Improving the Safety and Walkability of School Zones in Cuenca, Ecuador

An Interactive Qualifying Project submitted to the faculty of
WORCESTER POLYTECHNIC INSTITUTE
in partial fulfillment of the requirements for the degree of Bachelor of Science

Date:
2 May 2023

By:
Alasdair Campbell, Finnian Hamblett, Lili Hellerman and Owen Lehane

Submitted to:
Guilherme Chalhoub Dourado
EMOV
Professor Robert Kinicki and Professor Gary Pollice
Worcester Polytechnic Institute

Improving the Safety and Walkability of School Zones in Cuenca, Ecuador

An Interactive Qualifying Project submitted to the faculty of

WORCESTER POLYTECHNIC INSTITUTE

in partial fulfillment of the requirements for the degree of Bachelor of Science

By

Alasdair Campbell (Computer Science)

Finnian Hamblett (Aerospace Engineering)

Lili Hellerman (Chemical Engineering)

Owen Lehane (Computer Science)

Date:

2 May 2023

Report Submitted to:

Guilherme Chalhoub Dourado

EMOV

Professor Robert Kinicki

Professor Gary Pollice

Worcester Polytechnic Institute

Abstract

The goal of this project was to assist the team's sponsor, EMOV, to increase the safety and walkability of school zones throughout Cuenca, Ecuador to improve the security of the area and encourage more children to walk to school. Using observations, surveys, and interviews the team developed pilot tests for Tactical Urbanism interventions at two schools: Luis Cordero and Abelardo Tamariz. One intervention design created a half-pedestrianized street adjacent to a school and the other enhanced the walk to school with distance markers and games. After analyzing the pilot test results, the team recommended to EMOV, the transportation department of Cuenca, that they permanently implement the half-pedestrianization and further explore the positive effects of the distance marker implementation.

Acknowledgements

The team would like to thank the following people and organizations who contributed to the success of this project.

- Guilherme Chalhoub Dourado, the team's sponsor, for all his support and weekly feedback with the project.
- Professor Robert Kinicki, one of the teams' advisors, for all his help critiquing and editing the team's project and paper.
- Professor Gary Pollice, one of the teams' advisors, for all his help critiquing and editing the team's project and paper.
- Maria Veronica Hormazabal and Juan Diego Cordero, members of EMOV, for their support and meetings with the team that helped with design ideas.
- Professor Courtney Kurlanska, the teams' ID2050 professor, for setting the team up for a successful project in ID2050.
- Adriana Quezada, a member of LlactaLAB, for her collaboration and support of the team's project in conjunction with the LlactaLAB.
- Gladys Segarra, the director of Luis Cordero, for helping the team set up and run a focus group and sending out surveys to both parents and teachers.
- Maria Augusta, the director of Abelardo Tamariz, for sending out surveys to all the stakeholders of Abelardo Tamariz.
- Other members of EMOV for their continued support throughout the project including waking up in the early hours of the morning to help the team run its pilot tests.

Executive Summary

Background and Motivation:

Road traffic accidents (RTAs) are a severe problem throughout the world. Every year, traffic accidents kill 1.35 million people globally and injure over 50 million. Road traffic accidents disproportionally affect the most vulnerable road users which include pedestrians, cyclists, and motorcyclists. RTAs are the leading cause of death for people aged 5-29, and over half of all accident deaths involve vulnerable road users (WHO, 2018).

In Latin America, on average, 19.2 people per 100,000 die in RTAs. In Ecuador, the rate is even higher at 21.3 people per 100,000 (WHO, 2018). While having one of the lower RTA fatality rates in Ecuador, still had still 808 accidents and 44 fatalities during 2022 in Cuenca (G. Dourado, personal communication, February 2023).

To address the number of accidents and fatalities in the city, the team's sponsor, EMOV, has committed to upholding Vision Zero. Vision Zero is an approach to road safety with the belief that traffic deaths are preventable, and the design of the road system must account for the imperfection of human behavior (Belin et al., 1997). EMOV is the department of transportation and mobility for the city of Cuenca and believes in sustainable and equitable mobility for all. Therefore, the aim of EMOV is to implement a culture where it is ethically unacceptable for RTAs to kill or injure people. The team supported EMOV's efforts to introduce this culture and enhance the security of vulnerable road users by targeting improvements for Cuenca's school areas.

The goal of this project was to assist EMOV with a design of an intervention that increases the safety and walkability of school areas to encourage students to walk to school.

The principles and techniques of Tactical Urbanism inspired the team when creating the intervention ideas that achieved the goal of the project. The creators of Tactical Urbanism define it as a tool for neighborhood building and transformation using low-cost and scalable interventions allowing for testing and introductions before creating a permanent solution (Lydon et al., 2015).

The city of Cuenca and EMOV already started the process of constructing tactical urbanism interventions to improve the security of the students at some schools. A half-pedestrianized street next to the Instituto de Parálisis Cerebral del Azuay (IPCA) heavily influenced the researchers' intervention designs. This implementation increased the amount of pedestrian space available to students around the school, meaning they are less likely to have potentially dangerous interactions with cars (see Figure ES.1).

Figure ES.1: Example of half pedestrianization at IPCA

In another part of the city, Huasipichanga, an urban consulting company, collaborated with EMOV to paint interactive games and activities on the sidewalks surrounding Unidad Educativa Particular Nuestra Familia and in the nearby park to guide the children to a safer space for pick up and drop off. This project involved parents, teachers and the school children themselves (see Figure ES.2).

Figure ES.2: Examples of interactive signs and drawings at Unidad Educativa Particular Nuestra Familia

Tactical Urbanism designers must work closely with the community for an implementation to have positive long-term effects. Therefore, while executing this project, the team considered three main stakeholder groups: school children, parents, and teachers.

Methods:

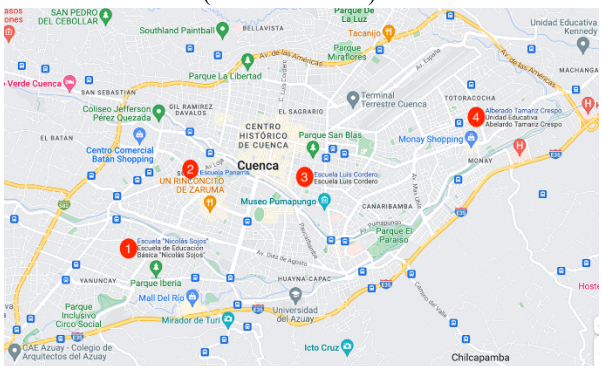
To achieve the goal of improving walkability and safety of Cuenca's school zones, the team established three objectives:

1. Determine the road safety issues and establish strategies to effectively solve the identified problems in the school areas.
2. Evaluate stakeholder perspectives of safety in school zones.
3. Determine effective solutions for implementing an intervention.

Objective 1:

The team used four methods to complete objective one. First, EMOV provided the team with data from the LlactaLAB, a group of professors at the University of Cuenca focusing on the research of sustainable cities. The LlactaLAB had data on four schools in different areas of Cuenca that the team reviewed and used to guide their initial observations at each of the four schools (see Figure ES.3 for each school's location).

Figure ES.3: Locations of the four schools in Cuenca (numbered in red)



The WPI students informally observed these four schools to gain a basic understanding of the environment and infrastructure at each school. The researchers took notes and photos of potential safety concerns and any other problems they observed.

Next, the team performed an in-depth analysis of the reports from LlactaLAB that EMOV provided. The reports contained charts and figures outlining the paths pedestrians took when crossing the road, a map of walkability of nearby streets, and initial conclusions of the safety problems in the school areas. The researchers examined these documents for common themes and compared the data to the group's findings from the informal observations at the four schools.

Following the initial observations and content analysis, the group interviewed a LlactaLAB professor who has been studying the walkability in school areas for the last six years. This interview informed the team of effective methods to gather data in the school areas and answered any questions the researchers had about the documents. After completing this method, the group narrowed its focus from four schools to two: Luis Cordero and Abelardo Tamariz. The team chose Abelardo Tamariz because it has the most students who walk to school and Luis Cordero because of its large and diverse student population.

After the team determined the two schools which would be their primary focuses, they returned to each school to formally observe the surrounding areas. Formal observation is when a team observes with an observation guide with a preplanned style of taking notes both qualitatively and quantitatively (Schensul et al., 1999). At both schools, children attend classes in two sessions, one in the morning and one in the afternoon. The team observed the arrival and dismissal of both groups. The first session went from 7:00am to 12:00pm and the second session went from 1:00pm to 6:00pm. The researchers used formal observations to deepen their understanding of the previously identified safety problems in each school area.

Objective 2:

For the second objective, the team utilized surveys and interviews to discover the three stakeholder perceptions of criminal and traffic dangers.

To obtain the perceptions of children, the group interviewed the same expert from the LlactaLAB, mentioned in objective 1, who completed an activity with students where the children who walk to school investigated the reasons why other children do not walk to school. The researchers conducted the interview in an unstructured manner to allow the LlactaLAB expert to lead the conversation with the help of general guiding questions that the team prepared in advance.

To get the perspectives of teachers, the team utilized an online survey. The questions used a Likert scale from one to four where an answer of one was “Totally Disagree” and an answer of four was “Totally Agree”. These questions focused on how comfortable teachers felt walking near their school and how much of a problem they thought crime and traffic was in the area. Additionally, an open response question at the end prompted the teachers to state one change they would like to see in the school zone that improved safety and walkability.

At Luis Cordero, the team conducted a focus group with seventeen teachers to obtain more comprehensive thoughts on road safety near the school. The focus group primarily used an affinity map to accomplish this goal where the teachers had to group their concerns into three categories: traffic, crime, and other. Following this, the team asked several questions designed to get the teachers to elaborate on their responses during the affinity map activity. To complement the teacher focus group, the team sent out a ten-question survey to the 60 teachers at Luis Cordero to get more representative data. The survey included a mix of questions using the Likert scale and open response questions.

In addition to surveying the teachers, the team also surveyed parents using the same Likert scale and open response scheme as the survey for teachers. The team analyzed 307 responses from Luis Cordero and 390 responses from Abelardo Tamariz for trends in parents’ beliefs about crime and traffic dangers and common changes they would like to see in the school area.

To evaluate the perspectives of these three stakeholder groups, the researchers acquired data from the Cuenca branch of ECU911, the national security department of Ecuador. The team obtained data for all crimes on the parish scale.

Objective 3:

For the final objective, the team conducted pilot tests to evaluate the effectiveness of their proposed interventions. The researchers created one tactical urbanism intervention for each school to accomplish this mission.

For Luis Cordero, the team designed distance markers accompanied by fun and

interactive games to improve the walkability and conviviality of the walk to school. Additionally, the WPI students relocated a crosswalk directly across from the entrance of the school to encourage students to use the crosswalk and increase the organization of the arrival and dismissal periods. The group observed how many children did or did not interact with each of the distance markers and games.

At Abelardo Tamariz the researchers implemented a temporary half pedestrianization of an adjacent street that contained games and drawings to entertain the students within the pedestrian space. The group repeated the same observation process as at Luis Cordero and recorded the number of interactions with the pedestrian area and the interactive games.

Results:

Abelardo Tamariz

At Abelardo Tamariz, the WPI students identified two major road safety issues: Students socialized in the street before and after school and children crossed the road dangerously close to cars on all the nearby streets.

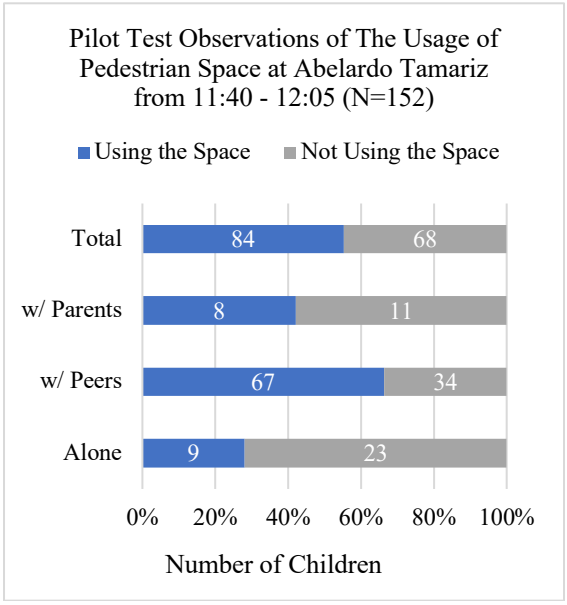
The major problems children identified with their walk to school is that they found the experience boring. Few children mentioned heavy traffic or inadequate sidewalks as barriers to them walking to school. Instead, most children stated their desire for more nature or interactive objects to improve their journey to school.

Teachers and parents both felt uncomfortable walking or allowing their children to walk in the area around Abelardo Tamariz. Both groups believed crime and traffic were major problems in the zone with 75% of teachers believing and 86% of parents saying they were concerned about crime near the school. In addition, 84% of teachers and 88% of parents were concerned by the amount of traffic around the school.

Finally, the team collected data from ECU911 that stated scandals, which are low level public disturbances, and possession of controlled substances were the largest instances of crimes in the parish of Totoracocha which includes Abelardo Tamariz. The Totoracocha parish is too large for the team to draw specific conclusions about crime near Abelardo Tamariz. However, the researchers were able to identify methods to increase the walkability and number of pedestrians in an area. Raising the walkability and number of pedestrians decreases the perceived risk of low-level crime, so the team used the ECU911 data to guide the design of an intervention to improve the walking environment and consequently the perception of unsafety (Kirk et al., 2023).

For the pilot test, the researchers observed more children interacted with the pedestrian area in the afternoon than the morning as they were not hurrying to get to class. Children with their peers were the most likely group to utilize the intervention, as shown in Figure ES.4.

Figure ES.4: Observations of pilot test interactions at Abelardo Tamariz



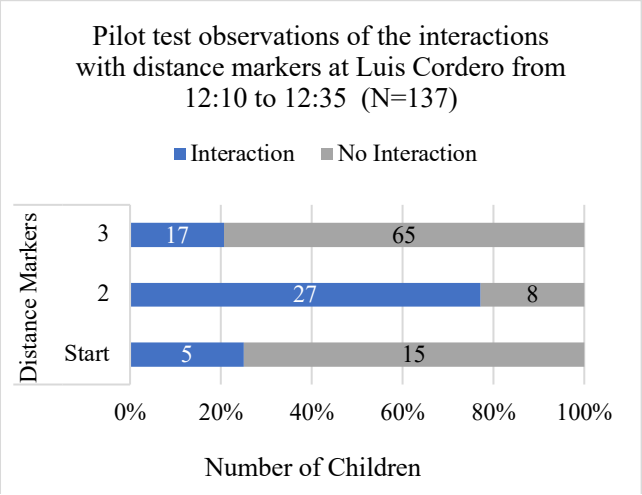
Luis Cordero

At Luis Cordero, the researchers also determined two primary safety concerns. Similar to the safety issues at Abelardo Tamariz, students and parents congregated in the roads during arrival and dismissal times and children often crossed the road in a dangerous manner without taking the necessary safety precautions.

The safety concerns children identified at Abelardo Tamariz were identical to the problems at Luis Cordero. Parents and teachers were also similarly concerned by crime and traffic levels in the school zone as crimes distressed 60% of teachers and 88% of parents, while traffic levels troubled 92% of teachers and 89% of parents. Furthermore, the ECU911 crime data for Luis Cordero displayed similar results to Abelardo Tamariz as scandals and possession of controlled substances were again the largest group of crimes in the parish where Luis Cordero resides.

The pilot tests were less successful at Luis Cordero than at Abelardo Tamariz as less students interacted with the distance markers. However, more students interacted with the pilot test on their way home than on their way to school and the most effective game design was 20 Questions at distance marker two as far more students interacted with that game than any others (see Figure ES.5).

Figure ES.5: Observations of pilot test interactions at Luis Cordero



Recommendations and Conclusions:

The team left EMOV with two major recommendations for each school. For Abelardo Tamariz, the team suggests EMOV permanently implements the half-pedestrianization accompanied by several interactive games and drawings to entertain the children. The researchers recommend hopscotch as one of the games included in the pedestrian space as it was particularly popular amongst students.

For Luis Cordero, the WPI students suggest EMOV permanently places a crosswalk immediately in front of the main entrance to the school. The team also suggests EMOV further explores the effectiveness of the distance markers as there are many variables impacting their success like placement and student knowledge of the intervention's existence.

The WPI students left EMOV with two interventions they hope EMOV will successfully implement. These tactical urbanism interventions should inspire future work around the city and improve the safety and walkability of children not just at Abelardo Tamariz and Luis Cordero, but throughout Cuenca.

Executive Summary References

Belin, Matts-Åke, et al. *The Vision Zero and Its Consequences*. Road Safety Sweden, 1997.

Dourado, G. (2023, February). *Traffic Accident Data* [Letter to Urban Development Team].

Kirk, B., Ha, M., & Lee, S. (2023). The relationship between children's fear of crime and pedestrian volume in school zones. *Journal of Asian Architecture and Building Engineering*, 1–15. https://doi.org/10.1080/13467581.2023.2172346

Lydon, Mike, et al. *Tactical Urbanism: Short-Term Action for Long-Term Change*. Washington, Dc, Island Press, 2015.

Schensul, S. L., Schensul, J. J., & LeCompte, M. D. (1999). Essential Ethnographic Methods: Observations, Interviews, and Questionnaires. In *Google Books*. Rowman Altamira. https://books.google.com.ec/books?hl=en&lr=&id=-QNKT0RJO8kC&oi=fnd&pg=PR8&dq=LeCompte+%26+Schensul&ots=DUoyPQ84AH&sig=_WUY_V-osYLb0G2tdc-Xa4Ed4a4#v=onepage&q=LeCompte%20%26%20Schensul&f=false

WHO. *Global Status Report on Road Safety 2018*. Geneva, Switzerland, World Health Organization, 2018

Authorship

Author Name	Sections Written
Alasdair Campbell	Abstract, ExecSum, 1.0, 2.0, 2.4, 2.4.1, 2.4.2, 3.1, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 4.0, 4.2, 4.2.3, 5.0, 5.1, 5.2, 5.3, Appendix A, Appendix D, Appendix H
Finnian Hamblett	2.1, 2.5, 3.1, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 4.1, 4.1.1, 4.2.4, 5.0, 5.1, 5.2, 5.3 Appendix A, Appendix C, Appendix D, Appendix E, Appendix F, Appendix G, Appendix H
Lili Hellerman	ExecSum, 2.2, 2.3, 2.3.1, 2.5, 3.0, 3.2, 3.2.1, 3.2.3, 3.2.4, 4.1.2, 4.2.2, 4.3, 4.3.1, 4.3.2, 5.0, 5.1, 5.2, 5.3, Appendix B, Appendix I
Owen Lehane	ExecSum, 2.3, 2.3.1, 2.3.2, 3.2.2, 3.3, 3.3.1, 4.1.2, 4.2.3, 4.2.4, 5.4, Appendix F, Appendix G, Appendix I

All team members contributed equally to editing and reviewing every section of the paper.

Table of Contents

Table of Figures

Table of Tables

1 Introduction

Every year, traffic accidents kill 1.35 million and injure over 50 million people. Road traffic accidents have been increasing globally for decades to the point that accidents are the eighth leading cause of death worldwide and the leading cause of death for people aged 5-29. Additionally, more than half of accident deaths globally involve vulnerable road users including pedestrians, cyclists, and motorcyclists (WHO, 2018).

In 2022, the Municipal Public Company for Mobility Transport, and Transportation of Cuenca or the Empresa Pública Municipal de Movilidad, Tránsito y Transporte (EMOV), recorded 808 total road traffic accidents with 798 serious injuries and 44 fatalities (G. Dourado, personal communication, February 2023). After declining during the COVID-19 pandemic, by 2022 road traffic accidents had caught and surpassed previous pre-pandemic levels (G. Dourado, personal communication, February 2023).

To address the increasing number of deaths and accidents, the World Health Organization (WHO) created an initiative to halve the number of road traffic deaths by 2030. All 191 United Nations (UN) member states have pledged to work towards this goal. A key component of this strategy is to reduce the number of cars on the road through encouraging people to walk more (WHO, 2018; United Nations, 2020). The most effective way to encourage people to walk is to lower the crime rate and improve the experience of walking on the road network (Foster et al., 2012). However, prohibitive costs and extended building and planning time of traditional civil engineering mean many lower income countries and cities do not have the resources for large scale construction to increase walkability. To counter this, communities have begun to use short-term, low-cost, and scalable initiatives to restructure and redesign neighborhoods. This innovative process is known as *Tactical Urbanism* (Lydon et al., 2015).

The sponsor for this project, EMOV, has asked the team to use the principles of Tactical Urbanism to recommend improvements to the safety and walkability of the road network surrounding a school. Therefore, the goal of the project was to assist EMOV with the design of an intervention that improves safety and walkability to encourage students to walk to school. The group first researched several topics: urbanization, walkability, safety in school areas, the design and implementation process of a tactical urbanism intervention and the current state of traffic, accidents, and road design in Cuenca. The team used a variety of methods to achieve the project goal such as interviews with experts and stakeholders, visual documentation and observation of the roadways surrounding two Cuenca schools and designing and running pilot tests for a potential intervention.

The team conducted pilot tests at both schools to determine how children would interact with interventions specifically designed for each school. At one school, Abelardo Tamariz, a half-pedestrianization pilot test resulted in 50% of children using and interacting with the pedestrian space. At a different school, Luis Cordero, the distance markers and games pilot test received similar levels of interaction with 50% of students interacting with at least one of the distance markers during both arrival and dismissal times. The team's results indicate that both solutions are strong candidates for a more permanent intervention. If EMOV does follow these recommendations and implement both interventions, the designs would permanently increase children's safety and walkability in their respective school zones and inspire further work in school zones throughout the city.

