكان (الناس والأطفال) بالمشاركة في مناقشة احتياجاتهم في الحي؟
□ 1 □2 □ 3 □ 4 □ 5 □ 6 □ 7

27. هل التواصل بين السكان فيما يتعلق برعاية وصيانة الميتى، ومحيطه، واضح، وفعال؟
□ 1 □2 □ 3 □ 4 □ 5 □ 6 □ 7

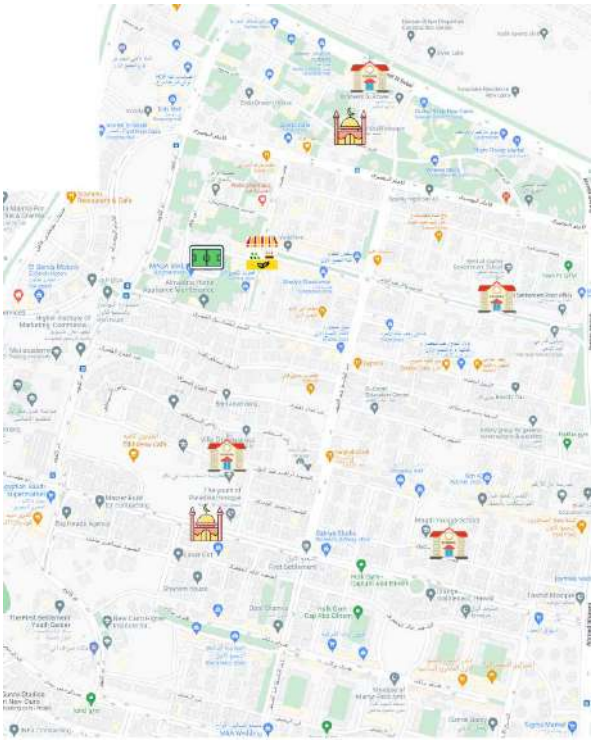
28. هل تشعر أنت وجيرانك أنك تنتمي الى الحي بغض النظر عن العمر، أو الجنس، أو العرق أو المعتقد الديني أو الإعاقة؟
□ 1 □2 □ 3 □ 4 □ 5 □ 6 □ 7

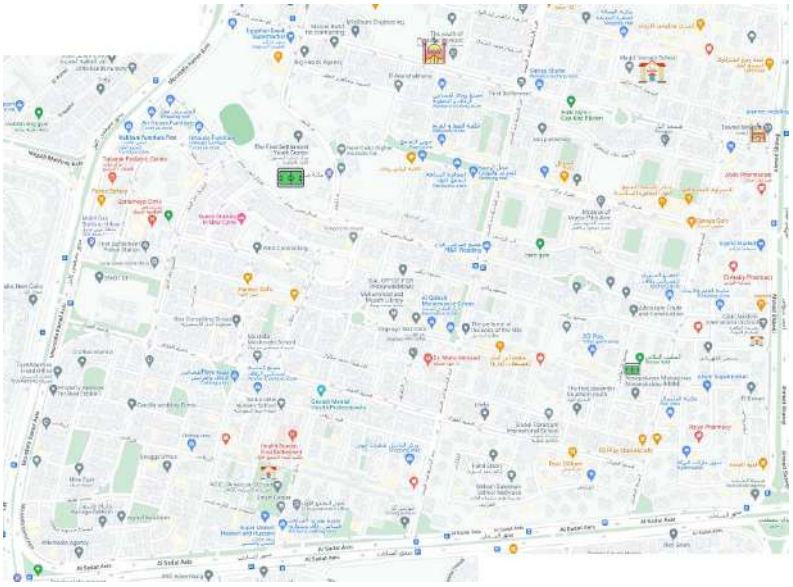
29. هل تعرف أي شخص من مجتمعك يعمل في مجال مراكز التدريب والمدارس ورعاية الأطفال داخل الحي؟
□ 1 □2 □ 3 □ 4 □ 5 □ 6 □ 7

30. هل يتوفرمتنوع من الشقق السكنية ذو جودة جيدة للجميع في الحي؟
□ 1 □2 □ 3 □ 4 □ 5 □ 6 □ 7