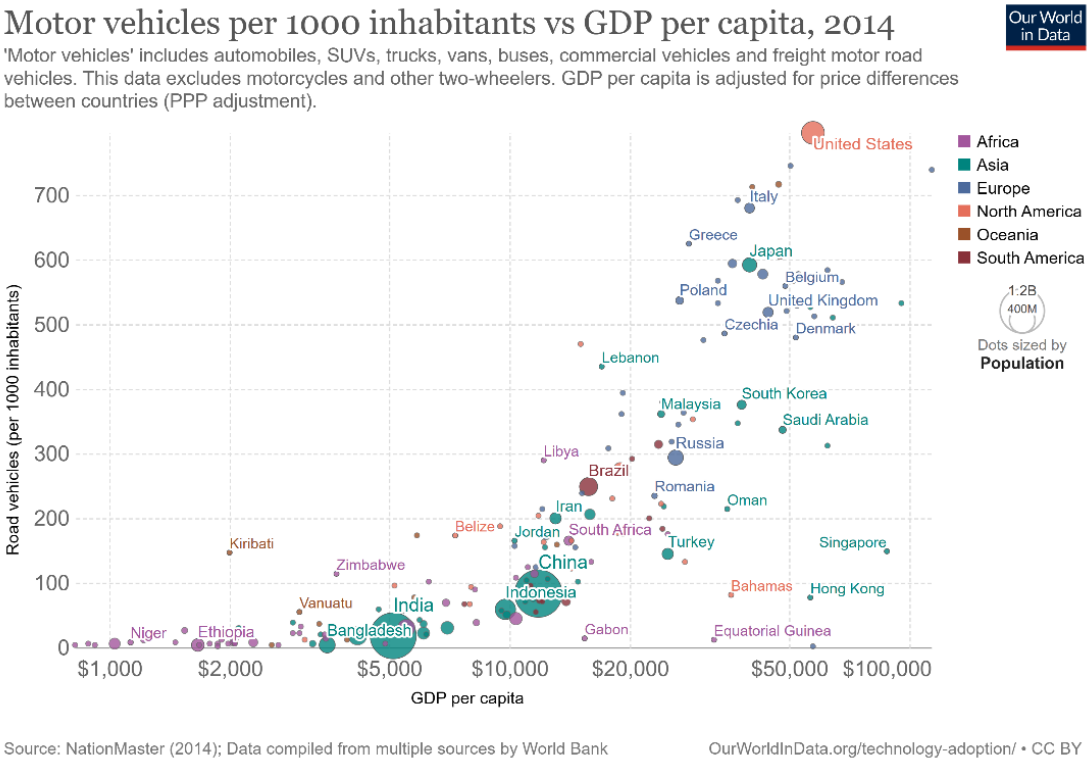
2 Background

Designing a tactical urbanism intervention requires extensive social and technical knowledge. This chapter presents the relevant knowledge needed to understand the successful design of a tactical urbanism intervention with the goal of increasing both the safety and walkability of the roads and sidewalks around schools in Cuenca. First, this chapter outlines the urbanization process to understand the origin of the modern-day mobility problems and insecurity in school zones. The following sections detail the criteria and various barriers to walkability that exist within school zones and the perceptions and reality of safety in school areas. The next section introduces Tactical Urbanism as a strategy for solving the previously highlighted problems within school areas. Finally, the chapter presents the work completed by EMOV and its partners prior to the team's arrival in Cuenca to provide background on the influences behind the goal and objectives of this report.

2.1 Urbanization and Its Consequences

Communities originally designed cities as small, rural farming villages with modest populations. These small settlements required little infrastructure or maintenance of the existing infrastructure (Borgia, 2022). However, since the 1950's, people have been relocating to urban centers at an accelerating rate. In 1950, 750 million people lived in urban areas and by 2018 that number had increased to 4.2 billion (Pesantez, 2018). During this period, the economy of the world has also grown from a total GDP (Gross Domestic Product) of just under 9.25 trillion in 1950 to over 113 trillion in 2019 (Roser, 2019). This extra capacity for spending has led to people purchasing more desirable objects that show their power and status, such as cars (Vasconcellos, 1997). Figure 2.1 illustrates the relationship between GDP and number of vehicles on the road.

Figure 2.1: Motor vehicles per 1000 inhabitants vs GDP per capita in 2014 (Roser, 2019)



The increase in the number of automobiles has changed the purpose of roads in cities. Previously, people perceived streets as a universal space where children played, and the public walked (Tranter & Doyle, 1996). However, as the use of cars became more prominent, cities created structures like playgrounds and sidewalks to relocate pedestrian transport and entertainment away from the roads. The lack of accessibility on city streets creates an unsafe environment for children as they are no longer free to explore independently due to the constant threat of traffic (Tranter & Doyle, 1996).

Additional vehicles using the roads have increased the infrastructural requirements of a city to the point where many cities have an insufficient ability to maintain their streets (Borgia, 2022; Weinberg, 2016). For example, the U.S. Department of Transportation estimates that 15% of U.S. roads are in unacceptable condition, costing the country many lives and billions of

dollars (Mischke, 2013). Old city roads cannot manage the volume and intensity of traffic characteristic of a modern society, with one study estimating that a poorly developed road system caused as many as 13.6% of all accidents (Joshi, 2014).

Urbanization created an environment that is not child friendly as public spaces have become deserted and dangerous to accommodate cars rather than being vibrant and populated (Tranter & Doyle, 1996). Therefore, children's play and travel became "car dependent" and "formally supervised." In other words, the dangers of walking to school led parents to either drive their children to school or accompany them when walking (Tranter & Doyle, 1996).

2.2 Walkability

Experts define walkability as the extent to which walking is easily available as a safe, connected, accessible and pleasant mode of transport (Kamel, 2013). Pedestrian satisfaction and activity levels increase when walking environments are less crowded, have good air quality, plenty of trees, and good pavement conditions (Jung et al., 2017). In broader terms, increasing the walkability of an urban environment makes urban life more pleasant and enjoyable for all inhabitants. Transportation specialists even suggest there is a reduction in automobile travel by people who live in more pedestrian-oriented areas (Joh et al., 2011). In other words, increasing walkability decreases car traffic and a reduction in car traffic reduces the probability of accidents, which increases the safety of pedestrians.

To address the issue of walkability many cities use Llewelyn Davies' five Cs criteria of walkability: convenient, conspicuous, convivial, comfortable, and consistent.

Convenience is the idea that open spaces are more appealing to pedestrians when urban planners connect them to the city (Kamel, 2013). Convenience increases the walkability of streets as people are more likely to use safe pedestrian paths like parks and promenades if they

form a clear path to important city features (Kamel, 2013). Convenient spaces are also often conspicuous and open locations.

Conspicuous spaces are open, safe, clearly defined, and secure areas. Zones that are obviously pedestrian oriented reduce barriers to walking like crime and road traffic (Kamel, 2013). Conspicuous spaces lead to an increase in the conviviality of an area.

The next C is convivial. Convivial areas are urban spaces that make walking fun and enjoyable for pedestrians. These spaces remove barriers to interaction between people, nature, and architecture. This increases walkability as people are more likely to enjoy walking more often if it is an enjoyable experience rather than a journey through a dull, urban space (Kamel, 2013). Convivial locations encourage comfortable spaces as people are more likely to enjoy using an area if they feel comfortable within it.

One of the most important C's for encouraging walkability is comfortability. Increasing the comfortability of an area requires including important features like easy access to bathrooms, shelters, and rest areas where pedestrians can relax. Additionally, it is important to remove pollutants like traffic noise and exhaust fumes from pedestrian spaces (Kamel, 2013). For all the Cs of walkability it is important they are consistent in design with one another.

The last C of walkability is ensuring the solution consistent and sustainable which is the idea that urban spaces should be environmentally friendly and sustainable and maximize social connectivity with the community surrounding them. All pedestrian areas should follow similar design patterns to increase familiarity, enjoyment, and satisfaction with an open urban area (Kamel, 2013).

2.3 Safety in School Zones

The most popular modes of transportation children use to get to school are private cars, school buses, public transportation, walking, bicycles, or sometimes a combination of these (Pabayo & Gauvin, 2008). Pedestrians and bicyclists are vulnerable road users and experience the dangers of an urban environment more than automobile users (Yannis et al., 2020). Traffic, crime, and other environmental factors pose the greatest threat to students who walk or bike to school (Yannis et al., 2020). Incidents of crime and traffic accidents decrease perceptions of security. Environmental factors such as the time of day and weather influence the perceived risk of crime and traffic related dangers (AlKheder et al., 2022) In addition, as the perception of risk grows, less parents allow their children to walk or bike to school. This results in an increase in private or public transport to school which adds to the traffic congestion and incidence of accidents around schools. Similarly, a lower volume of pedestrians on the roads increases the perceived risk of crime and insecurity (Kirk et al., 2023). For a project to be successful and have long lasting effects on the community, all relevant stakeholders must contribute (van Berkel et al., 2016). Therefore, encouraging walking in urban areas involves addressing the perceptions of the three stakeholder groups (children, parents, and teachers) in addition to tackling the traffic congestion and crime rates around schools (Kamel, 2013).

2.3.1 Traffic Accidents

Every day in the United States, Road Traffic Accidents (RTAs) kill three children aged 14 years or younger, while injuring almost 500 more children daily, often while they are going to and from school (Yu, 2015). RTAs are collisions between any user and another user or obstacle in the road. RTAs are particularly frequent around school areas as there is an influx of traffic

when parents pick up or drop off their children (Wang et al., 2019). Particularly dangerous road features often located within school zones are narrow roads and intersections.

Narrow roads significantly decrease the conspicuousness and comfortability of pedestrian spaces as they force pedestrians to travel close to cars with little separation. In addition, narrow roads often have limited sidewalks which decreases both pedestrian and vehicle safety (Kweon et al., 2021). Problems arise because existing urban infrastructure, such as buildings, limits the ability of many cities to expand the width of their roads and add sidewalks. Cities have often solved this problem by converting an inadequate two-way road system to a one-way system (Chiu et al., 2007). One-way road systems increase the drivable width of the street which reduces the number of accidents involving pedestrians. However, a consequence of one-way systems is they encourage higher vehicle speeds and create confusion at intersections which increases the number of RTAs (Zegeer et al., 2013). Intersections form a significant part of traffic infrastructure and are also a leading cause of accidents accounting for 40-50% of all road crashes worldwide (Lefèvre et al., 2012).

Pedestrians face further challenges when walking to school as the governments of many developing countries focus more on infrastructure improvements for vehicles than pedestrians (Mukherjee & Mitra, 2020). A lack of pedestrian infrastructure leads to more random movement of pedestrians in and around traffic, often leading to higher pedestrian fatalities (Short, 2010; Kiroung Sherpa et al., 2021). Additionally, 80% of pedestrian-vehicle accidents occur when a pedestrian crosses the road, with the majority occurring where there was either a non-signalized crosswalk or no crosswalk at all (Gitelman et al., 2012).

2.3.2 Crime

Research indicates that 42.8% of crime occurs in residential areas, which is where most schools reside. Therefore, children who walk to school are particularly vulnerable to criminal activity (Byun & Ha, 2017). People do not have to be directly involved with an act of crime to perceive an area as dangerous. One study that surveyed students about safety in their own school zones reported the actual number of reported criminal incidents that researchers could classify as a "direct criminal experience" were minimal. In fact, children reported numerous encounters that did not classify as a criminal experience, but rather classified as feeling unsafe or threatened (Kirk et al., 2023).

Although children have their own perceptions of crime, parents are the deciding factor of how children get to school (Mehdizadeh et al. 2017). Therefore, parents' perceptions of crime around schools are a major determinant on whether children walk to school. When parents perceive there to be high levels of crime around a school, more parents will drive their children to school or send them on the bus. This increases the number of cars on the road and further endangers the children who do walk (Mehdizadeh et al. 2017). Therefore, improving parental knowledge of safety and educating parents further on crime levels around schools encourages more students to walk to school (Mehdizadeh et al. 2017; Kirk et al., 2023).

2.4 Tactical Urbanism and the Vision Zero Approach

To increase the safety and walkability of school zones many cities and government entities have begun to implement a Vision Zero approach. The goal of the Vision Zero approach is to implement a culture where it is ethically unacceptable for the road transport system to kill or seriously injure people (Belin et al., 1997). There are three key responsibilities for a road designer when implementing a Vision Zero approach (see Figure 2.2):

1. The designers of the road system bear ultimate responsibility for all uses of the system therefore, they are responsible for the safety of the entire system.
2. All road users are responsible for obeying the traffic and road usage rules made by road system designers.
3. If road users fail to obey these rules or injuries and deaths occur within the road transport system, the system designers must take the necessary steps to counteract the causes of accidents (Belin et al., 1997).

Figure 2.2: The three responsibilities of the road system (Vision Zero Network, 2013)

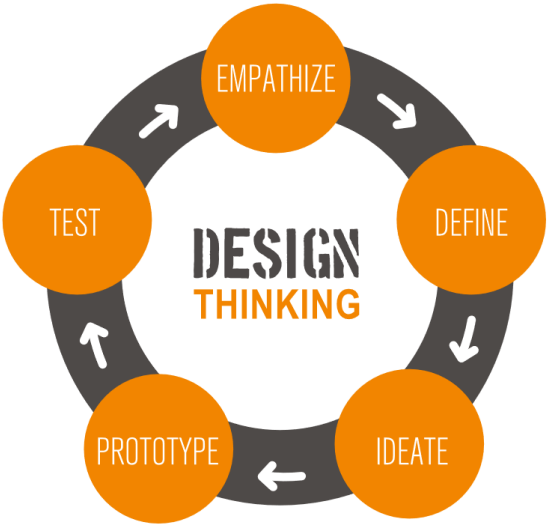
To accomplish the goals set out in a Vision Zero policy, road planners often use Tactical Urbanism (Lydon et al., 2015). The creators of Tactical Urbanism define the term as a tool for neighborhood building and transformation using low-cost and scalable interventions allowing for testing and easy adjustments before creating a permanent solution (Lydon et al., 2015; Hoppe, 2020).

2.4.1 Design Process of Tactical Urbanism

Communities use tactical urbanism strategies because they allow citizens to immediately reclaim and redesign public space without the lengthy wait of bureaucracy and the high cost of civil engineering. Meanwhile, developers and government entities utilize tactical urbanism initiatives to garner support from the public without the slow and expensive process of traditional civil engineering. There are three main applications of Tactical Urbanism: a tool for citizens to bypass traditional construction efforts; a tool for governments and developers to explore public perceptions of a project; and a "phase 0" implementation to determine the feasibility of a project (Lydon et al., 2015).

To successfully implement a tactical urbanism intervention a Tactical Urbanist should follow the steps outlined in Figure 2.3 (Lydon et al., 2015).

Figure 2.3: Implementing Tactical Urbanism design steps (Lydon et al., 2015)



A Tactical Urbanist needs to understand the people they are working for by empathizing with the local community to clearly understand and define their needs. Designing and consulting with the community results in the participation of more diverse groups, creating better and more inclusive solutions (Yassin, 2019). It is equally important that the designers clearly determine the

root causes of the problems with the road section, so the problem does not reappear in a different form. The prototyping and testing of a tactical urbanism initiative is also extremely important as these steps give the planners an opportunity to have the public interact with the design and provide valuable feedback. Additionally, implementing a "phase 0" intervention allows for the group to collect feedback with minimal cost and public disruption before finding a permanent solution (Yassin, 2019; Lydon et al., 2015).

2.4.2 Implementing Tactical Urbanism with Vision Zero

One example of a successful tactical urbanism intervention achieving the goals of a Vision Zero approach is in Brazil where the Institute for Transportation & Development Policy (ITDP) in conjunction with the City of Sao Paulo, redesigned a busy, dangerous, and vehicle-dominated intersection. The project focused on expanding pedestrian space by extending sidewalks and shortening the crosswalks to transform the intersection into a safe and attractive area for pedestrians. The main goals of the project were to reduce speeds, increase compliance with the city's reduced speed zones, to improve the safety and comfort of pedestrians, and to design sustainable and affordable interventions (Hoppe, 2020).

Figure 2.4 shows the new narrowed and more choreographed path for cars to follow through the intersection. This has the benefit of increasing the safety of pedestrians through a clear separation from cars. The team quickly constructed and deconstructed the pop-up intervention, with the trial intervention only running for one day. Following this intervention, the designers used the ideas from the pop-up to craft a permanent intervention that incorporates the positive features from the original design (Institute for Transportation and Development Policy, 2020).

Figure 2.4: Tactical urbanism implementation on the intersection of the Salete and Dr Cesar streets in Sao Paulo (Hoppe, 2020).

The ITDP surveyed users of the intersection during the pop-up intervention. The users noted a 75% increase in safe pedestrian crossings, a 40% increase (from 12% to 19%) in cars yielding for pedestrians to cross and 86% of people surveyed approving of the street design with 82% wanting the design to be permanent. After the permanent implementation, the new design reduced the average speed of cars by 32% and ITDP reported 89% of pedestrians and 72.5% of drivers felt safer at the intersection. This aligns with the goals of a "Vision Zero" approach because it aimed to reduce accident deaths through increasing pedestrian safety and decreasing vehicle speeds (Institute for Transportation and Development Policy, 2020; Hoppe, 2020).

The team also analyzed examples of tactical urbanism interventions in Cuenca. One school, the Instsituto de Parálisis Cerebral del Azuay (IPCA), in Cuenca half pedestrianized a street to create extra pedestrian space and a safer walking path for children to and from school. Figure 2.5 pictures this intervention.

Figure 2.5: An implementation of half-pedestrianization at the IPCA

A different school, the Unidad Educativa Particular Nuestra Familia, painted interactive activities and games on the sidewalk to encourage students to walk safely. The patterns and games lead students away from the streets and dangerous areas and towards safer places to wait for their parents or bus like the local park. Figure 2.6 is an example of some of the drawings.

Figure 2.6: An example of patterns increasing the walkability of a street nearby the Unidad Educativa Particular Nuestra Familia

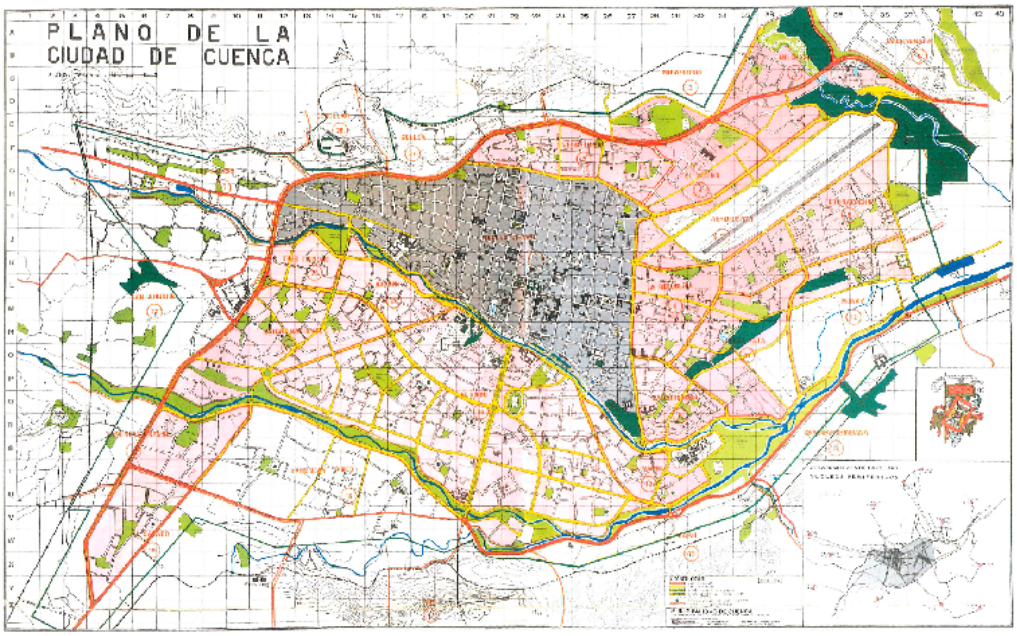
A Vision Zero approach has two primary goals: to reduce traffic speeds to a level that does not pose an undue risk to vulnerable road users, and to increase and improve the available pedestrian space (Johansson, 2009). To achieve this, planners must design the road system to be safe and available for everyone while making the safety of the most vulnerable road users a priority (Belin et al., 1997).

2.5 School Safety in Cuenca

Cuenca is the third largest city in Ecuador with an urban population of 400,000 and 700,000 in the wider metropolitan area (CIA, 2023). Cuenca is situated in a valley in the heart of the

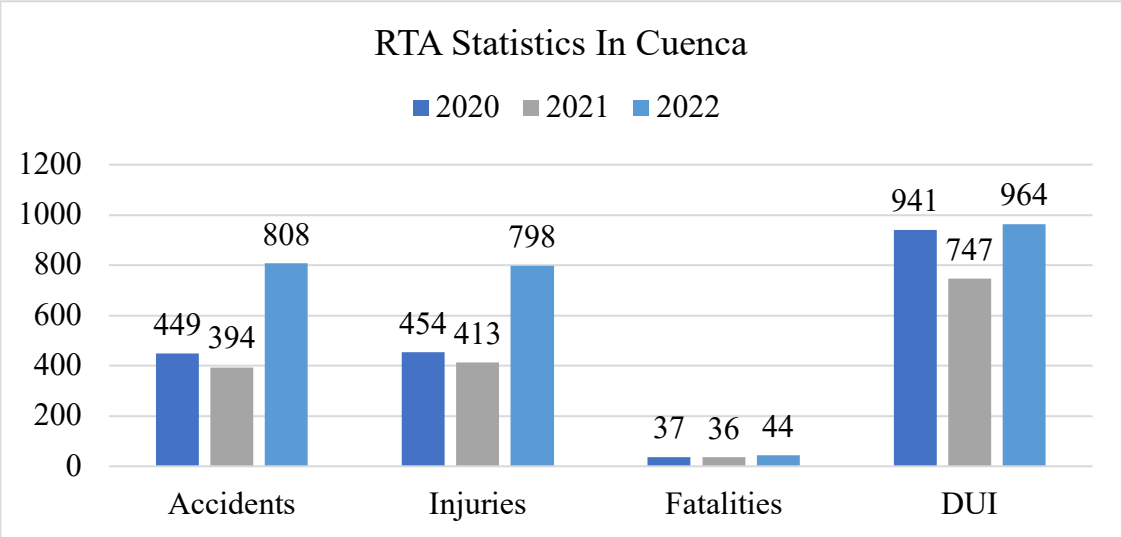
Andean Mountain range in the Azuay province in the south-central Sierra region of Ecuador (Centre, n.d.). UNESCO has recognized the historical center of Cuenca as a cultural heritage site, requiring the city to preserve the historic layout and infrastructure (Centre, n.d.). This has caused outdated infrastructure in the center of the city and has led to significant mobility issues causing high traffic levels throughout the city (Borgia, 2022). Cuenca's high population density and rapid growth since the 1950s has only intensified the strain on the city's old infrastructure (United Nations, 2022). Figure 2.7 is a map of Cuenca that highlights the historic center.

Figure 2.7: Map of the city of Cuenca with the historic center highlighted in grey (Albornoz, 2008).



In 2022, Cuenca had 808 traffic accidents with 798 injuries and 44 fatalities (G. Dourado, personal communication, February 2023). Accident numbers in the city have doubled since 2020, primarily affecting the most vulnerable road users, such as children (G. Dourado, personal communication, February 2023). Figure 2.8 shows the police stoppages in Cuenca between 2020 and 2022.

Figure 2.8: Police stoppages in Cuenca between 2020 and 2022 (G. Dourado, personal communication, February 2023).



On average, 21.34% of students walk to school in Cuenca while the remainder of the students choose to use public transportation, school buses or private vehicles (Ortega et al., 2019). Since 2016, EMOV has explored solutions to increase safety and walkability in school zones with a focus on tactical urbanism techniques. Beginning in 2021, EMOV has worked closely with the University of Cuenca LlactaLAB to gather data on road traffic and pedestrian safety around four local schools: Escuela Panama, Escuela Luis Cordero, Escuela Nicolas Sojos and Escuela Abelardo Tamariz.

The LlactaLAB at the University of Cuenca is the team responsible for collecting preliminary data for EMOV at schools throughout the city of Cuenca. LlactaLAB is a sustainable cities research group whose primary focus is developing cities that tackle the urban issues of the 21st century (LlactaLAB, n.d.). These main challenges of the 21st century are: urban growth, climate change, resource and energy depletion, urban inequality, information management, and the general health and well-being of the urban population (LlactaLAB, n.d.). The LlactaLAB launched the study on schools because it contributes to work on multiple of their goals as

increasing the walkability and safety of school spaces reduces the impact schools have on climate change, manages urban growth, and increases the health of the population.

EMOV, the students project sponsor, is dedicated to promoting the safety of pedestrians. EMOV is a government organization that functions as the department of transportation and mobility for the city of Cuenca. EMOV's mission as an organization is to promote Cuenca as a safe, inclusive, environmentally friendly, and sustainable city by advocating for a culture of integral mobility (EMOV, n.d.). To further their goal of eliminating all pedestrian deaths EMOV is committed to upholding the values of the worldwide Vision Zero policy. As part of their Vision Zero policy, EMOV tasked the team with developing a tactical urbanism intervention for implementation in school zones around Cuenca that aims to reduce mobility related deaths.

3 Methodology

The goal of the project was to assist EMOV with a design of an intervention that increases the safety and walkability of school areas to encourage students to walk to school. The team identified three objectives to accomplish this goal:

Objective 1: Determine the road safety issues and establish strategies to effectively solve the identified problems in the school areas.

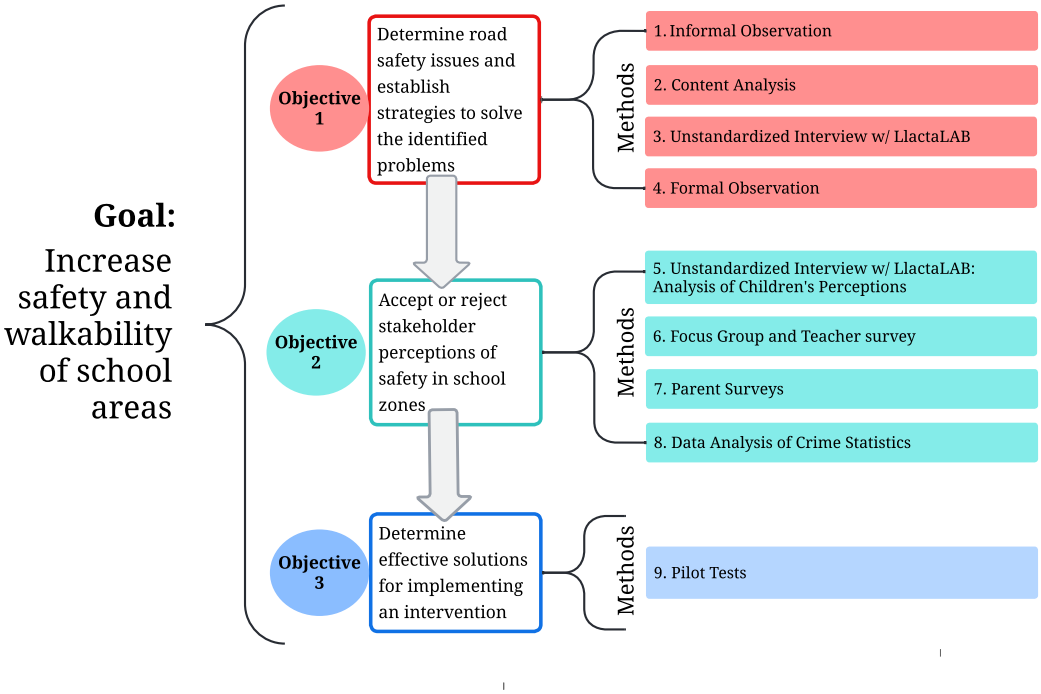
Objective 2: Evaluate stakeholder perspectives of safety in school zones.

Objective 3: Determine effective solutions for implementing an intervention.

The students spent seven weeks completing preparatory work in Worcester, MA from January 10th, 2023, to March 3rd, 2023, then spent another eight weeks in Cuenca, Ecuador from March 7th, 2023, to May 3rd, 2023, working alongside EMOV and the University of Cuenca's LlactaLAB to accomplish the above goal.

This project focuses on evaluating and addressing the issues that reduce walkability to increase the safety of children in school zones. The second part of the project involves designing an intervention using Tactical Urbanist principles to make the areas around schools safer for all stakeholders. The final part of the project tests the designs and provides recommendations for a permanent solution. Figure 3.1 provides a visual representation of the methods used for each objective.

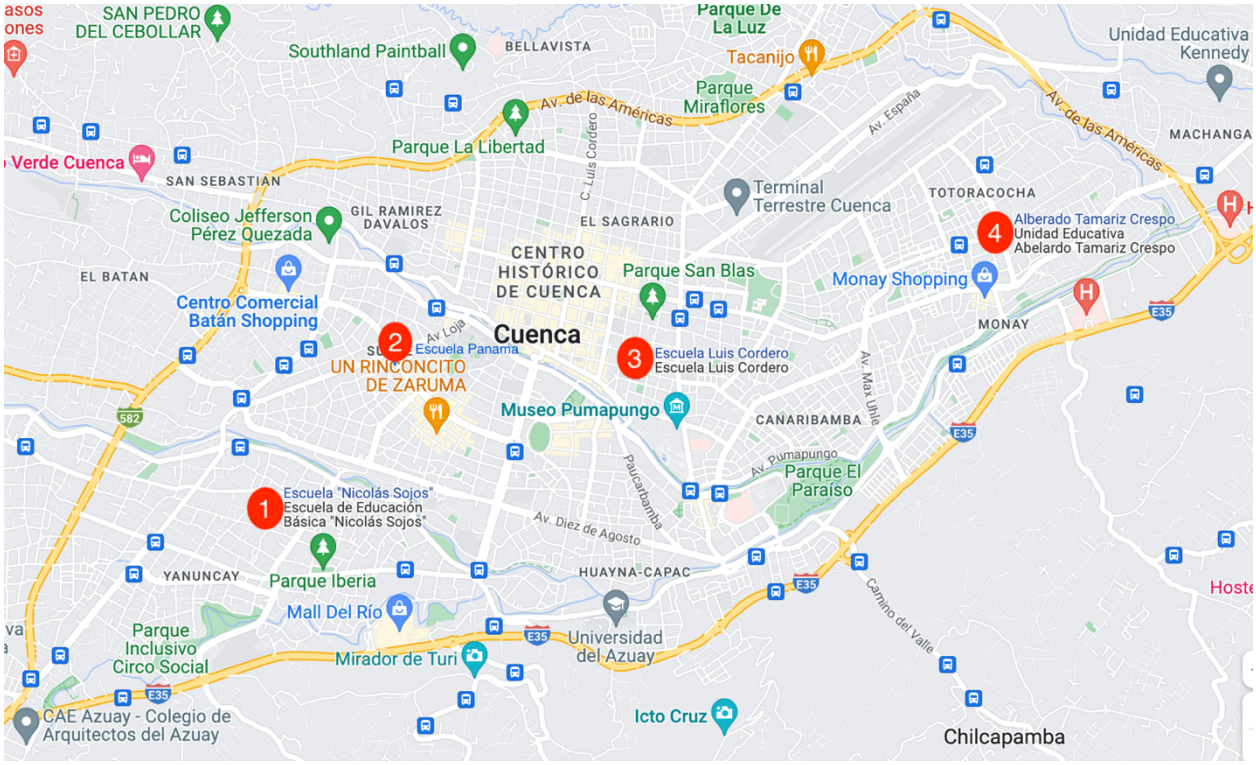
Figure 3.1: Visual of the Methodologies the team used to achieve the objectives



3.1 Objective 1: Determine the road safety issues and establish strategies to effectively solve the identified problems in school areas

EMOV initially provided the team with safety and accident data the LlactaLAB collected on four school zones within the city of Cuenca: Escuela Panama, Escuela Luis Cordero, Escuela Nicolás Sojos and Escuela Abelardo Tamariz. Figure 3.2 shows the locations of the four schools. In this objective, the team observed the schools to identify road safety problems within all four school zones. The group also collaborated with experts at EMOV and the LlactaLAB to discuss the safety issues that all parties identified in each of the four school zones. The next step was to narrow the project focus to the two schools in which an intervention would have the most impact. The WPI students completed data analysis and interviews in this objective and learned there was a gap in the research regarding parent and student perceptions of children's safety when they were walking to school. The team used this information to guide the next objective.

Figure 3.2: Locations of the four schools from left to right: Escuela “Nicolás Sojos” (1), Escuela Panama (2), Escuela Luis Cordero (3), Abelardo Tamariz Crespo (4)



3.1.1 Informal Observation

The first method the group executed upon arriving in Cuenca was to visit each of the four schools to gather initial observations on the walkability problems. An informal observation differs from a formal, systematic observation as there are no pre-determined variables or attributes that the team is measuring. Instead, the team focused on gathering initial impressions and took note of anything they believed to be important (LeCompte and Schensul, 2000). The team completed this method first since the sponsor suggested our fresh perspective and unique background would be an advantage during this observation activity.

During the informal observation, the team spent roughly an hour at each school walking around the area and taking photos and notes of the environment and infrastructure in the area

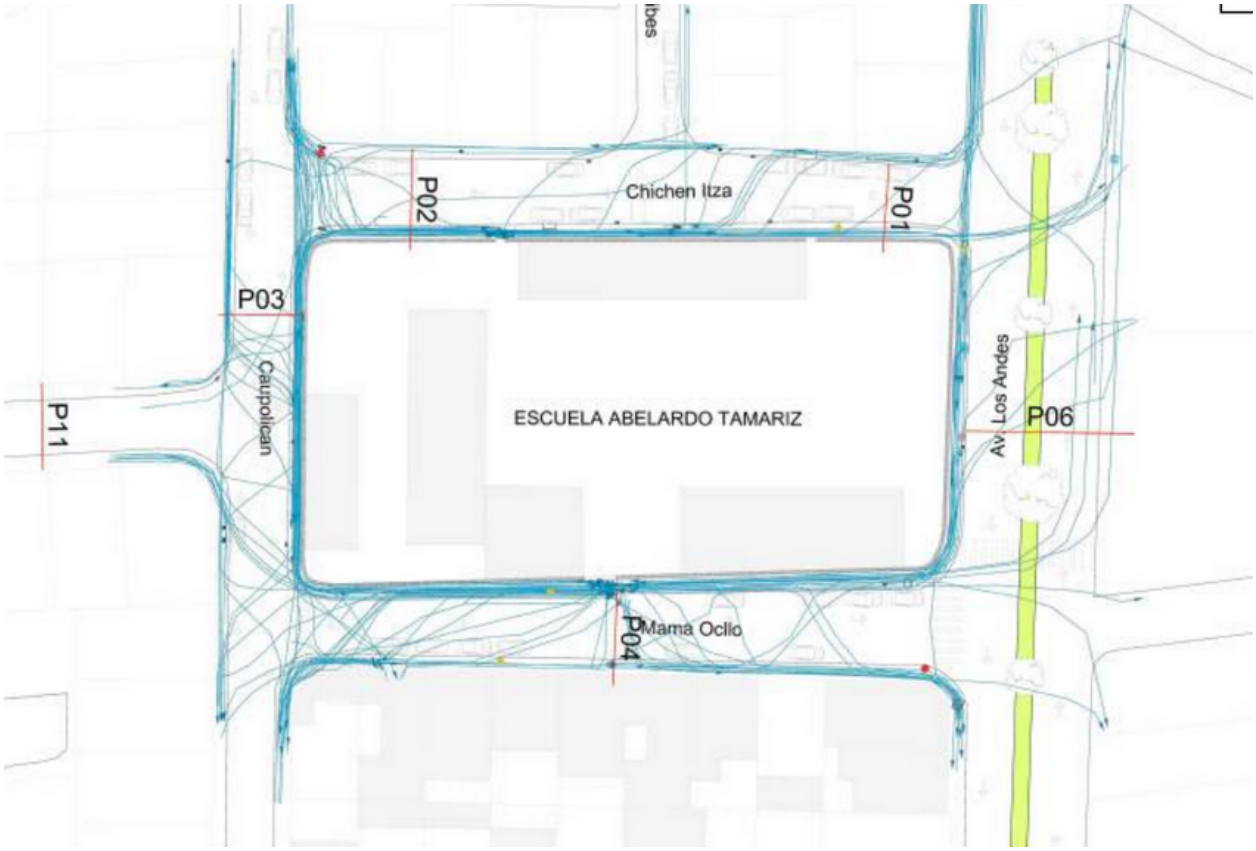
around the schools. Topics of particular interest to the team were: presence of sidewalks and sidewalk width, traffic volume vehicle speeds, crosswalks and the presence of crossing guards, and adequate signs and signals. After completing the informal observations, the team compared their findings with the detailed information from the LlactaLAB department. Figures 3.3 and 3.4 are examples of the data collected by the LlactaLAB.

3.1.2 Content Analysis

Content analysis is the process of analyzing data to learn about a subject matter (Neumann, 2023). The data EMOV provided to the team included four documents containing charts and figures on various statistics such as: locations where students and other pedestrians cross the road; a map of walkability of the surrounding blocks; and initial conclusions about the safety problems in the area. Figure 3.3 and Figure 3.4 provide examples of the maps contained in these documents.

Figure 3.3: The walkability around Luis Cordero

Figure 3.4: Students' paths to school marked through blue lines at Escuela Abelardo Tamariz



The team analyzed this data for common themes like street vendors blocking sidewalk access, lack of pedestrian stoplights, and poor crosswalk placement. In these documents, the LlactaLAB had already categorized the data and provided their thoughts on common themes and problems with each school. The team analyzed the field notes and supplementary photographs taken during the informal observation to ensure our observations matched the LlactaLAB's findings. The group used this knowledge to prepare for a meeting with the LlactaLAB researchers.

3.1.3 Unstructured Interview with the University of Cuenca LlactaLAB

After completing the informal observations and analyzing the content provided to the team by the LlactaLAB, the group met with Professor Adriana Quezada of the LlactaLAB to discuss their research and the best strategy for collaborating with them. The group held the meeting in a similar fashion to an unstructured interview, as the team did not know all the information necessary to create a list of specific questions for the meeting (Mancebo, 2006). An unstructured interview is a form of interview where the interviewee leads the flow of conversation. To complete an unstructured interview a team will prepare a certain number of topics they would like to cover, however the interview focuses on topics that the respondent believes are most important for the interviewer to know (Mancebo, 2006). Researchers commonly use meetings with experts early on in studies to gather information when they do not know much about the subject (Beebe, 2014). The group prepared several broad questions and topics to ask during the meeting, however, as this was an unstandardized meeting, the topics of conversation often varied from the prepared ideas. Before the interview, the team read to the group the informed consent statement located in Appendix A. The team, Professor Quezada, and EMOV held the meeting as a conversation among the three. The interview was in Spanish, but one team member took notes in English throughout the meeting. The goals of this meeting were to learn the methods the university team used to collect their data, answer any questions the team had about the data and discover how the team's work could best complement LlactaLAB's research.

After completing the meeting with Professor Quezada, the team categorized the interview notes into five groups:

- Perceptions of students, teachers, and parents of safety around the schools
- The current environment and walkability of the school area
- The methods the LlactaLAB used to collect data
- Any suggestions the LlactaLAB had for the team moving forward
- The transportation methods students used to travel to school

Subsequently, with the help of LlactaLAB and EMOV, the team narrowed their focus to Abelardo Tamariz and Luis Cordero. The WPI students decided to reduce their focus to these two schools to increase the effectiveness of the final intervention designs since they could spend more time working on each school. The team chose Abelardo Tamariz because it has a large population of pedestrian commuters and Luis Cordero because it has a large and geographically diverse student community. In addition, the contrast between the two schools demographics increases the probability that the designs are more widely applicable to schools in Cuecna. The team's next step was to return to each of these schools during the arrival and dismissal periods given in Table 3.1 and complete a formal observation of the safety of students traveling to and from school.

Table 3.1: Opening and closing times of both the chosen schools

	Abelardo Tamariz	Luis Cordero
Morning drop-off	7:00am	7:00am
Morning pickup	12:00pm	12:00pm
Afternoon drop-off	1:00pm	1:00pm
Afternoon pickup	7:00pm	7:00pm

3.1.4 Formal Observation

For the formal observations of the Abelardo Tamariz and Luis Cordero schools the team used systematic observation of the school areas and photographic analysis of the key points of interest. The researchers split into pairs and each pair observed and took notes on the same school for the time periods of arrival and dismissal. The WPI students also took photos of relevant road features and safety hazards. The researchers initially performed the formal observations for the morning session from 6:30am to 7:10am and 11:50am to 12:30pm on March 24th, 2023, for both schools. Later, the team returned on April 5th, 2023, to observe the evening dismissal from 6:50pm to 7:30pm to evaluate if there were differences in dismissal during the nighttime. Arrival and dismissal are the times where the schools experience both the highest vehicular and pedestrian traffic and therefore are the most dangerous times for students to walk to school.

Photographic analysis provides an image of the non-moving characteristics that exist in an area at a given time of day. At each school, the group searched for hazards such as parked cars, street vendors, crosswalks, street signs and other obstacles that posed a threat to student safety and walkability and photographed them. Photographic analysis was valuable because combining the new photos with the photos the LlactaLAB researchers took during their data collection allowed for the comparison of organizational phenomena, such as hazards, across time (Ray & Smith, 2011).

The first step in analysis of the observations was comparing the contemporary photos to older photos taken from previous research and identifying any similarities and differences. The

next step involved identifying common themes in the photographs like signalized intersections, crosswalks, street vendors, parked cars, and other road obstructions.

To examine the moving components of school areas such as pedestrians and cars the team used systematic observation. Systematic observation is a well-ordered method for close examination of a phenomenon or aspect of behavior that involves a list of prepared actions, attributes, or other variables for the researcher to look for when in the field (APA Dictionary of Psychology, 2014). After meeting with the LlactaLAB researchers and analyzing the data they collected, the team identified areas of observation where the LlactaLAB had done less research. Therefore, the WPI students used formal observation as a method to further expand upon the team's understanding of the problems within the two school zones of focus. In addition, observations allowed the group to gather their own perceptions of safety before interviewing stakeholders. Appendix B contains the full observation guide the team used.

The team analyzed the systematic observations similarly to the analysis of the photographic observation above. The group compared their notes and observations to identify any similarities between the school zones. Following this, the students used the data gathered during the formal observation to inform potential tactical urbanism interventions.

3.2 Objective 2: Evaluate stakeholder perspectives of safety in school zones

Encouraging student pedestrians required the team to first investigate the reasons children are not walking to school. During the first interview with LlactaLAB professor Adriana Quezada, the team learned that children do not feel safe walking to school because they believe there is a large amount of crime and dangerous people around the school. The WPI students conducted another unstructured interview with Professor Quezada to gather more details on the

children's perceptions. Professor Quezada offered to speak with the team to explain more about the workbooks and their initial findings from the activity.

Next, the team investigated the perspectives of the schoolteachers of Luis Cordero and Abelardo Tamariz. During the initial interview with Professor Adriana Quezada the team learned of the possible influence teachers may have on children's perceptions. At Luis Cordero, the project team combined a focus group with a survey to discover the perceptions of over 60 teachers and administrators. Meanwhile, at Abelardo Tamariz the WPI students conducted an online survey. The surveys for Luis Cordero and Abelardo Tamariz contained ten identical questions to determine the teachers' perceptions and their perceived influence over their children's perspectives (See Appendix F). The focus group centered around the completion of an affinity map which the team used to guide and inspire the subsequent conversation with the teachers. In addition to a lack of data on teacher perspectives, the LlactaLAB also expressed one of the gaps in their data was on the parent perceptions of safety around the four schools shown in Figure 3.2. The team surveyed parents at both schools to collect their perceptions on the safety around the school and how likely they are to allow their child to walk to school. The group worked in conjunction with the school administrators to email the survey to the parents. The researchers then compiled the results and analysis from the parents' survey and compared them to the teachers' and children's perspectives.

To guide the team on which stakeholder concerns they could most effectively address, the WPI students reached out to the Cuenca branch of ECU911, the national security department of Ecuador, to obtain data on crime in the two parishes the schools are within: San Blas Parish for Luis Cordero and Totoracocha Parish for Abelardo Tamariz. The team requested information on

all crime activity from 2021 to 2023 because the LlactaLAB began collecting data on the four schools, including Abelardo Tamariz and Luis Cordero, in 2021. The team used this data to guide the development of interventions.

3.2.1 Unstructured Interview with the University of Cuenca LlactaLAB: Analysis of Children's Perspectives

The LlactaLAB research group performed a workbook activity with school children that focused on collecting children's perceptions on walking to school. As part of the activity, a puppet asked the children to be detectives and help investigate why other children do not walk to school. The teachers assigned activities in the workbook for homework, but not all teachers made it a mandatory assignment. The activities included answering why they do not walk to school, marking hazards on the sidewalks with chalk and responding to questions like "what characteristics do you want your walking buddy to have?" The LlactaLAB had not finished analyzing the children's responses, so they invited the team to meet with them to discuss their results. There were no questions prepared for this interview because the goal was for an open dialogue with the interviewee leading the discussion. However, the researchers prepared several themes for the interview to cover. These topics are in Appendix C. The team was searching for information on the children's perceptions of safety and specifics of what makes the area around their school safe or unsafe.

The team also sought to understand the process of working with the children and asked Professor Adriana Quezada for help with getting into contact with the administrators at Luis Cordero and Abelardo Tamariz. The full and translated interview transcript is in Appendix D.

3.2.2 Focus Group and Survey of Schoolteachers

The team conducted a focus group to determine the schoolteachers' perceptions of crime and safety around the school areas. A focus group is an interview with multiple respondents and can be either highly structured or informal (Beebe, 2014). Using a focus group is a method that provides unique benefits such as interactions between respondents which allow for new insights, especially ones generated between communication between participants (Beebe, 2014). The team centralized the focus group around an activity called affinity mapping. Affinity mapping requires participants to categorize their answer based on which category is most closely associated with their statement.

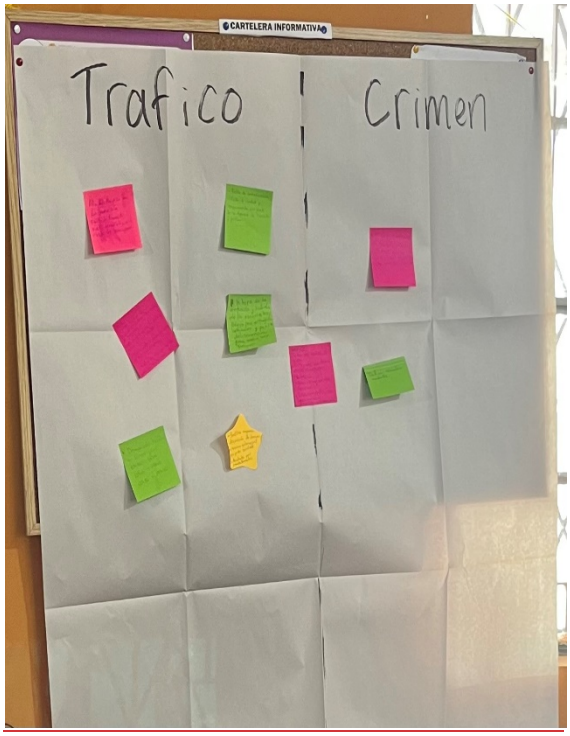
The team interacted with a group of seventeen teachers for the focus group at Luis Cordero (see Figure 3.5). Before the focus group began the researchers gave each participant a name tag to fill out and briefly introduced themselves. The WPI students provided each attendee with lunch. Following this, the researchers briefly introduced themselves and the project before starting the affinity map activity.