Appendix B

Base maps for the children's map activity





Appendix C

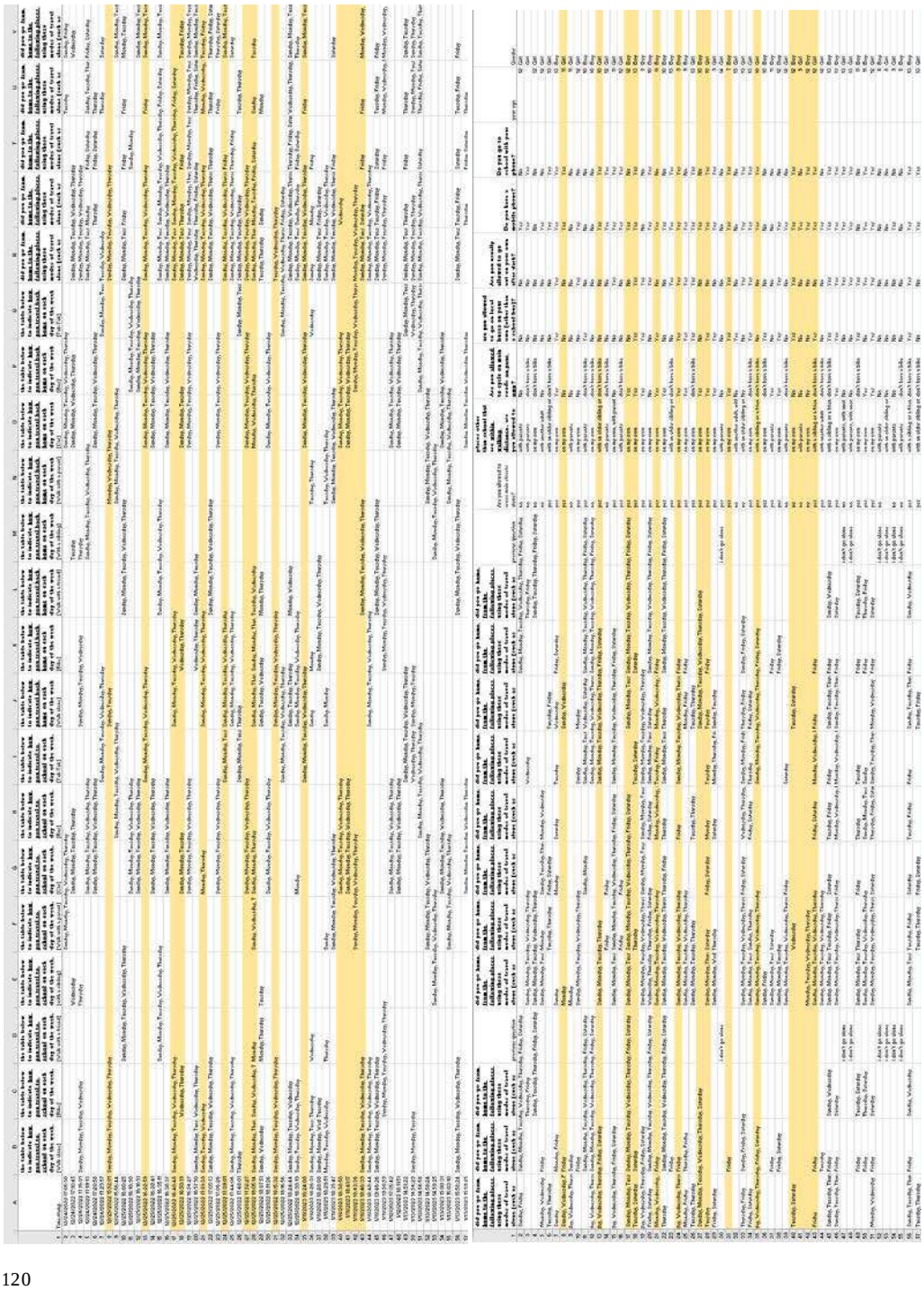
Neighborhood map observations

Appendix


2nd most used street people walk on middle walk way between cars cause 1 side private/other services
most used street
150
3rd most used street
sidewalk

Appendix D

Children's Questionnaire Results



Appendix

Parents' Questionnaire Results

تأثير الخصائص التصميمية للشوارع على التنقل المستقل للأطفال

ملخص

في البلدان النامية ، يواجه الأطفال مشاكل اجتماعية - مكانية مختلفة في أحيائهم تؤثر على صحتهم الجسدية والعقلية. بيئتنا البنائية هي الكسوة العملاقة التي تحتوي على العناصر الملموسة والوسائل غير الملموسة التي تؤثر على حرية الأطفال في التنقل داخل شوارع أحيائهم. يركز هذا البحث على الخصائص التصميمية المادية للشوارع التي تؤثر على التنقل المستقل للأطفال في منتصف الطفولة، من خلال تأثير عناصر الشوارع بشكل مباشر أو بالتركيبة السكانية أو المبادئ الاجتماعية والثقافية بعلاقة غير مباشرة, في مصر.