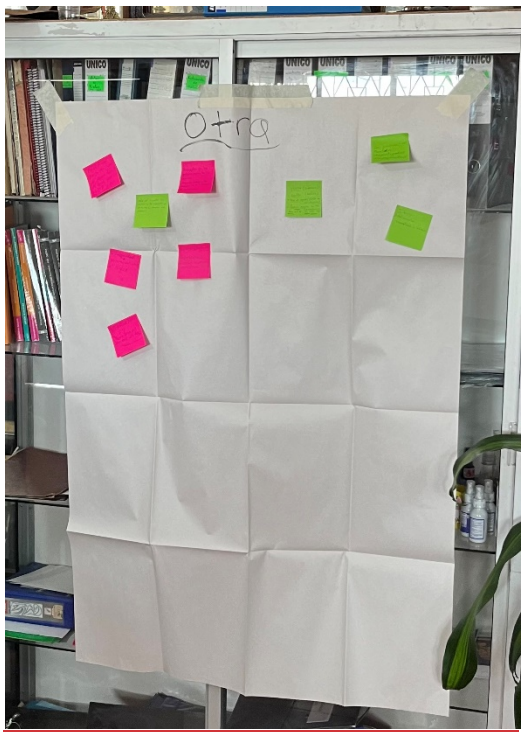
The team used the affinity map to get the focus group started and used it as a baseline for the rest of the interview going forward. The team asked the teachers "What do you think are the biggest safety issues in the Luis Cordero school zone?" With this question, the teachers used as many sticky notes as they wanted to write their answers and organize them into categories selected by the team: "Crime" "Traffic" and "Other" (see Figure 3.6 for an example of the affinity map). Following the affinity mapping activity, the team used a previously prepared series of questions to guide the focus group of teachers in a deeper discussion about the problems they identified in the affinity map. Appendix E has the full list of focus group questions. The WPI students asked questions after the affinity mapping activity that allowed participants to expand upon their answers. After concluding the focus group, the team used the notes taken during the

process to analyze all the perspectives on display and categorize the data by perspective on both safety and walkability.

Figure 3.5: The focus group at Luis Cordero

Figure 3.6: The Affinity Map halfway through the focus group





In addition to the focus group, the team also sent an online survey using Qualtrics to the teachers of Abelardo Tamariz and Luis Cordero. The surveys sent to both sets of teachers were identical, apart from minor changes to make locations in the survey specific to each school. The team used a four-point Likert scale for the survey with an answer of one being equivalent to "Completely Disagree" and an answer of four being the same as "Completely Agree" (Mcleod, 2019). The survey did not contain a neutral answer response to encourage greater thought and stronger opinions from survey participants.

The survey aimed to accomplish the dual purpose of establishing the predominant opinions of teachers regarding safety and to determine how much they influence the perceptions of their students. To accomplish this the survey asked participants how much they agreed or disagreed with statements like:

"I feel comfortable walking in and around the school during the day."

"I think I have an influence over the perceptions of security of my students."

Appendix F contains the full survey sent out to teachers using a group email alias.

3.2.3 Parent Surveys

Parents are valuable stakeholders in the safety and walkability of schools and the surrounding areas because they guide and determine the actions of their children. The team distributed the survey to parents online via Qualtrics with the assistance of school administrators. The survey was very similar to the survey sent out to teachers to allow for comparisons between the two groups' responses. The team designed both surveys so parents and teachers would have to rate how much of a problem both crime and traffic is in the school zone. The parent survey used the same four-point Likert scale as before.

The survey asked parents questions about how they perceive their child's safety in school zones and why they feel comfortable or uncomfortable letting their child walk to school. In addition, the survey included a section for parents to suggest any changes they would like to make to the school zone to make it safer for children. The survey collected parent perceptions to allow for a more diverse set of stakeholders to provide feedback (de Munck et al., 1998). The key statements the parents responded to were:

"I am concerned about traffic when my child walks to school."

"My child is aware of the dangers of traffic when they walk to school."

"My child wants to walk to school."

The full list of survey questions is in Appendix G.

3.2.4 Data Analysis of Crime Statistics

To obtain the crime rates around Abelardo Tamariz and Luis Cordero the team reached out to ECU911 who provided crime data on the parishes containing the schools. In Ecuador, parishes are large subdivisions of a city. Therefore, there are other variables or outliers outside of the immediate school zone that might affect the number of crimes in an area. The data package ECU911 sent to the team is in Appendix H.

The team then compared this data with the analysis of stakeholder perceptions to determine whether the perceptions of stakeholders were valid. Furthermore, the group established the primary reasons people felt unsafe in a school zone and compared this information with the data they received from ECU911 to guide the design of an implementation that would address these concerns.

3.3 Objective 3: Determine effective solutions for implementing an intervention.

For the final step in the iterative design process, the team used their observations, stakeholder perceptions of safety in school zones, and ECU911 data to design interventions to evaluate using pilot tests. The team spoke with EMOV and the LlactaLAB before conducting pilot tests to get advice and assistance. Members of EMOV assisted the team in setting up pilot tests by providing necessary support and resources. Due to the significant differences between Abelardo Tamariz and Luis Cordero, the team designed a different intervention for each school.

3.3.1 Pilot Tests

The goal of the pilot tests was to implement a temporary design for each school that would help the team determine the feasibility and practicality of permanently implementing these designs. Previous interventions, covered in section 2.4.2, from multiple schools around Cuenca inspired the researchers' designs. For Luis Cordero, the group designed fun games and distance markers for the children to interact with on their route to school from a public bus stop. The team arrived at Luis Cordero at 5:45am to set up for the pilot test. The goal of the distance markers was to make the walk to school more conspicuous, convivial, and comfortable for children. Appendix I includes the complete distance marker and game designs. In addition to distance markers and games, the team implemented a new crosswalk leading directly from the front door of the school to the opposite sidewalk. Figure 3.7 and Figure 3.8 are examples of the pilot test's implementations.

The team observed the crosswalk and distance markers on April 21st, 2023, from 6:40am until 7:10am then returned from 12:10pm to 12:35pm to observe the dismissal of students. The table contained in Appendix J outlines how the team recorded data on how many children interacted with the distance markers and games, and how many did not.

Figure 3.7: Implementation of a crosswalk directly outside the entrance for Luis Cordero

Figure 3.8: Example of distance markers and games on walls and street signs near Luis Cordero

For the next pilot test, the team went to Abelardo Tamariz at 5:00am to pedestrianize Calle Mama-Ocllo using cones. The group also used chalk to draw colorful figures and games for children to interact with inside the pedestrianized zone. Figure 3.9 shows the area demarcated by cones for pedestrians and Figure 3.10 shows an example of a game the team drew.

Figure 3.9: The full pedestrianized area on Mama-Ocllo

Figure 3.10: Hopscotch and other games located within the pedestrian area at Abelardo Tamariz

The student researchers observed the pedestrian area during the students' arrival from 6:40am to 7:00am then returned later to observe dismissal from 11:40am to 12:05pm on Monday April 24th, 2023. The team recorded the number of students who interacted with the intervention in addition to the number of students who ignored it. Furthermore, the WPI students recorded which children interacted with the games and other chalk drawings and which students only utilized the extra pedestrian space. Appendix K has the full observation guide.

4 Results and Analysis

This chapter presents the findings from:

- Observing the street areas around schools during arrival and dismissal times.
- Evaluating the perceptions of stakeholder groups including children, parents, and teachers regarding safety around the schools.
- Studying the relevant crimes and traffic accidents within the area and parish of the school.
- Analyzing the effectiveness of an intervention pilot test design for the school.

Luis Cordero and Abelardo Tamariz share few similarities, so this chapter discusses the results of each school separately. The WPI students used the findings from the observations, surveys of stakeholders, and background knowledge of Tactical Urbanism to design a suitable intervention for each school. The group conducted pilot tests to observe how children and pedestrians interact with the design. The results from the pilot tests informed the team's final recommendations for EMOV.

4.1 Formal Observations

The team observed the area directly surrounding the entrances of each school at three times: 6:30am-7:10am, 11:50am-12:30am and 6:30pm-7:10pm. These formal observations had the purpose of learning about the safety and traffic problems at arrival and dismissal times. A major finding from the group's observations was that because the children behaved similarly at both schools, the safety concerns and traffic problems were the same. The two schools differ in many ways including size, location, student demographics and traffic patterns.

4.1.1 Observations at Abelardo Tamariz

When observing Abelardo Tamariz, the WPI students determined there were two main safety concerns. As seen in Table 4.1, the two concerns are children socializing and playing in the road before and after school and children crossing the road in unsafe ways.

Table 4.1: Safety problems and their causes around Abelardo Tamariz

Problem	**Causes**
Children socializing in the road before and after school	- Street vendors crowding the entrance - No convenient safe space to gather before or after school
Children crossing the road in front of cars on Mama-Ocllo, Chichén Itzá and Avenida Los Andes	- Lack of use of crosswalks - Cars constantly and unexpectedly leave the road to park then reenter the road - No designated space to drop off/pick up children - Desire not to arrive late

The team determined that the popularity of street vendors right outside Abelardo Tamariz and the lack of a nearby park or open area for students to gather in after school were the primary causes of school children choosing to socialize in the road. This problem was most prevalent during the 11:50am – 12:30pm observation period as this was when the most children and street vendors were present. The number of street vendors varied from one to three depending on the time of day. Figure 4.1 shows this clustering of children in the street Mama-Ocllo and around the vendors.

Figure 4.1: Children congregating in the streets and purchasing from the street vendor outside of Abelardo Tamariz between 11:50am and 12:30pm

The other problem the team identified was that many children crossed Mama-Ocllo, Chichén Itzá, and Avenida Los Andes without caution and close to vehicles. The infrequent use of crosswalks exacerbated the problem, especially when students were running late and were in a hurry. The researchers observed cars stopping abruptly to avoid hitting students.

Another cause of children crossing the road dangerously close to vehicles was cars stopping unpredictably on either side of the roads to drop off or pick up children. Unpredictable drivers make it difficult for pedestrians to safely cross a road. During arrival and dismissal times there was a high volume of pedestrians socializing and waiting in the roads near Abelardo Tamariz because there was no place for them to safely congregate near the school. The result was a dangerous conflict between pedestrians and vehicles on the roads.

4.1.2 Observations at Luis Cordero

The group also concluded that there were two main safety issues at Luis Cordero. The safety concerns at Luis Cordero were similar to those at Abelardo Tamariz (see Table 4.2). However, unlike Abelardo Tamariz, the main entrance to Luis Cordero is located on a very busy and narrow street. Therefore, the same behavior in the streets posed a greater threat to the school

children of Luis Cordero than Abelardo Tamariz. In addition, because Luis Cordero is in the historic center of the city, many parents drop their children off at school on their way to work in the morning. Therefore, the team observed the heaviest traffic between 6:30am-7:10am when the first group arrived for school.

Table 4.2: Safety problems and their causes around Luis Cordero

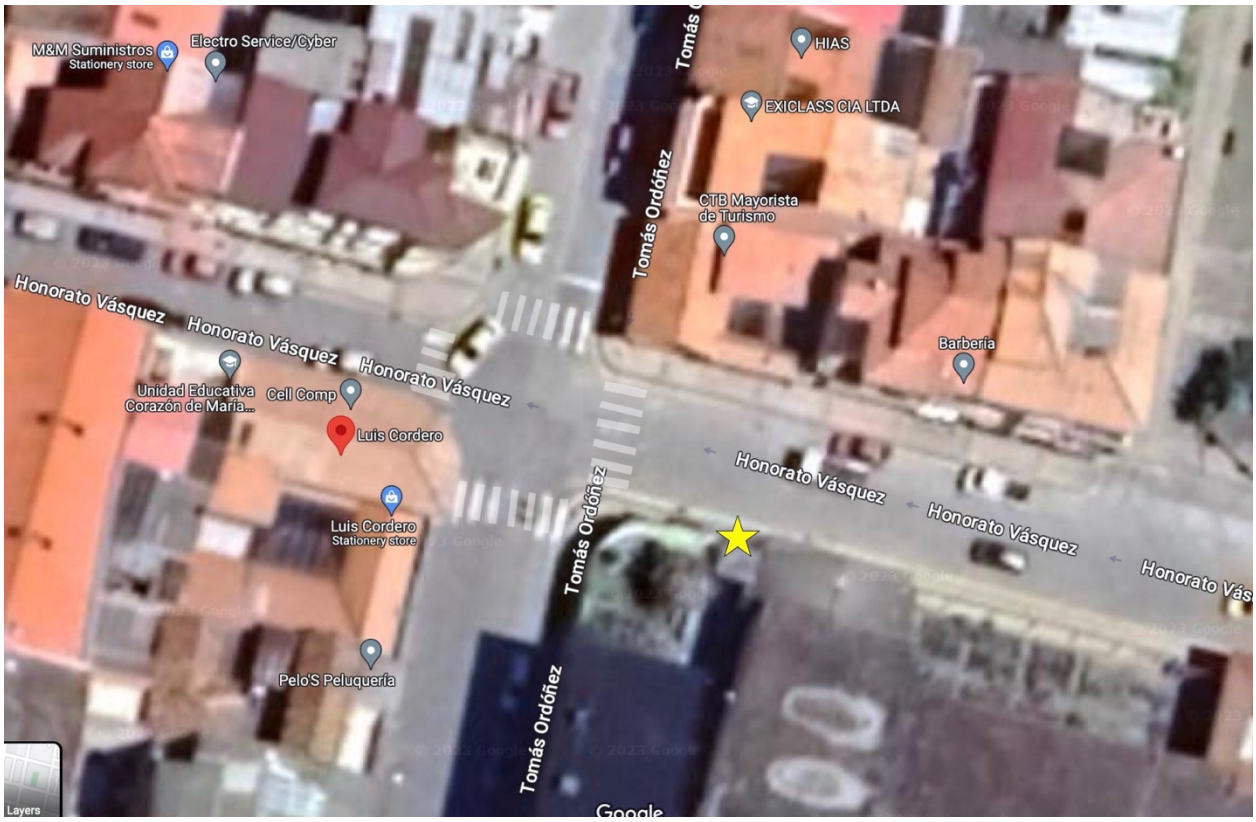
Problem	Causes
Dangerous Pedestrian Crossings on Honorato Vasquez and Tomás Ordóñez	- Badly designed crosswalks because they are not located at entrance and not easily visible - Poor choice of drop off/pick up locations - Ineffective crossing guards: pedestrians do not listen to crossing guards - Unsignalized intersection - High traffic volume - Street vendors blocking crosswalk
Parents and children standing in the road	- Street vendors occupying road - Parents and children socializing on surrounding sidewalks

Luis Cordero has two separate entrances. Located in the southwest corner of the school is the entryway for younger students. The team noticed parents crowded this gate and nearby sidewalk during arrival and dismissal times (see Figure 4.2). The crowd frequently spilled into the street, which increased danger to pedestrians. The younger students' entrance opens out onto Tomás Ordóñez where there is a designated school bus lane. Many privately owned cars and motorbikes ignored the no parking signs and temporarily parked in the bus lane during arrival and dismissal times. This limited the space for school buses to safely transport the children to school. Furthermore, the school buses parked so the door to exit the bus opened onto the road rather than the sidewalk, directly exposing children to the oncoming traffic.

Figure 4.2: Entrance for younger grades at Luis Cordero

The main entrance is located on Honorato Vásquez near the busy four-way intersection with Calle Tomás Ordóñez pictured in Figure 4.3. The crosswalk is twelve meters from the entrance to the school. The team observed both children and parents crossing Honorato Vásquez either diagonally or taking a path parallel to the crosswalk but directly in front of the entrance. Figure 4.3 shows the locations of the crosswalks in the immediate vicinity of Luis Cordero's main entrance.

Figure 4.3: Aerial view of crosswalks near the main entrance, marked by a yellow star, of Luis Cordero.



For both the main and secondary entrance there was no designated car drop-off or pick-up area and the few parking spots available at the nearby park filled up before the school doors opened. This caused parents to stop in the road, block a crosswalk or obstruct an accessibility ramp to drop off or pick up their children. These actions increased pedestrian danger and limited pedestrian mobility.

4.2 Stakeholder Perceptions of Safety

After completing the observations, the team discovered many safety flaws that increased the danger of children and potentially prevented them from walking to school. Through collaboration with the LlactaLAB, the group learned that children were concerned with the crime levels surrounding the schools, with their perceptions potentially influenced by their parents and teachers. This section focuses on gathering and analyzing the perceptions of children, parents,

and teachers to identify the barriers of walkability at both Luis Cordero and Abelardo Tamariz. An interview with a LlactaLAB professor informed the team of children's perceptions since the LlactaLAB had collected data on children's perceptions in 2023. Analysis of the results from the teacher focus group at Luis Cordero, which included the affinity mapping activity, and supplemental teacher surveys for both schools provided the team with insight on teacher perceptions. Lastly, the team sent out a parent survey with a similar structure and question content to the teachers' survey to get a glimpse into the parents' perceptions of safety. The team compared the various stakeholder perceptions to real crime data of the parishes containing each school and accident data specific to area around school to corroborate perceptions of traffic and crime.

4.2.1 Children's Perceptions

To analyze the children's perceptions the team interviewed LlactaLAB researcher Adriana Quezada, who collaborates closely with EMOV. The LlactaLAB Professors completed a workbook activity with the children at four schools in Cuenca, including Luis Cordero and Abelardo Tamariz. The LlactaLAB researchers had not completed their project at the finish of this IQP, so the team was not able to access the full results from the workbook activity. However, Professor Quezada was able to meet with the team to discuss the major findings from the workbooks. According to Professor Quezada the results from the children workbook activities were surprising because "few to none of the children mentioned good sidewalks" when asked about improvements they wanted to see in their walking environment (A. Quezada, personal communication, March 28, 2023). The LlactaLAB researchers learned that children pay little attention to traffic, intersections, or adequate sidewalk width when walking to school. Rather, when asked about improvements they would like to see most children talked about more

nature, games and other improvements that would make the journey to school more enjoyable. The LlactaLAB did not collect data on the children's perceptions on crime, but when the team spoke with the teachers as Luis Cordero, they expressed fear for the children and mentioned that their students have stated they are afraid of crimes.

4.2.2 Teacher and Parent Perceptions at Abelardo Tamariz

The team distributed both a parent and a teacher survey at Abelardo Tamariz. The teacher survey contained ten questions. The first part of the survey included questions about the teachers' name, age, gender, and the grade they teach. Next, the survey asked a series of questions about the safety and walkability of the school area. The full list of teacher survey questions is in Appendix F. The team utilized the Likert scale outlined in Section 3.2.2 to collect the teacher survey responses. The average responses to five statements about the safety and walkability of Abelardo Tamariz are in Table 4.3.

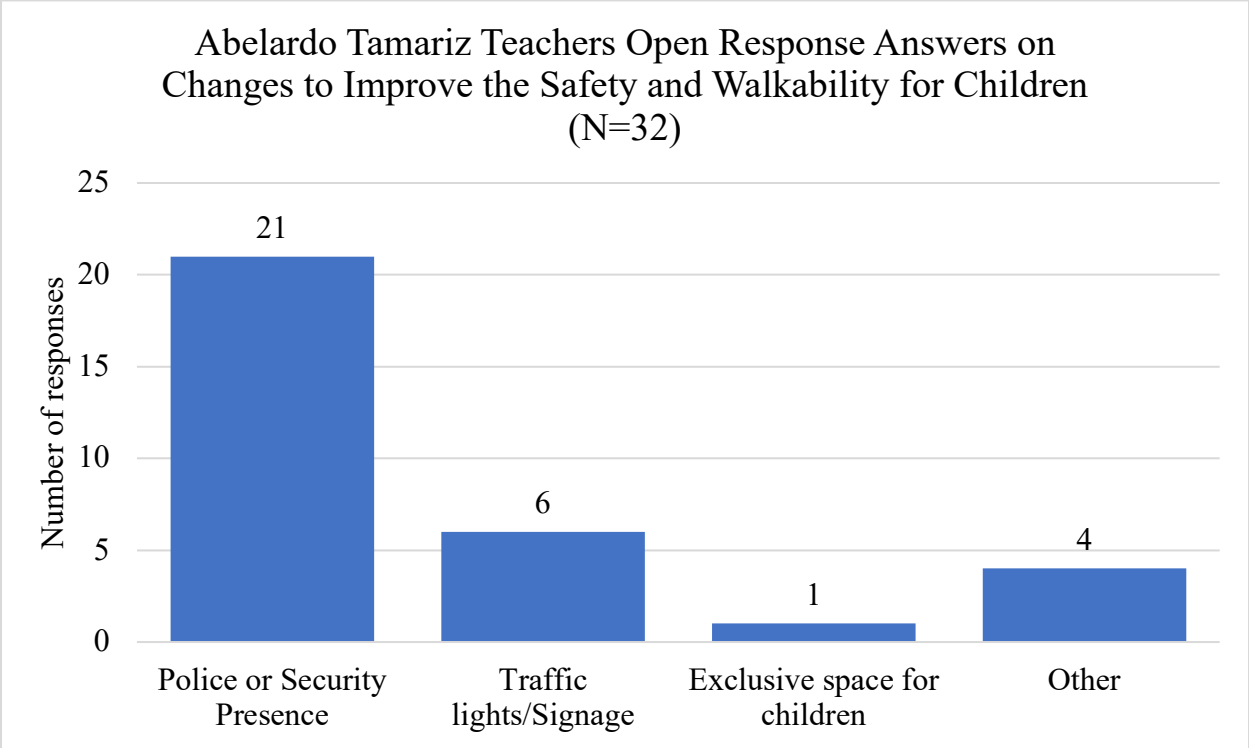
Table 4.3: Average, Standard Deviation and Variance of the survey questions asked to teachers at Abelardo Tamariz

Question N=32	Average	Std. Deviation	Variance
I am comfortable walking in and around Abelardo Tamariz during dawn	2.4	0.9	0.8
I am comfortable walking in and around Abelardo Tamariz during dawn and dusk	2.3	1.0	1
I believe that crime is a problem in and around Abelardo Tamariz	2.9	0.9	0.8
I believe that traffic is a problem in and around Abelardo Tamariz	3.1	0.9	0.8
I believe I have an influence on the children	3.1	0.7	0.6

At the end of the teacher survey, the team included an open response question asking teachers to suggest any initiatives they believe could improve the safety and walkability of the

school zone in Abelardo Tamariz. The most frequent response was to increase the police or security presence around the schools. Addressing this concern was not within the scope of the project, however the team recommended EMOV further explore these suggestions. The second most popular response from the teachers at Abelardo Tamariz was improving the traffic lights and signage in the school area. With the help of EMOV, the students incorporated car traffic into the designs for Abelardo Tamariz. The results from the survey open response question are in Figure 4.4.

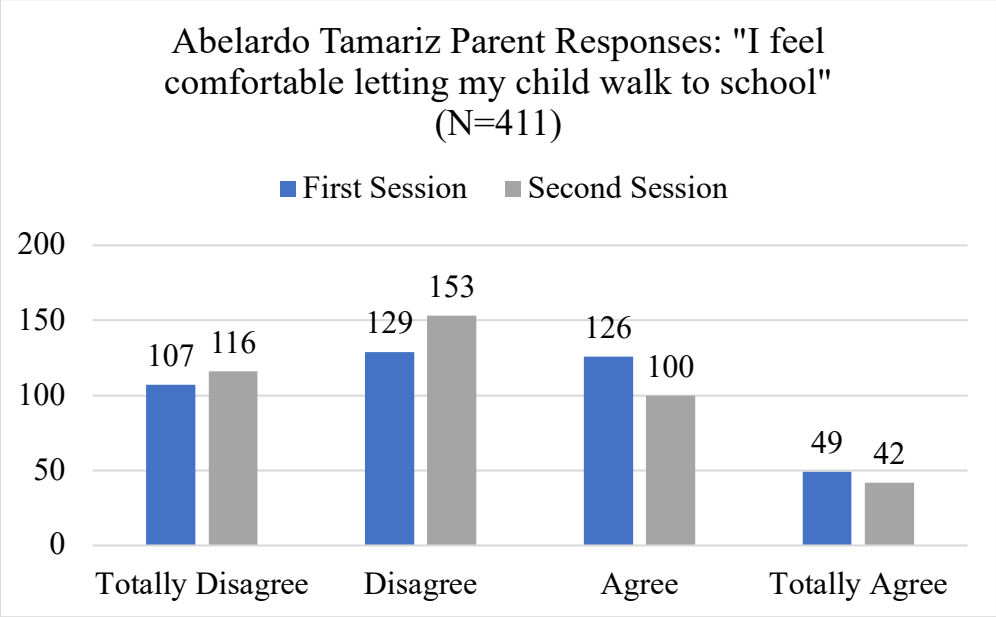
Figure 4.4: Abelardo Tamariz teacher survey on what should be done to increase safety and walkability



The parent survey also contained ten questions. The first part asked how many children they had and their number and age. The next part of the survey asked a series of questions using a Likert scale to gather the perceptions of parents regarding their level of agreement with statements about the safety and walkability of Abelardo Tamariz and its nearby surroundings.

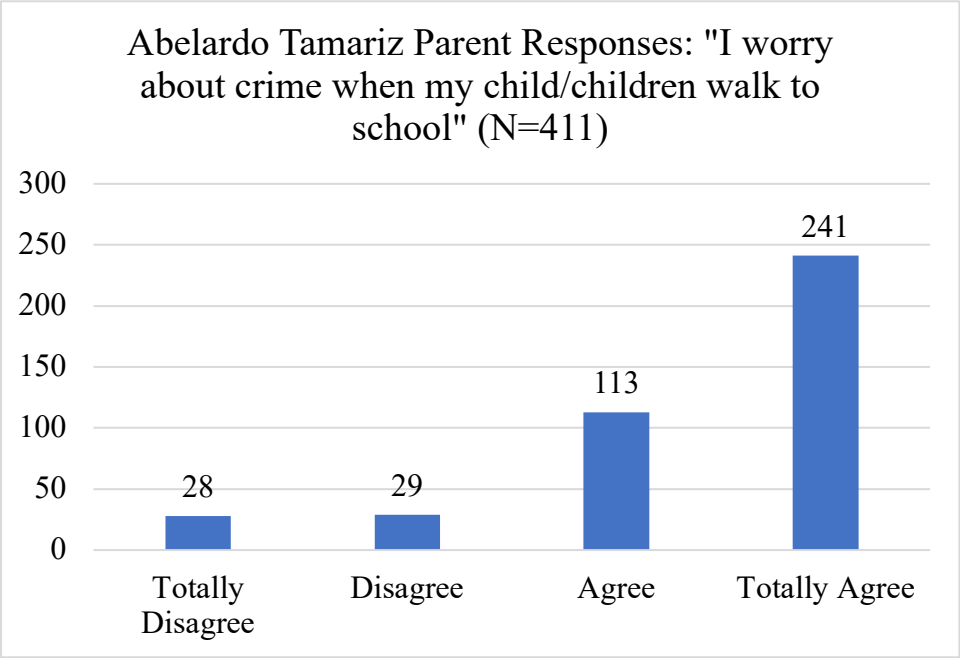
The parent survey yielded 411 completed responses. Figure 4.5 displays the parent responses to the statement “I feel comfortable letting my child walk to school” during the first session and during the second session. According to parent responses, 57% do not feel comfortable letting their child or children walk to school during the first session and 65% do not feel comfortable letting their child or children walk during the second session.

Figure 4.5: Abelardo Tamariz parent responses to “I feel comfortable letting my child walk to school”



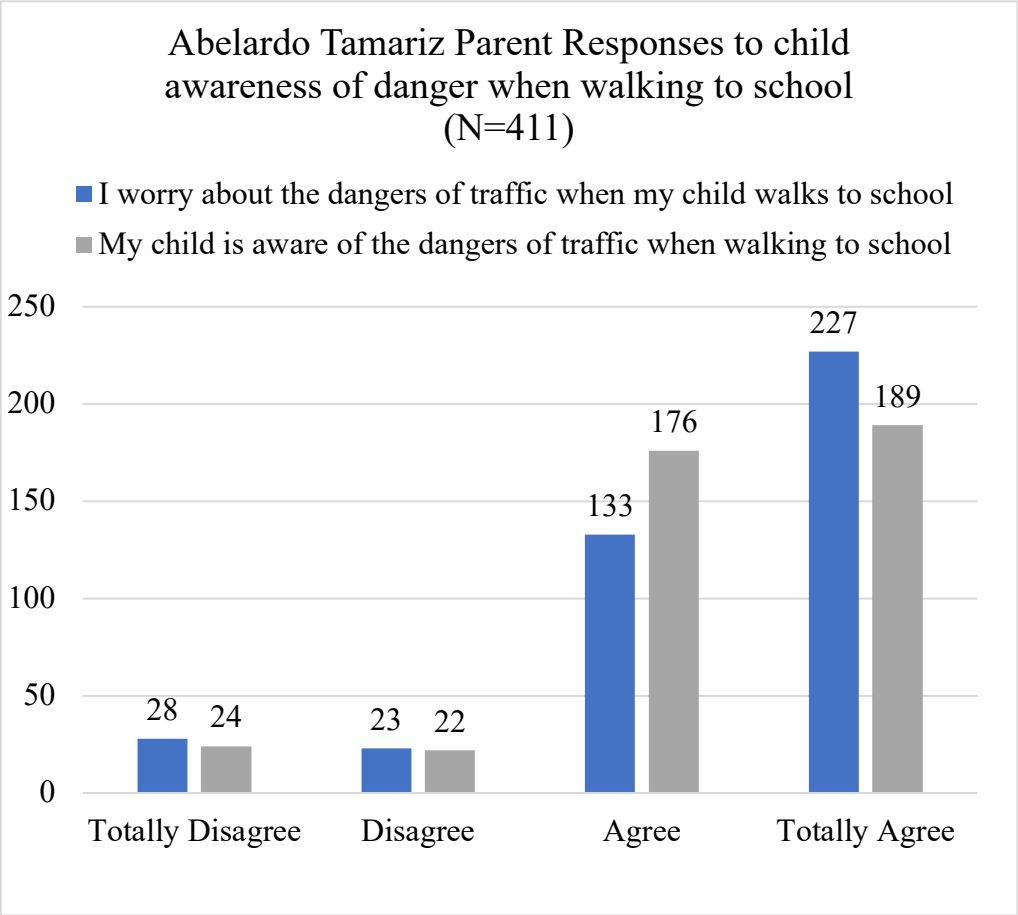
The team wanted to further understand why parents did not feel comfortable allowing their children to walk to school during all times of the day. According to Figure 4.6, 86% of parents said they worry about crime when their children walk to school.

Figure 4.6: Abelardo Tamariz parent survey responses to “I worry about crime when my child/children walk to school”



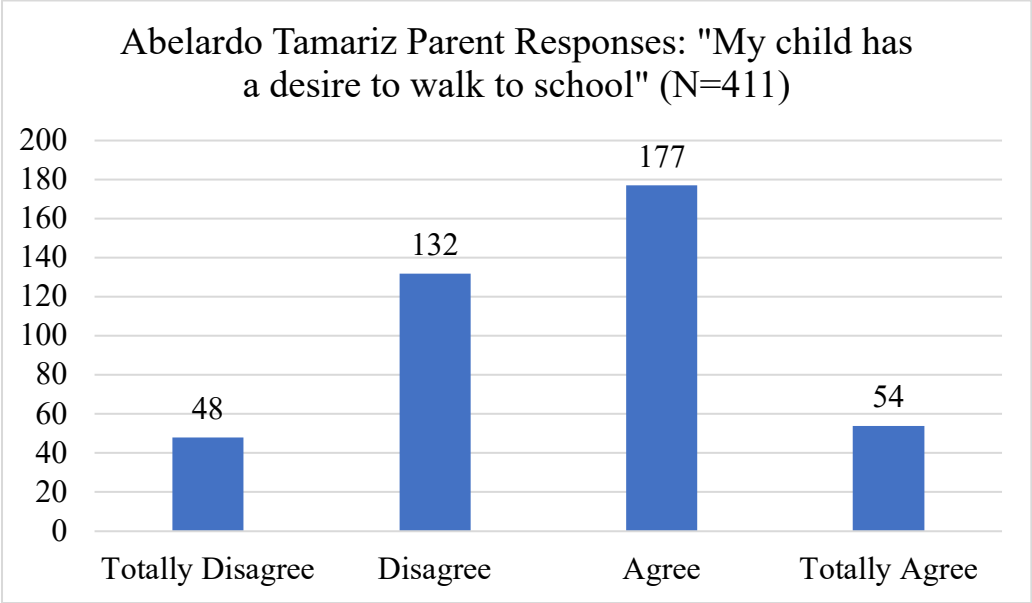
Next, the group asked parents about the perceptions of traffic dangers nearby the schools. The team recorded the responses on both the parents concern with traffic and to what level they thought their child or children were aware of the dangers. The results for parent perceptions on traffic are in Figure 4.7. Most of the responses were in the “Agree” or “Totally Agree” category, as 88% of parents worry about traffic when their children walk to school, and 89% of children are aware of the dangers of walking to school.

Figure 4.7: Comparison of parent worry and children awareness of traffic dangers when walking to school at Luis Cordero



Lastly, the group wanted to gather information on children's interest in walking to school. According to Figure 4.8, 44% of parents said their child does not want to walk to school and 56% said their child has interest in walking to school.

Figure 4.8 Abelardo Tamariz parent responses to “My child has a desire to walk to school”



At Abelardo Tamariz both teachers and parents perceive crime to be high around the school and it impacts the number of children who walk to school. The team did not directly address crime in the area, but rather designed an intervention that was appealing to children and increased the immediate safety of the area from traffic. The team hoped that increasing the use of pedestrian space and increasing foot traffic around the school would deter crime from the area (Kirk et al., 2023).

4.2.3 Teacher and Parent Perceptions at Luis Cordero

The WPI students gathered the safety perceptions of teachers at Luis Cordero through a combination of a focus group and online survey. Central to the focus group was an affinity map where the team asked the teachers their opinion on the biggest problems in the Luis Cordero school zone. The affinity map activity yielded 45 responses with crime being the primary category of concern. Within the crime category, “delinquency”, “drugs”, and “lack of support from police or officials” were the three most common responses. Traffic received the second most responses, with the top responses being “heavy traffic”, “lack of signaling”, and “traffic

accidents". The most common response in the "other" category stated that the nearby parks were destitute and boring. Figure 4.9 and Table 4.4 further break down the results from the focus group.

Figure 4.9: Results of the affinity map at Luis Cordero and what each teacher views as the largest problem.

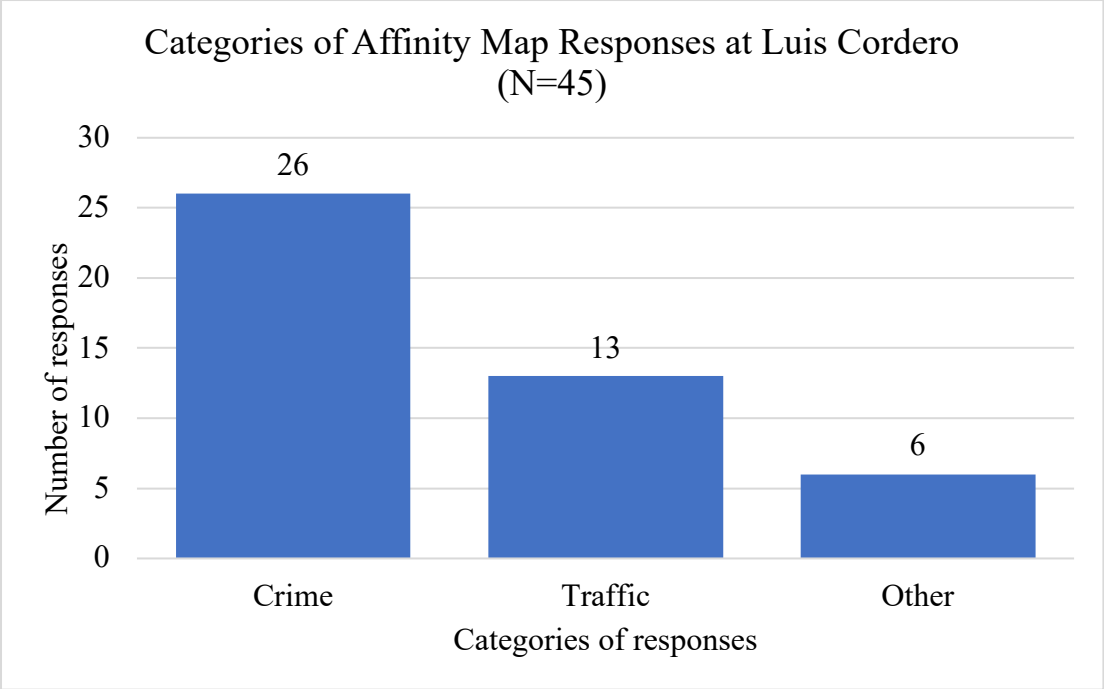


Table 4.4: Luis Cordero affinity map categorized by themes of response (N=45)

Crime	Traffic	Other
Delinquencies (5)	Heavy traffic (4)	Foreigners asking for money (3)
Drugs (4)	Lack of traffic signaling (4)	Park considered 'destitute' (2)
Little police support (4)	Traffic accidents (3)	Wind
Kidnapping (3)	Lack of control from authorities	
Robbery (3)	Lack of pedestrian knowledge	
Crimes (2)		
Drunk people		
Gangs		
Prostitutes		
Strangers		
Violence		

After the affinity map activity, the team asked questions to encourage conversation about what the teachers had just written down and to expand on their ideas. Appendix E contains the questions for the focus group. Most teachers believed the immediate area around the school was safe from crime. However, crime becomes more prevalent beyond the immediate vicinity of the school. Many teachers expressed that more crime occurs after 6:30pm and when it is dark outside. Another problem the teachers discussed was a lack of police support around the school. They mentioned how in other provinces of Ecuador the police help children walk to and from school or organize groups of children to walk together to mitigate criminal acts. However, in

Cuenca, schools often only have a single security guard whose job is to control entry to the school.

Although the affinity map showed crime was a bigger safety concern, during the rest of the focus group teachers mentioned that traffic was a greater problem than crime in the immediate area around the school. They explained that the volume of traffic is often heavy during school arrival and dismissal hours, which increases the risk for children walking to and from school. More specifically, the teachers said they believed motorcycles are involved in the most accidents and their high-speed travel and disregard for the rules of the road posed a greater threat to children than cars. Lastly, the team wanted to get an idea of how much influence the teachers had over the perceptions of children. The teachers indicated that they frequently speak with their students about the dangers of walking to school and how to safely navigate their way in Cuenca beyond the school gate.

In addition to the focus group, the team surveyed teachers at Luis Cordero to get broader and more representative responses about the safety in the school zone (see Appendix F for survey questions). The survey yielded responses from 57 teachers at Luis Cordero. Table 4.5 shows the average survey responses in addition to the standard deviation and variance. The team used a four-point Likert scale for the survey with an one being equivalent to “Completely Disagree” and four being the same as “Completely Agree”.

Table 4.5: Average, Standard Deviation and Variance of the survey questions asked to teachers at Luis Cordero

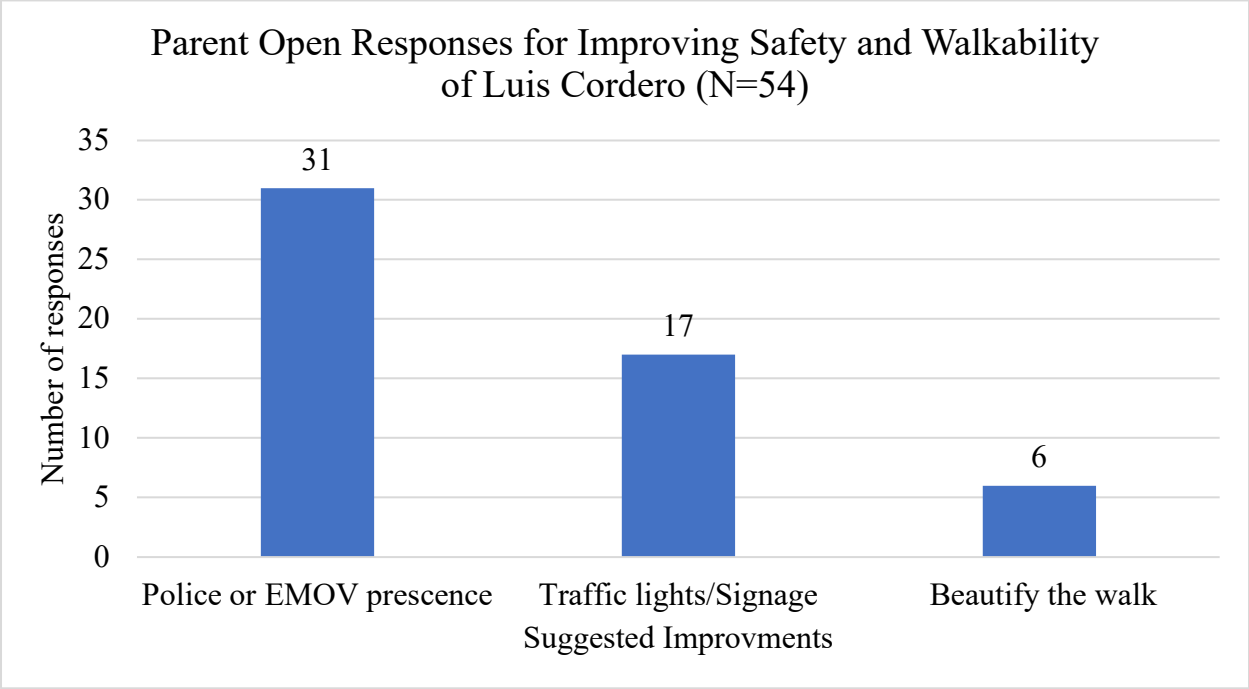
Question	N = 57	Average	Std. Deviation	Variance
I am comfortable walking in and around the school during the day.		2.5	0.8	0.6
I am comfortable walking in and around Luis Cordero		2.5	0.7	0.5
I believe that crime is a problem in and around Luis Cordero		2.8	0.8	0.7
I believe that traffic is a problem in and around Luis Cordero		3.4	0.8	0.6
I believe I have an influence on the children		3	0.6	0.4

On average, the teachers "Agree" or "Completely Agree" with the statement that traffic is a problem in and around Luis Cordero. Although they were less concerned with crime than with traffic, 59.18% of teachers either "Agree" or "Completely Agree" with the statement that crime is a problem in and around Luis Cordero. Also important is that the teachers felt they have a strong influence on the children's perceptions of safety in the Luis Cordero area. The survey indicates 83.68% of teachers either "Agree" or "Completely Agree" with the statement that they have an influence over the children.

The teachers also answered an open response question at the end of the survey that asked them "What would be one change you would like to see in school areas that would increase

safety and children's interest in walking?" The most common answers were to have a greater presence of authority like police, security, and transit officers to help with crime and traffic. Second to that, the teachers emphasized the need for proper signaling at crosswalks and adding traffic lights. Additionally, more relevant to the team's intervention designs, several teachers mentioned improving the appearance of the sidewalk. Teachers also mentioned providing activities or games for the children to complete on their way to school. Figure 4.10 illustrates the categories of the teachers' replies.

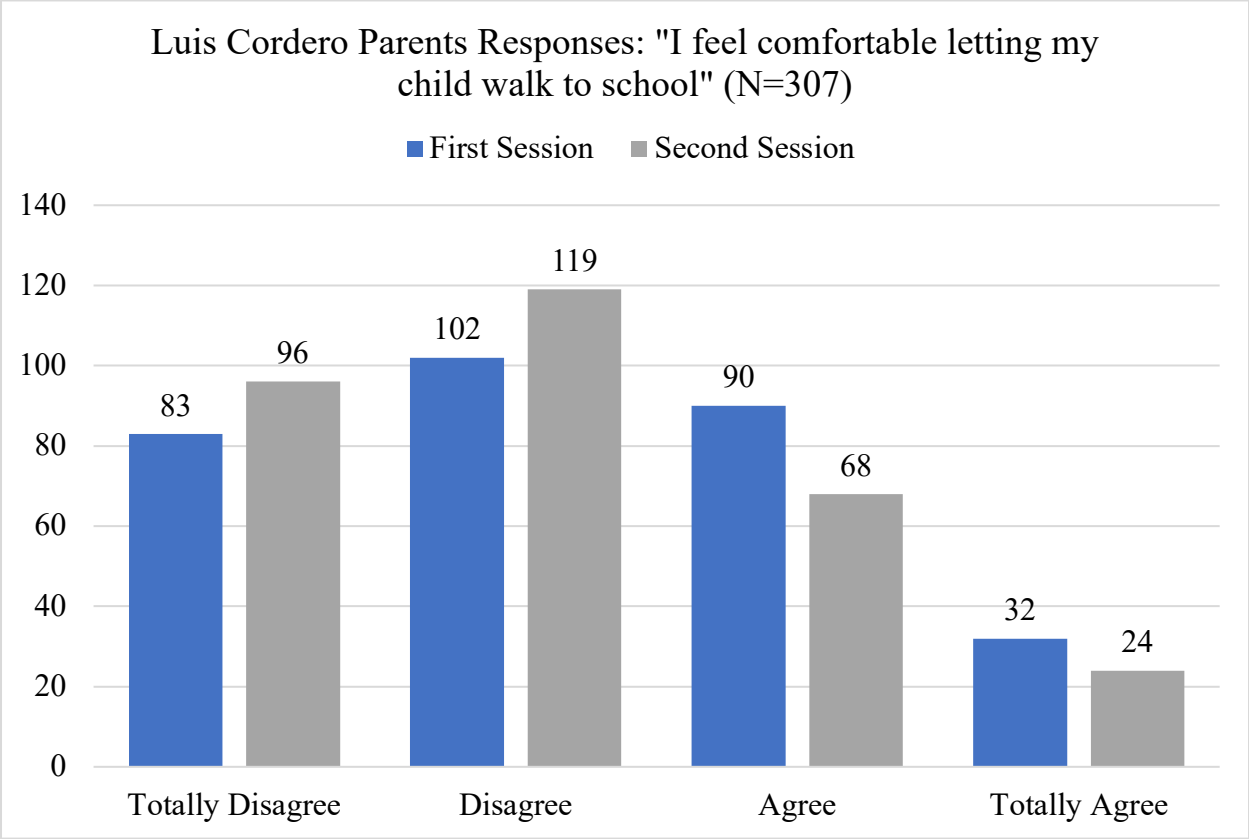
Figure 4.10: Frequent responses by parents about increasing the safety of children when walking to school at Luis Cordero



The team also sent a survey, similar to the teachers' survey, to the parents of the students with the goal to understand parent perceptions on safety and walkability for children in the Luis Cordero school zone. The team used the same four-point Likert scale used for the teachers in the parent survey. The researchers received responses from 307 parents. The first question the team asked parents about safety perceptions was for them to rate how comfortable they feel letting

their child walk to and from school. Figure 4.11 shows the results of this question broken down by school session.