ينصب تركيز هذا البحث على المدن الجديدة في مصر, والتي تم بناؤها لجذب السكان بعيدًا عن المركز بتصميم حضري أكثر تطورًا. تم أخذ القاهرة الجديدة كدراسة حالة للتحقيق في التنقل المستقل للأطفال ، حيث إنها واحدة من أكثر المدن الجديدة فاعلية.تركز الدراسة على الأطفال الذين تتراوح أعمارهم بين 13-9 عامًا من الأسر ذات الدخل المتوسط إلى المنخفض. بنيت الدراسة على بيانات نوعية تم تقسيمها إلى مرحلتين: الأولى تم جمعها من الأطفال وأولياء أمورهم من خلال ورش عمل كالرسم ونشاط خريطة و استبيان شبه منظم للأطفال في الفصول الدراسية بمدارسهم, وذلك بهدف تحديد عملية التكرارللتنقل المستقل للأطفال داخل الأحياء من خلال المشي أو ركوب الدراجات أو وسائل النقل العام. تم وضع رؤية الوالدين لمجتمعهم في الاعتبار والذي يمكن أن يؤثر على وتيرة تنقل الأطفال المستقل, والتي تم جمعها أيضًا من خلال استبيان تم إرساله مع كل طفل. تتعلق المرحلة الثانية بملاحظات حول خصائص الشوارع الأكثر استخدامًا من قبل الأطفال للوصول إلى هدف البحث.

أخيرًا ، تم إجراء تحليل لتأثير الخصائص التصميمية لكل شارع على نطاق وترخيص CIM. عرضت هذه التأثيرات المتغيرة المدروسة على تكرار تنقل الأطفال في الشوارع الأكثر استخدامًا, أن الخصائص الملموسة وغير الملموسة للمدينة متشابكة معًا, ويجب على إجراءات التنمية للدراسات القادمة فى مناطق أخرى التحقيق اولا في السبب الرئيسي المؤثر وعلاقته بالبيئة المحيطة.

الكلمات الرئيسية: التنقل المستقل للأطفال - الخصائص التصميمية المادية للشوارع - ترخيص CIM - نطاق CIM - الوضع الاجتماعي والاقتصادي.

إقرار

هذه الرسالة مقدمة في جامعة عين شمس وجامعة شوتجارت للحصول على درجة العمران المتكامل والتصميم المستدام. إن العمل الذي تحويه هذه الرسالة قد تم إنجازه بمعرفة الباحث سنة ...

هذا ويقر الباحث أن العمل المقدم هو خلاصة بحثه الشخصي وأنه قد اتبع الإسلوب العلمي السليم في الإشارة إلى المواد المؤخوذه من المراجع العلمية كلٌ في مكانه في مختلف أجزاء الرسالة..

وهذا إقرار مني بذلك،،،

التوقيع:

الباحث:ميرنا لبيب

التاريخ:31/03/2023

تأثير الخصائص التصميمية للشوارع على التنقل المستقل للأطفال

دراسة حالة من القاهرة الجديدة, بمصر

مقدمة للحصول على درجة الماجستير في العمران المتكامل والتصميم المستدام

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أستاذ.....
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أ.د.....
أستاذ.....
جامعة .....

أ.د.....
أستاذ.....
جامعة .....

تاريخ المناقشة:.....

الدراسات العليا

ختم الإجازة

موافقة مجلس الكلية .../.../...

أجيزت الرسالة بتاريخ:.....

موافقة مجلس الجامعة .../.../...

جامعة عين شـــــمس

MM/DD/YYYY

جامعة شتوتجارت

تأثير الخصائص التصميمية للشوارع على التنقل المستقل للأطفال

دراسة حالة من القاهرة الجديدة, بمصر

رسالة مقدمة للحصول على درجة الماجستير في العمران المتكامل والتصميم المستدام

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