Figure 4.11: Luis Cordero parent responses when asked “I feel comfortable letting my child walk to and from school”

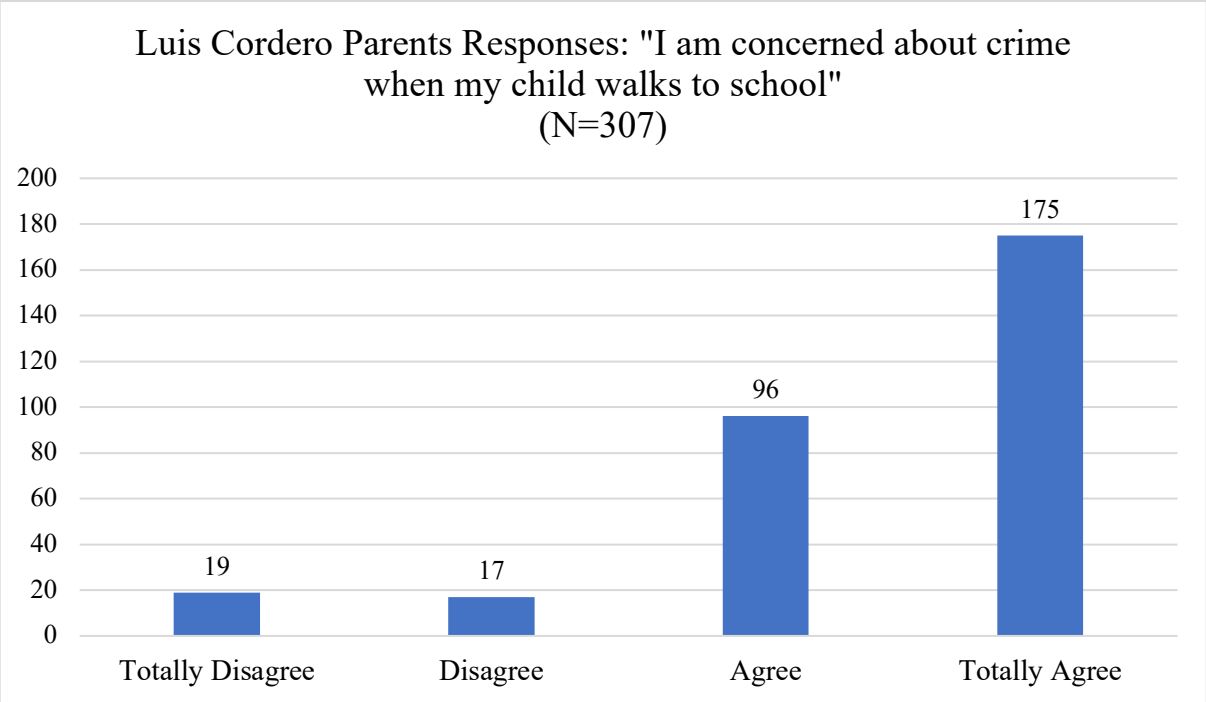


In both sessions more parents felt uncomfortable letting their children walk to school than parents who felt comfortable allowing their children to walk. However, this difference was more pronounced in the second session as the mean response for the second session was 2.07, compared to 2.23 for the morning session. This means that although more parents feel uncomfortable letting their children walk to school than parents who feel comfortable, parents generally felt less comfortable letting their children walk to and from school in the afternoon or evening. Additionally, only 7% of parents said they felt completely comfortable letting their

children walk to school. This highlights the obstacles to increasing the number of children who walk to school.

The next two survey questions determined the predominant reason parents are afraid to let their children walk to school. Through previous research and meetings, the WPI students determined crime and traffic dangers were the primary causes of concern for parents, so the survey asked parents how concerned they were with crime and traffic problems when their child walks to school. Only 12% of parents were unconcerned by crime when their child walked to school. Figure 4.12 shows the results of this question.

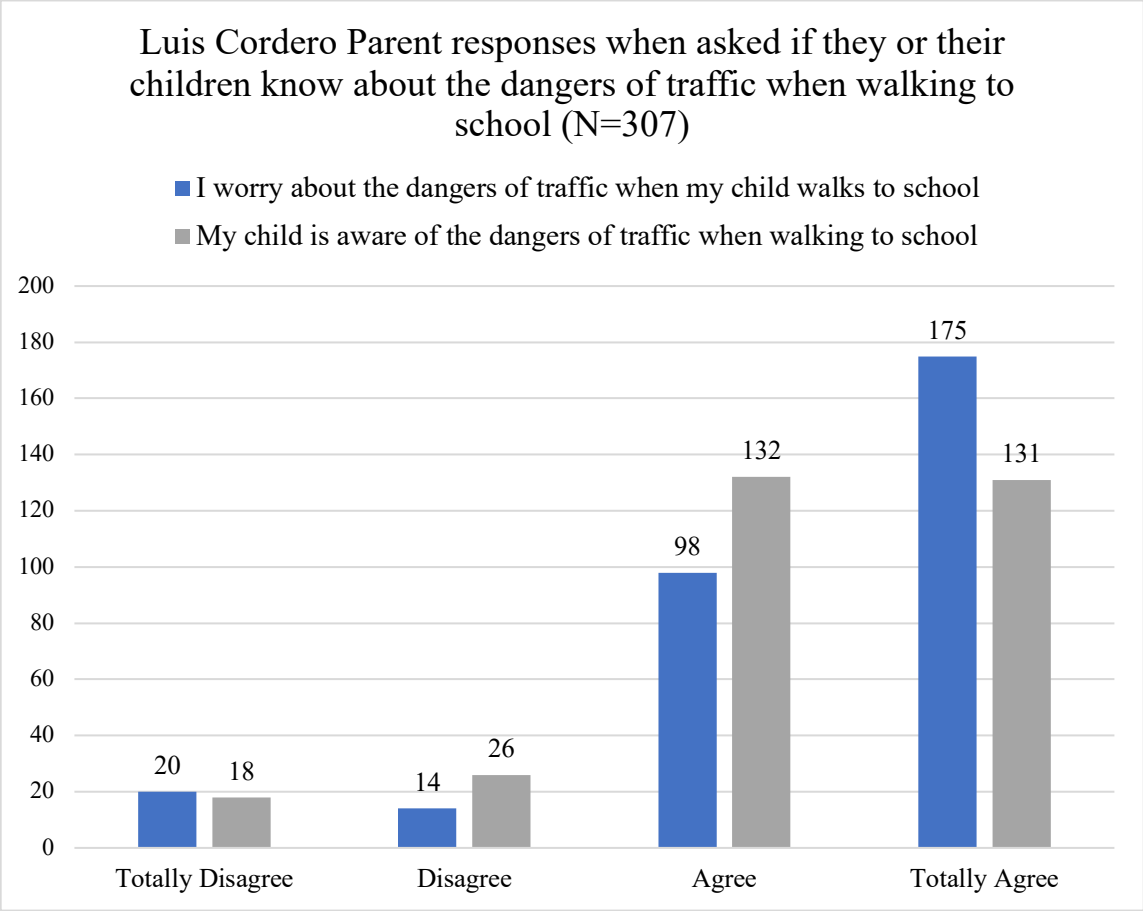
Figure 4.12: Luis Cordero parent responses when asked “I am concerned about crime when my child walks to school”



After gathering parents’ thoughts on crime, the next step was for the group to discover if parents were equally as distressed by traffic. Additionally, during observations the team noticed many children had a lack of awareness of road safety. So, the group also surveyed parents on their opinions of how knowledgeable their children were about traffic safety. Compared to the

12% of parents who were not worried about crime, 11% were not concerned about traffic. Figure 4.13 displays a comparison between parent and child concerns about traffic.

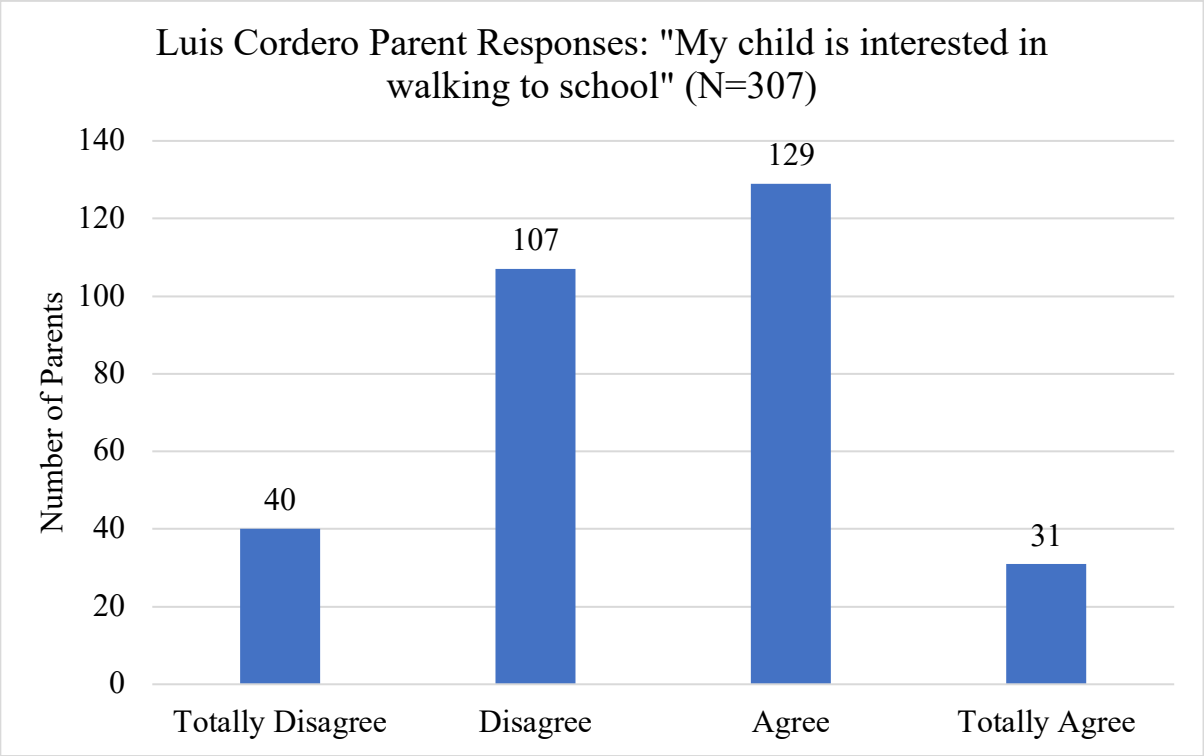
Figure 4.13: Comparison of parent worry and children awareness of traffic dangers when walking to school at Luis Cordero



As Figure 4.12 and Figure 4.13 show parents are frightened about crime and traffic dangers for their children when they walk to school. Furthermore, most parents believed their children were aware of the dangers of traffic when walking to school, however this did not prevent them from also being concerned about their child's ability to navigate heavy traffic. In conclusion, parents are concerned about both traffic and crime with the average responses to worrying about crime and traffic being 3.39 and 3.38. This suggests that successful interventions should take both issues into consideration to encourage more children to walk to school.

Finally, the team wished to discern whether crime and traffic were the only deterrents to children walking to school, or if many children simply did not wish to walk to school. To achieve this goal the group asked parents if their child wanted to walk to school or not. Figure 4.14 depicts the answers to this question.

Figure 4.14: Luis Cordero parent responses when asked “My child wants to walk to school”



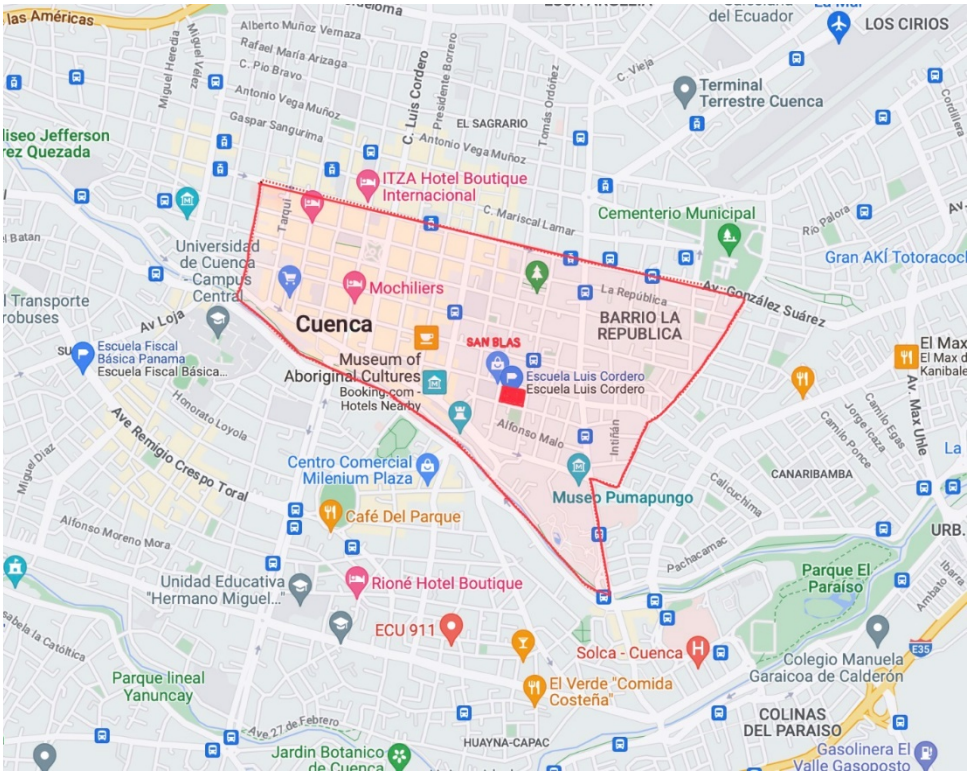
The mean response for this question was 2.49 meaning about half of all children have a desire to walk to school. This means an effective intervention needs to increase the number of children walking to school and increase the safety of those who walk. Additionally, an effective implementation could further increase the number of children who want to walk to school as they will hear from their classmates how much they enjoyed walking to school.

4.2.4 Comparison to ECU911 Data

After collecting the stakeholder perceptions, the next step for the team was to compare the opinions of teachers, parents, and children to reality. The team obtained ECU911 data that

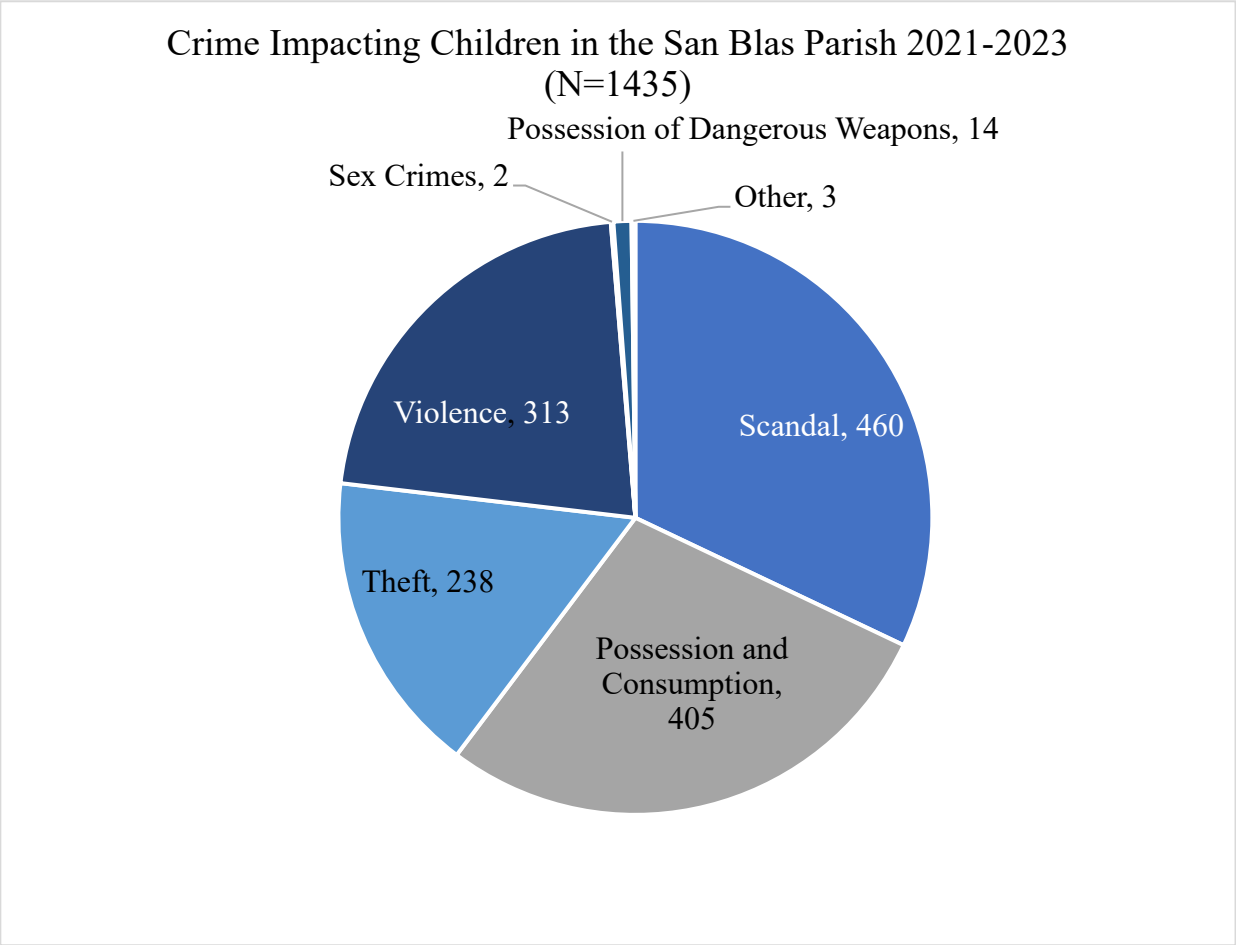
covers the crimes in the complete parish of each school. Figure 4.15 outlines the San Blas parish containing the Luis Cordero school zone. The ECU911 data the team received covers the complete parish.

Figure 4.15: The area of the San Blas parish with the location of Luis Cordero depicted by a red square.



The San Blas parish is a much larger area than the immediate surroundings of Luis Cordero. Therefore, not every call that ECU911 registered in the parish is relevant to the safety of children around Luis Cordero. However, a high level of crime throughout the entire parish can still affect public opinions concerning their safety in the school zone and therefore impact children's walk to school. Figure 4.16 classifies the instances of crime that effects children walking to school in San Blas. A scandal is a noise complaint, instance of low-level and general violence or public intoxication. Possession and consumption is the possession or usage of regulated substances such as alcohol or cocaine.

Figure 4.16: Pie chart of the public crimes that could affect the safety of children walking to school in the San Blas Parish



The team counted 2170 total crimes in the ECU911 data, however only 1435 of the crimes were public enough to affect people's perceptions of walking to school. The group decided crimes that took place in a private residence would not affect stakeholders' perspectives about the safety of a school zone because they do not take place within the school area. The data suggests the proportion and rate of crimes in San Blas is similar to that of the Totoracocha parish, a map of which is located in Figure 4.17.

Figure 4.17: The area of the Totoracocha parish with the location of Abelardo Tamariz depicted by a red square.

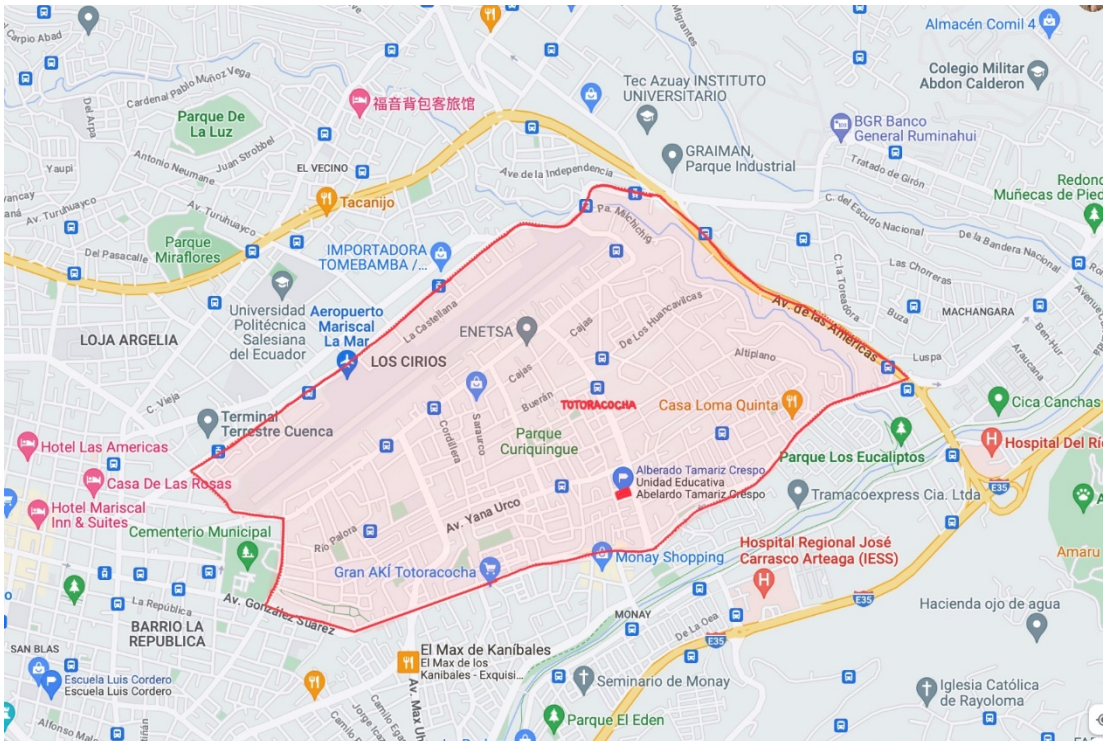
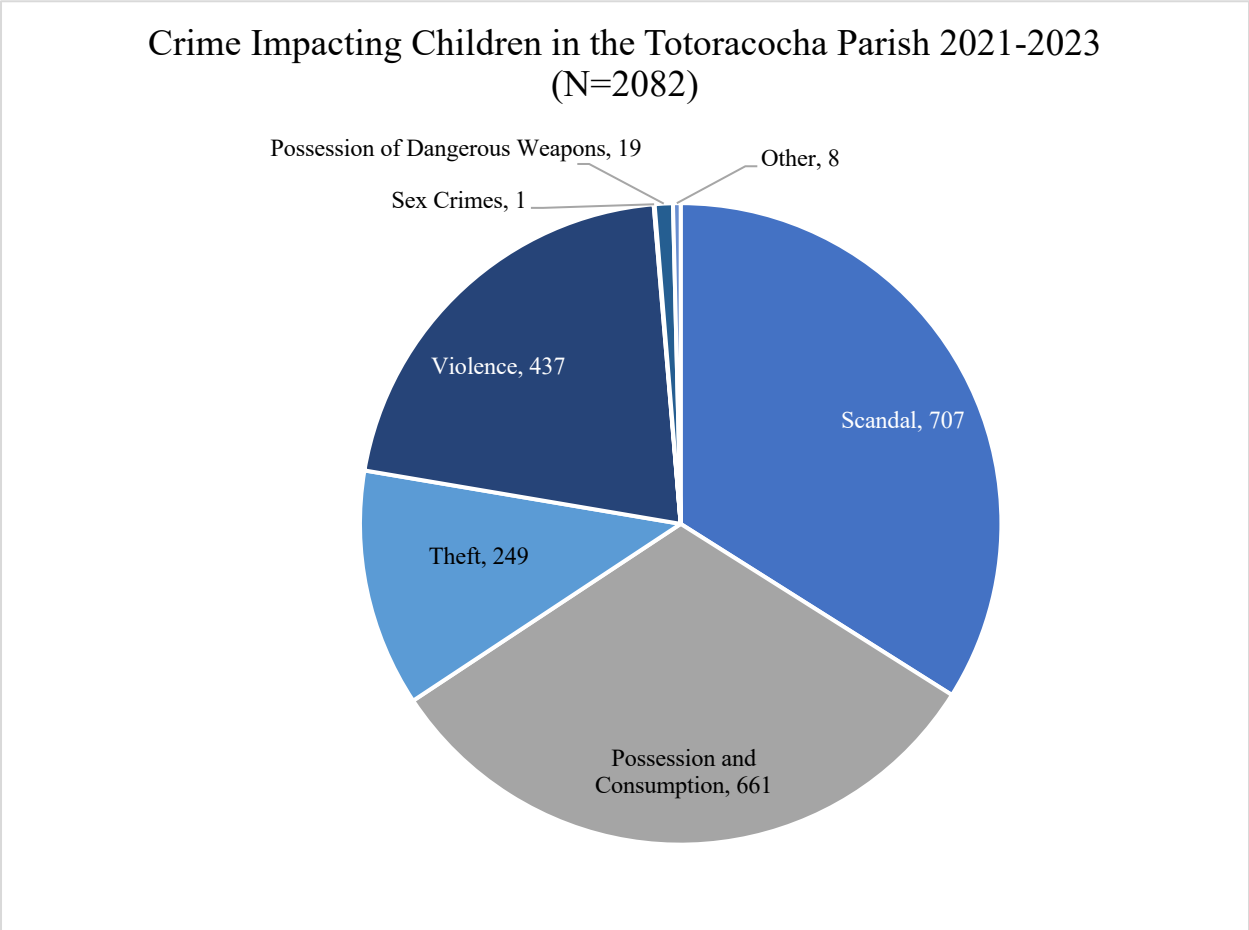


Figure 4.18 categorizes the crimes in Totoracocha. In Totoracocha, ECU911 responded to 3399 crimes, however similarly to San Blas the team determined only 2082 crimes were public enough to affect perceptions of children walking to school.

Figure 4.18: Pie chart of the public crimes that could affect the safety of children walking to school in the Totoracocha parish



Additionally, many teachers mentioned low level crime and drug use as the major crime issues nearby the school. According to background research the best way to address both concerns is to increase the walkability of the area by addressing the five Cs. As both teachers and parents stated they were concerned about crime and traffic, any intervention design would need to address both fears. ECU911 revealed which crimes were most prevalent, and the researchers decided increasing the beauty and habitability of the area would be the most effective solution. Stakeholders also discussed an increased police presence, but this solution was beyond the scope of the project. Therefore, the team designed tactical urbanism interventions to primarily address and increase the comfortability and conviviality of the street areas.

4.3 Intervention Pilot Tests

The team used their understanding of Tactical Urbanism and interventions that EMOV previously successfully implemented in Cuenca to develop an intervention for each school (see Section 2.4). After solidifying the designs, the WPI students worked with EMOV to organize a pilot test of the designs for Luis Cordero and Abelardo Tamariz. The goal of the pilot tests was to observe how school children would interact with the interventions. The observations provide valuable information regarding the feasibility and whether it would have the desired impact on the security and walkability of school zones.

Based on the stakeholder perceptions data, the team identified that each school had very different needs and feasibilities in terms of interventions. The intervention at Abelardo Tamariz focused on the safety of children and pedestrians directly in front of the main entrance. At Luis Cordero, the intervention focused on increasing the level of enjoyment children experienced when walking to school. Although both interventions had different goals, both aimed to increase the overall walkability of school children in Cuenca, Ecuador.

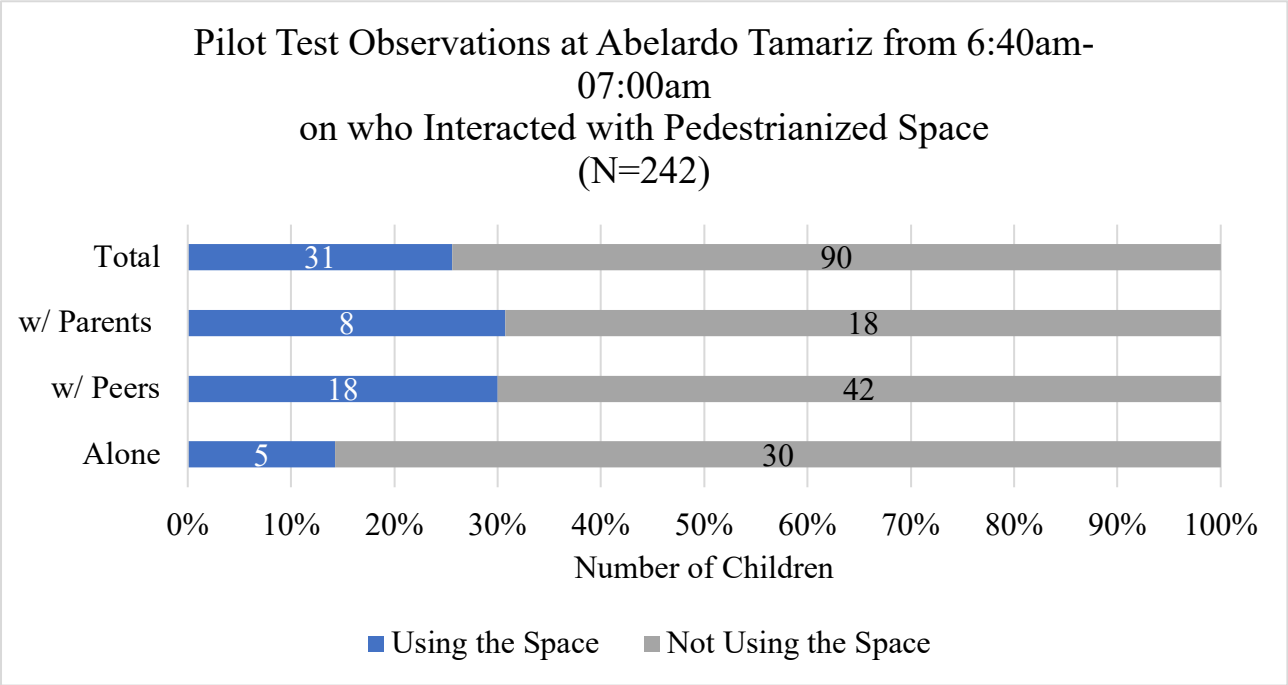
4.3.1 Pilot Test at Abelardo Tamariz

At Abelardo Tamariz, the team identified the lack of a space for the children to play in before and after school hours as a major safety concern. The observations at this school noted that children and parents would spill out into the streets before and after school hours. To address this issue, the WPI students proposed the half-pedestrianization of Calle Mama-Ocllo. Half-pedestrianizing a street involves reducing the space for cars and dedicating half the street to pedestrians. Figure 4.19 shows the half-pedestrianization of Mama-Ocllo. To make the space more welcoming for school children the team included chalk drawings and games such as hopscotch.

Figure 4.19: Children and parents utilizing the extra pedestrian space at Escuela Abelardo Tamariz

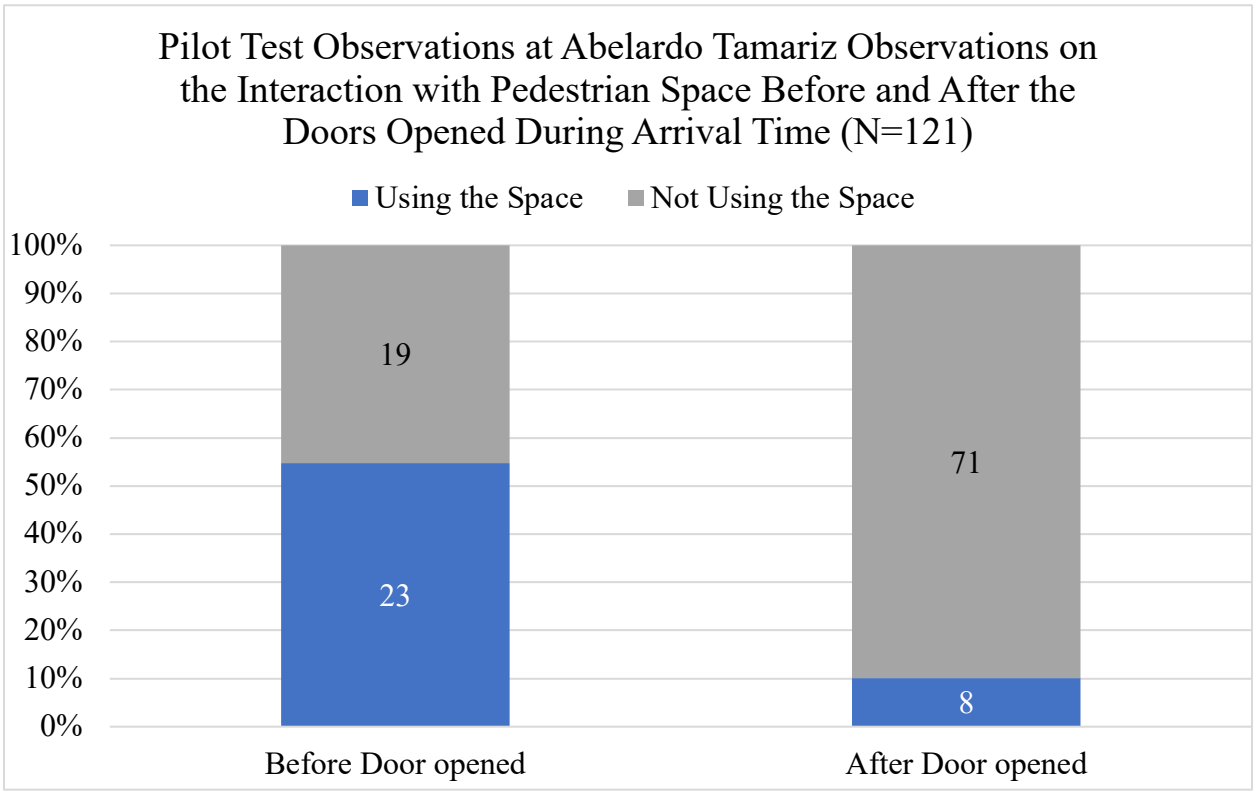
The team used systematic observation to determine the effectiveness of the design. Three group members collected quantitative results and one team member collected general observations. The team members observed the use of the space and whether or not children interacted with the games and drawings. The observation guide is in Appendix K**.** The group observed from 6:40am to 7:00am for the arrival period and from 11:40am to 12:05pm for the dismissal period on date. Figure 4.20 shows the results during the morning period of observation.

Figure 4.20: Children who interacted or did not interact with the pedestrianized space in the morning at Abelardo Tamariz



The group saw that after the door opened at 6:50am the children were rushing to get to class. Before this occurred, the students were standing around within the pedestrianized area talking to each other and playing with some of the games. Therefore, after the door opened there was no need for the space and the interactions decreased. Figure 4.21 shows the difference between the number of children who used the space before and after the school doors opened.

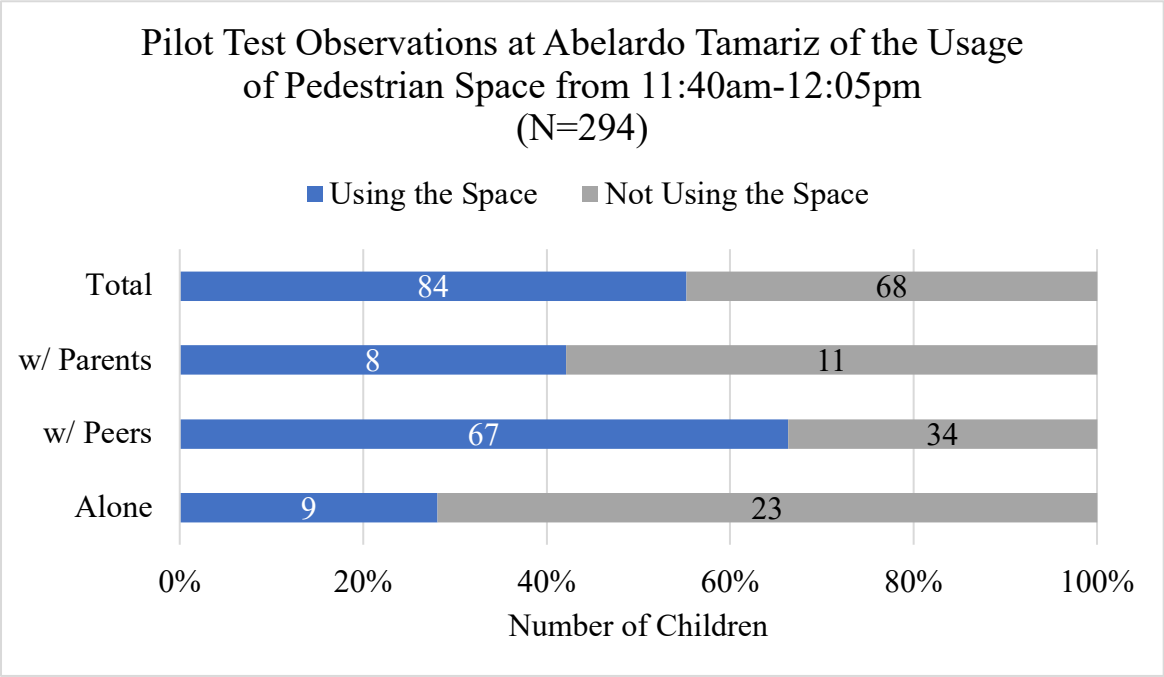
Figure 4.21: Comparison of the numbers of children at Abelardo Tamariz who did or did not interact with the intervention before and after the school doors opened at 6:50am



The team also collected data on children's interaction with the chalk drawings. Out of the 31 students who used the space from 6:40am to 7:00am, 29 students interacted with the drawings or played the games.

The children were in less of a rush during the afternoon and therefore more of them interacted with the pedestrian space than did in the morning. Figure 4.22 shows the use of pedestrianized space during dismissal time.

Figure 4.22: Children who interacted or did not interact with the pedestrianized space in the afternoon at Abelardo Tamariz



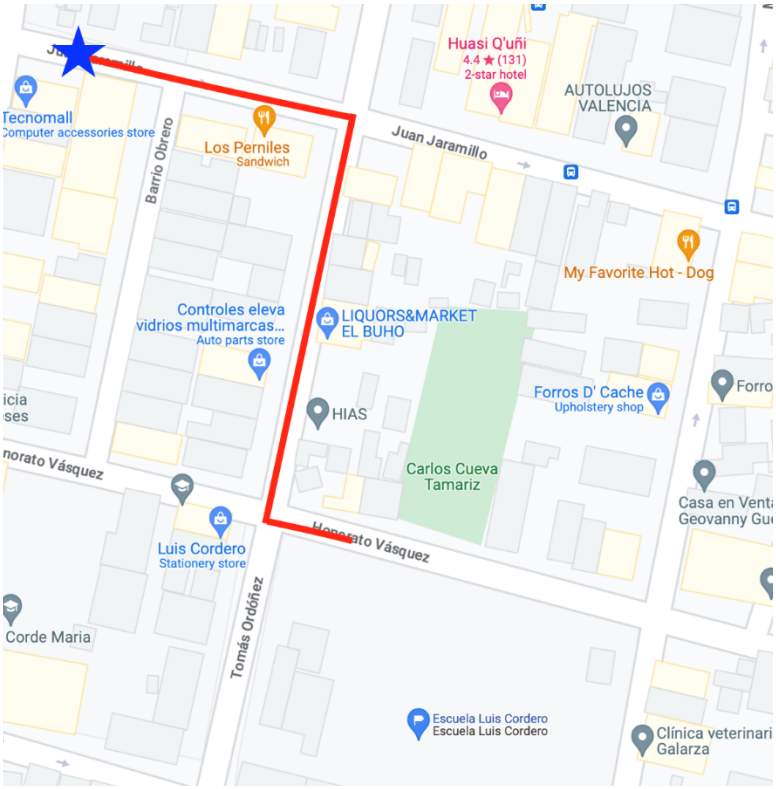
The pedestrianized portion of the street provided children with a space to socialize with friends after school. In addition, it made accessing street vendors, who set up their cart in the street, safer since cones blocked the area off to vehicle traffic. Out of the 84 children who used the space, 22 of them interacted with the drawings or played games.

Between both the morning and afternoon observations, the results suggest that pedestrianizing could be a promising solution for a permanent intervention at Abelardo Tamariz. The design did not inhibit car traffic, and children were able to safely socialize with friends before and after school. The most popular game was hopscotch which children of all genders and ages enjoyed. In the afternoon, children used extra chalk to draw on the sidewalk. Researchers also observed that parents used the pedestrianized area to wait for their children during dismissal. Normally the parents would be standing in the road or crowding the sidewalk, but with the pedestrianized area they were able to wait for their children comfortably and safely.

4.3.2 Pilot Test at Luis Cordero

Unlike Abelardo Tamariz, most students at Luis Cordero take public transport, private transport, or the school buses. During the children's perceptions meeting with Adriana Quezada the team learned that although only a small portion of students at Luis Cordero walk from home, a large portion of the students must walk two or three blocks from the bus stops. In addition, Adriana explained that children are only concerned with more nature and making the walk to school fun as opposed to improving sidewalks or security. Therefore, the WPI students developed an intervention that focused on making the walk to school more enjoyable for students. For the pilot test, the team chose the route depicted in Figure 4.23.

Figure 4.23: Route the team used for the pilot test

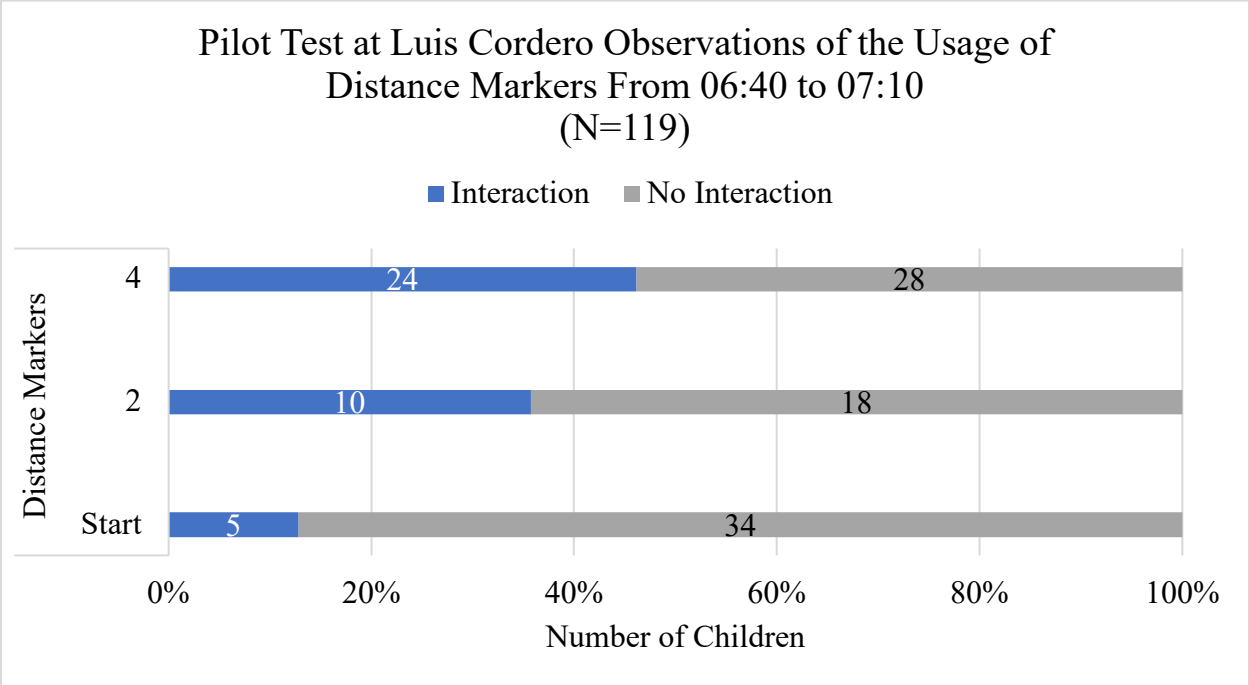


Along the route, the team placed six distance markers indicating how far from school students were at each marker. To make the walk fun, the team made three game signs and placed them at every other distance marker along the route. The games the team used for the pilot test

were I-Spy, Twenty Questions and a “talk it out” question. The distance marker signs are in Appendix I.

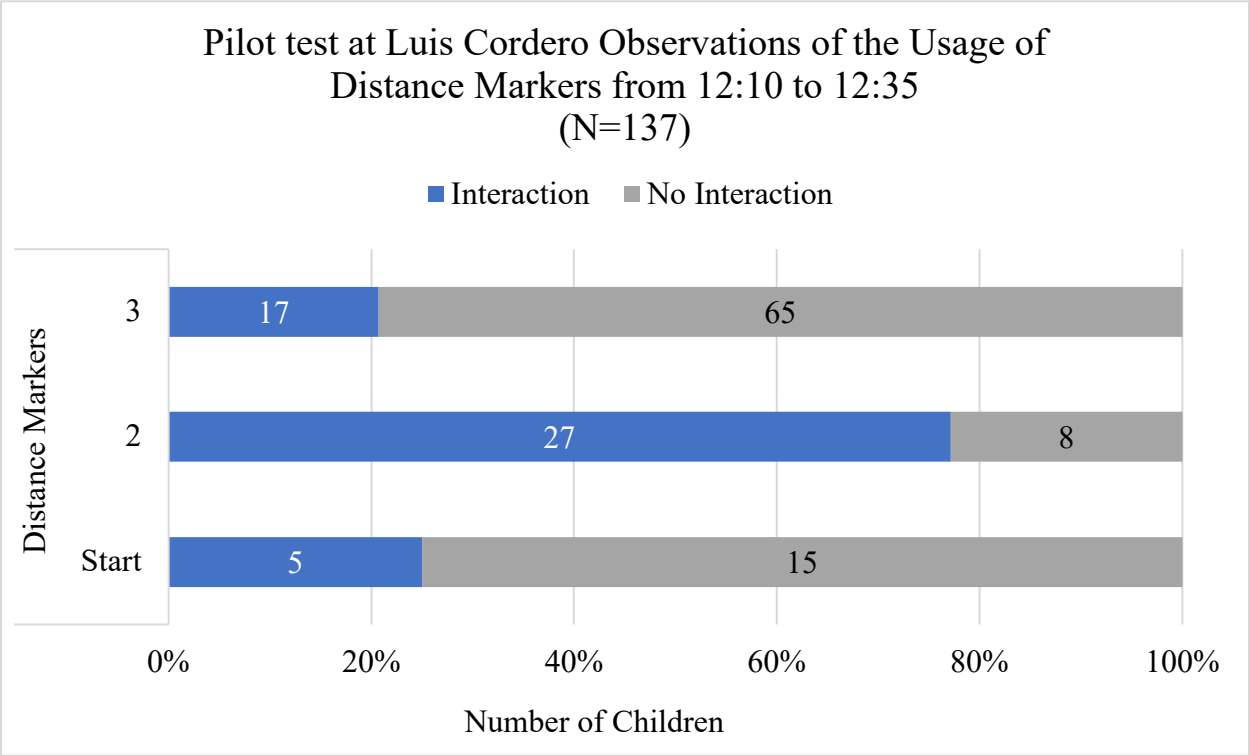
The group used systematic observation to gather data on how children interacted with the distance markers. The observation guide is in Appendix K. Each group member had at least one distance marker they observed with two people observing two distance markers. Throughout the observations, the team determined that the number of interactions with the distance markers without the games was insignificant because few to no people interacted with the distance markers without games. Figure 4.24 shows the results from observations during student arrival at Luis Cordero.

Figure 4.24: Number of children who interacted with the distance markers that accompanies games in the morning at Luis Cordero



Distance marker four was closest to the school and as a result received the most attention because students funneled in from different locations. Figure 4.25 shows the number of children in the afternoon who interacted with the distance markers that had games.

Figure 4.25: Number of children in the afternoon who interacted with the distance markers with games at Luis Cordero



The results during the afternoon were similar to the rate of interaction during arrival with distance marker two being an exception. There is no clear explanation for the high level of interaction at distance marker two, however the researchers theorize 20 Questions was a popular game amongst the students.

Furthermore, the team observed many children interacting with the crosswalk located directly across from the main entrance that the researchers delineated with cones and chalk. The researchers noticed more students used the new crosswalk than used the crosswalks located on the nearby intersection during the formal observation period. The new crosswalk improved the organization of dismissal as there was a clearer path for the crossing guards to use and cars were more attentive to children crossing the road as the crosswalk was more obvious. Additionally, the team included a hopscotch game at the end of the crosswalk that was popular amongst children. The success of the crosswalk and pedestrian area at both schools was related as the team noticed

more students and pedestrians interacted and utilized the areas WPI students had clearly designed for pedestrians.

5 Conclusions and Recommendations

This study investigated tactical urbanism techniques to increase the safety and walkability of Luis Cordero and Abelardo Tamariz. Based on the results of the investigation, the team developed a set of guidelines and recommendations for EMOV to implement. EMOV can implement these recommendations at either of the two schools the researchers studied and use them to influence further work at other schools in Cuenca.

5.1 Recommendations for Abelardo Tamariz

Permanently implement a half pedestrianization of Mama-Ocllo.

The pilot test of the expanded pedestrian space on Mama-Ocllo was a success. During dismissal slightly more than 50% of parents and children interacted with the additional space than chose to ignore it, and the team observed most people who did not use the area were in a hurry rather than actively avoiding the area. Furthermore, the intervention did not disrupt car traffic as cars were able to both park on the other side of the road and drive normally through the middle.

Consequently, the team recommends EMOV introduces a permanent implementation of the half-pedestrianization of Mama-Ocllo. A permanent design would replace the makeshift components of the pilot test, like the cones and chalk drawings, and replace them with benches and trees and painted drawings. In addition, the team recommends that EMOV considers including interactive games as part of the design. Hopscotch and chalk drawing received a lot of attention from the school children during the pilot test. Previously EMOV has worked with an urban consulting group called Huasipichanga to implement similar tactical urbanism designs in school zones around Cuenca. Additionally, the LlactaLAB has designed a similar solution involving pedestrianizing part of Mama-Ocllo. Therefore, the team recommends that EMOV consult both parties to effectively implement the pedestrianization. The WPI team envisions the

pedestrianized area being set up in a similar style to a small park to encourage as much safe interaction with the area as possible.

5.2 Recommendations for Luis Cordero

Further Explore the Distance Markers and Games

During the pilot test of the game designs the team found that students interacted with the signs on their way to school. The distance markers towards the end of the route received more interactions than the ones at the start, highlighting that student's engagement increased as they continued along the route. The team recommends EMOV follows up with LlactaLAB and their completed results from the children workbook activity to better understand what children want to see on their walk to school and design activities accordingly. The results from the distance marker pilot test did not conclusively say whether the distance markers would be a success if permanently implemented. Therefore, the team suggests conducting another pilot test using a route that experiences heavier foot-traffic to drive engagement with the distance markers. The team believes the distance markers have the potential of being a successful intervention around schools in Cuenca because they alleviate the primary concern of many students when they walk to school, which is boredom. In addition, through creating a more appealing route to school, the sidewalks with the interventions could concentrate foot traffic which would create a safer environment for children to walk.

Re-Locate crosswalks around Escuela Luis Cordero.

After observing Luis Cordero, the team discovered the current location of the crosswalks were inconvenient for students. As a result, the students and parents wouldn't utilize the crosswalks. During the pilot test the team and EMOV personnel set up a crosswalk directly across from the main entrance. The team delineated the crosswalk using cones and chalk which provided a safer place for large groups to cross the road. More students used this newly

constructed crosswalk as a result. Additionally, the small hopscotch game set up at the end of the crosswalk proved to be popular with students. As most accidents take place when pedestrians cross the road without a crosswalk, it is important to the safety of an area that pedestrians use crosswalks. Therefore, the team suggests that EMOV re-locate the crosswalks and replicate the team's process during the pilot test by using unique markers and identifiers to encourage the use of the crosswalks and increase visibility to drivers. Ultimately, both the pilot tests have the potential to improve school areas in Cuenca, providing a safer and more walkable environment for the students of the city.

5.3 Future Work and Conclusions

The team identified two main areas of future work for this project.

Explore the feasibility of a similar half pedestrianization of Chichén Itzá.

Due to the success of the pedestrianized space on Mama-Ocllo, the team recommends EMOV explores a similarly pedestrianized space on the nearby road Chichén Itzá. Chichén Itzá runs parallel to Mama-Ocllo on the other side of Abelardo Tamariz and has a very similar street design to Mama-Ocllo. Therefore, the group recommends EMOV analyzes whether a similar intervention would be feasible on Chichén Itzá. The next step would involve running a pilot test of an intervention of half-pedestrianization on Chichén Itzá and evaluating how many people interacted with that intervention. However, since the gate on Chichén Itzá is less popular than the entrance on Mama-Ocllo, it is possible not enough children use that space for an intervention to be viable or cost effective.

Examine if it is possible to provide police and EMOV personnel to help children walk to school safely.

A common theme between all the interviews and surveys the team completed was that many stakeholders desired a greater EMOV and police presence near the school. One teacher mentioned during the focus group that at a school they had previously worked at in Ecuador

police assisted children in getting to and from school. Many parents and teachers said in their open response questions the change they would most like to make to the school area is to have police and EMOV direct both vehicular and pedestrian traffic during the arrival and dismissal periods. The team recommends EMOV explores the feasibility of providing officers to enforce good behavior during these hours, although the group also understands the cost of these assignments is likely prohibitive.

5.4 Final Conclusions

In conclusion, this project reveals that there is a significant need for interventions that prioritize pedestrian safety and improve the overall walkability of school zones. Through surveys, interviews, and pilot test implementations of evidence-based solutions, such as pedestrianization, installing crosswalks or enlarging sidewalks, and making the walk to school more fun for children, the team was able to create designs to promote a safer and more walkable environment for students and their families. It is important that policymakers and stakeholders take these findings into consideration and work towards implementing effective interventions to improve safety in school zones based on the work the team has done and the community's needs. The team leaves EMOV and LlactaLAB with the recommendations above with the intention that they will be able to further the work and eventually implement similar designs.

References

Albornoz , B. (2008). *Planos E Imágenes de Cuenca*. Municipalidad de Cuenca.

AlKheder, S., Alkandriy, F., Alkhames, Z., Habeeb, M., Alenezi, R., & Al Kader, A. (2022). Walkability, risk perception and safety assessment among urban college pedestrians in Kuwait. *Transportation Research Part F: Traffic Psychology and Behaviour*, *86*, 10–32. https://doi.org/10.1016/j.trf.2022.02.003

APA Dictionary of Psychology. (2014). *APA Dictionary of Psychology*. Apa.org. https://dictionary.apa.org/systematic-observation

Beebe, J. (2014). *Rapid qualitative inquiry: a field guide to team-based assessment*. Rowman & Littlefield, Washington DC.

Belin, M.-Å., Johansson, R., Lindberg, J., & Tingvall, C. (1997). *The Vision Zero and its Consequences*. Road Safety Sweden. https://www.roadsafetysweden.com/contentassets/5e3d8c0eb4e94efd9738cca74b912bf5/vz_and_its_consequenses.pdf

Borgia, G. (2022, June 2). *The History of Cities | National Geographic Society*. Education.nationalgeographic.org. https://education.nationalgeographic.org/resource/history-cities/

Byun, G., & Ha, M. (2017). Are Children Safe from Crime?: Focusing on Streets in Elementary School Zones. *Journal of Asian Architecture and Building Engineering*, *16*(1), 45–52. https://doi.org/10.3130/jaabe.16.45

Centre, U. W. H. (n.d.). *Historic Centre of Santa Ana de los Ríos de Cuenca*. UNESCO World Heritage Centre. https://whc.unesco.org/en/list/863/

Chiu, Y.-C., Zhou, X., & Hernandez, J. (2007). Evaluating Urban Downtown One-Way to Two-Way Street Conversion Using Multiple Resolution Simulation and Assignment

Approach. *Journal of Urban Planning and Development*, *133*(4), 222–232. https://doi.org/10.1061/(asce)0733-9488(2007)133:4(222)

CIA. (2023, January 25). *Ecuador - The World Factbook*. Www.cia.gov. https://www.cia.gov/the-world-factbook/countries/ecuador/

de Munck, V., Sobo, E., & Roos, G. (1998). *Using Methods in the Field*. Rowman Altamira.

Dourado, G. (2023, February). *Traffic Accident Data* [Letter to Urban Development Team].

EMOV. (n.d.). *¿Quiénes somos? – EMOV EP*. Www.emov.gob.ec. Retrieved April 5, 2023, from https://www.emov.gob.ec/quienes-somos/

Foster, S., Giles-Corti, B., & Knuiman, M. (2012). Does Fear of Crime Discourage Walkers? A Social-Ecological Exploration of Fear As a Deterrent to Walking. *Environment and Behavior*, *46*(6), 698–717. https://doi.org/10.1177/0013916512465176

Gitelman, V., Balasha, D., Carmel, R., Hendel, L., & Pesahov, F. (2012). Characterization of pedestrian accidents and an examination of infrastructure measures to improve pedestrian safety in Israel. *Accident Analysis & Prevention*, *44*(1), 63–73. https://doi.org/10.1016/j.aap.2010.11.017

Hoppe, D. (2020). *Inciting change through tactical urbanism*. IDTP Brazil. https://www.itdp.org/wp-content/uploads/2020/02/DHoppe_TacticalUrb_11032020-1.pdf

Institute for Transportation and Development Policy. (2020). *How to scale tactical urbanism using lessons from the global south: From Pilot to Permanent*. ITDP. https://www.itdp.org/wp-content/uploads/2020/09/ITDP_From-Pilot-to-Permanent_Sept2020.pdf

Joh, K., Nguyen, M. T., & Boarnet, M. G. (2011). Can Built and Social Environmental Factors Encourage Walking among Individuals with Negative Walking Attitudes? *Journal of*

Planning Education and Research, *32*(2), 219–236. https://doi.org/10.1177/0739456x11427914

Johansson, R. (2009). Vision Zero – Implementing a policy for traffic safety. *Safety Science*, *47*(6), 826–831. https://doi.org/10.1016/j.ssci.2008.10.023

Joshi, A. K. (2014). Road traffic accidents in hilly regions of northern India: What has to be done? *World Journal of Emergency Medicine*, *5*(2), 112. https://doi.org/10.5847/wjem.j.issn.1920-8642.2014.02.006

Jung, H., Lee, S., Kim, H. S., & Lee, J. S. (2017). Does improving the physical street environment create satisfactory and active streets? Evidence from Seoul's Design Street Project. *Transportation Research Part D: Transport and Environment*, *50*, 269–279. https://doi.org/10.1016/j.trd.2016.11.013

Kamel, M. (2013). *Encouraging walkability in GCC cities: smart - ProQuest*. Www.proquest.com. https://www.proquest.com/docview/1462485427?accountid=29120&parentSessionId=7B2wlbarxw0i37pZhlTXRSwyJNlKvaZCtb%2FAEhZZniI%3D&pq-origsite=primo

Kirk, B., Ha, M., & Lee, S. (2023). The relationship between children's fear of crime and pedestrian volume in school zones. *Journal of Asian Architecture and Building Engineering*, 1–15. https://doi.org/10.1080/13467581.2023.2172346

Kiroung Sherpa, U., Bomzon, U., & Sarkar, S. (2021). A Case Study of Pedestrian Facility at Rangpo Traffic Intersection (Sikkim). *IOP Conference Series: Earth and Environmental Science*, *796*(1). https://doi.org/10.1088/1755-1315/796/1/012053

Kweon, B.-S., Rosenblatt-Naderi, J., Ellis, C. D., Shin, W.-H., & Danies, B. H. (2021). The Effects of Pedestrian Environments on Walking Behaviors and Perception of Pedestrian Safety. *Sustainability*, *13*(16). https://doi.org/10.3390/su13168728

Lefèvre, S., Laugier, C., & Ibañez-Guzmán, J. (2012, June 1). *Risk assessment at road intersections: Comparing intention and expectation*. IEEE Xplore. https://doi.org/10.1109/IVS.2012.6232198

LlactaLAB. (n.d.). *#llactalab*. LlactaLAB – Universidad de Cuenca. Retrieved April 5, 2023, from https://llactalab.ucuenca.edu.ec/

Lydon, M., Garcia, A., & Duany, A. (2015). *Tactical urbanism: short-term action for long-term change*. Island Press.

Mancebo, F. (2006). Urbanism. *HAL Archives-Ouvertes*, *00006939*.

Mcleod, S. (2019). *Likert scale definition, examples and analysis*. Simply Psychology. https://www.simplypsychology.org/likert-scale.html

Mehdizadeh, M., Nordfjaern, T., Mamdoohi, A. R., & Shariat Mohaymany, A. (2017). The role of parental risk judgements, transport safety attitudes, transport priorities and accident experiences on pupils' walking to school. *Accident Analysis & Prevention*, *102*, 60–71. https://doi.org/10.1016/j.aap.2017.02.020

Mischke, J. H. and J. (2013, April 11). *Fixing the World's Infrastructure Problems*. Harvard Business Review. https://hbr.org/2013/04/fixing-the-worlds-infrastructu

Mukherjee, D., & Mitra, S. (2020). A comprehensive study on identification of risk factors for fatal pedestrian crashes at urban intersections in a developing country. *Asian Transport Studies*, *6*. https://doi.org/10.1016/j.eastsj.2020.100003

Neumann, P. (2023, February 2). *Guides: Research Methodology: Archival Research*. Libguides.wpi.edu. https://libguides.wpi.edu/c.php?g=355454&p=2396446

Ortega, J., Tóth, J., Palaguachi, J., & Sabbani, I. (2019). Optimization Model for School Transportation Based on Supply-Demand Analyses. *Journal of Software Engineering and Applications*, *12*(6), 215. https://doi.org/10.4236/jsea.2019.126013

Pabayo, R., & Gauvin, L. (2008). Proportions of students who use various modes of transportation to and from school in a representative population-based sample of children and adolescents, 1999. *Preventive Medicine*, *46*(1), 63–66. https://doi.org/10.1016/j.ypmed.2007.07.032

Pesantez, G. (2018, May 16). *68% of the world population projected to live in urban areas by 2050, says UN | UN DESA | United Nations Department of Economic and Social Affairs*. Www.un.org. https://www.un.org/development/desa/en/news/population/2018-revision-of-world-urbanization-prospects.html#:~:text=Today%2C%2055%25%20of%20the%20world%E2%80%99s%20population%20lives%20in

Quezada, A. (2023, March 28). *LlactaLAB children perceptions* [Interview by Lili Hellerman, Finnian Hamblett, & Owen Lehane].

Ray, J. L., & Smith, A. D. (2011). Using Photographs to Research Organizations: Evidence, Considerations, and Application in a Field Study. *Organizational Research Methods*, *15*(2), 288–315. https://doi.org/10.1177/1094428111431110

Roser, M. (2019). *Motor vehicles per 1000 inhabitants vs GDP per capita*. Our World in Data. https://ourworldindata.org/grapher/road-vehicles-per-1000-inhabitants-vs-gdp-per-capita

Schensul, S. L., Schensul, J. J., & LeCompte, M. D. (1999). Essential Ethnographic Methods:

Observations, Interviews, and Questionnaires. In Google Books. Rowman Altamira. https://books.google.com.ec/books?hl=en&lr=&id=-QNKT0RJO8kC&oi=fnd&pg=PR8&dq=LeCompte+%26+Schensul&ots=DUoyPQ84AH&sig=_WUY_V-osYLb0G2tdc-Xa4Ed4a4#v=onepage&q=LeCompte%20%26%20Schensul&f=false

Short, J. R., & Pinet-Peralta, L. M. (2010). No Accident: Traffic and Pedestrians in the Modern City. *Mobilities*, *5*(1), 41–59. https://doi.org/10.1080/17450100903434998

Soares, Rodrigo R., and Joana Naritomi. "Understanding high crime rates in Latin America: The role of social and policy factors." *The economics of crime: Lessons for and from Latin America*. University of Chicago Press, 2010. 19-55.APA

Tranter, P., & Doyle, J. (1996). Reclaiming the residential street as play space. *International Play Journal*, *4*(91-97).

United Nations. (2020). *Ecuador: Sustainable Development Knowledge Platform*. Sustainabledevelopment.un.org; United Nations. https://sustainabledevelopment.un.org/memberstates/ecuador

United Nations. (2022). *World Population Prospects - Population Division - Cuenca, Ecuador*. Un.org; United Nations. https://population.un.org/wpp/

van Berkel, F. J. F. W., Ferguson, J. E., & Groenewegen, P. (2016). Speedy Delivery Versus Long-term Objectives: How Time Pressure Affects Coordination Between Temporary Projects and Permanent Organizations. *Long Range Planning*, *49*(6), 661–673. https://doi.org/10.1016/j.lrp.2016.04.001

Vasconcellos, E. A. (1997). The demand for cars in developing countries. *Transportation Research Part A: Policy and Practice*, *31*(3), 245–258. https://doi.org/10.1016/s0965-8564(96)00021-3

Vision Zero Network. (2013). *What is Vision Zero?* Visionzeronetwork.org. https://visionzeronetwork.org/about/what-is-vision-zero/

Wang, W., Yuan, Z., Yang, Y., Yang, X., & Liu, Y. (2019). Factors influencing traffic accident frequencies on urban roads: A spatial panel time-fixed effects error model. *PLOS ONE*, *14*(4). https://doi.org/10.1371/journal.pone.0214539

Weinberg, N. (2016, August 11). *How Can Cities be Preemptive and Effective in Preventing Overcrowding?* Data-Smart City Solutions. https://datasmart.ash.harvard.edu/news/article/how-can-cities-be-preemptive-and-effective-in-preventing-overcrowding-888

WHO. (2018). *Global status report on road safety 2018*. World Health Organization.

Yannis, G., Nikolaou, D., Laiou, A., Stürmer, Y. A., Buttler, I., & Jankowska-Karpa, D. (2020). Vulnerable road users: Cross-cultural perspectives on performance and attitudes. *IATSS Research*, *44*(3), 220–229. https://doi.org/10.1016/j.iatssr.2020.08.006

Yassin, H. H. (2019). Livable city: An approach to pedestrianization through tactical urbanism. *Alexandria Engineering Journal*, *58*(1), 251–259. https://doi.org/10.1016/j.aej.2019.02.005

Yu, C.-Y. (2015). How Differences in Roadways Affect School Travel Safety. *Journal of the American Planning Association*, *81*(3), 203–220. https://doi.org/10.1080/01944363.2015.1080599

Zegeer, C., Nabors, D., & Lagerway, P. (2013, August). *Pedestrian Safety Guide and Countermeasure Selection System*. www.pedbikesafe.org. http://www.pedbikesafe.org/pedsafe/authors.cfm

Appendix A: Informed Consent Statement

Appendix A.1: Informed Consent Statement - English

Hello, our names are Ali, Lili, Finn and Owen and we are conducting research for Worcester Polytechnic Institute in the USA and EMOV here in Cuenca. Our goal is to create designs for interventions that increase the safety and walkability of school areas to encourage students to walk to school. We have seen your work on a similar topic and would like to collaborate with you further and ask some questions on this topic. With your permission we will record this interview. Do we have permission to record? Do we have permission to use your name and face, or would you like to remain confidential? The team will use the data obtained from this interview to further our research into the causes and underlying factors that are increasing road user danger in school zones. This interview should take roughly an hour and you can stop the interview or refuse to answer a question at any time.

If you would like to contact the team in the future, our contact information is:
gr-Urban-Development-D23@wpi.edu
Our advisors contact information is:
Robert Kinicki
rek@wpi.edu
Gary Pollice
gpollice@wpi.edu

Appendix A.2: Informed Consent Statement – Spanish

Hola, nuestros nombres son Ali, Lili, Finn y Owen y estamos llevando a cabo investigaciones para el Instituto Politécnico de Worcester en los Estados Unidos y EMOV aquí en Cuenca. Nuestro objetivo es crear diseños para intervenciones que aumenten la seguridad y la accesibilidad para peatones de las áreas escolares para alentar a los estudiantes a caminar a la escuela. Hemos visto su trabajo sobre un tema similar y nos gustaría colaborar más con usted y hacer algunas preguntas sobre este tema. Con su permiso grabaremos esta entrevista. ¿Tenemos permiso para grabar? ¿Tenemos permiso para usar su nombre y rostro, o le gustaría permanecer confidencial? El equipo utilizará los datos obtenidos de esta entrevista para informar aún más nuestra investigación sobre las causas y los factores subyacentes que están aumentando el peligro de los usuarios de la carretera en las zonas escolares. Esta entrevista debe durar aproximadamente una hora y puede detener la entrevista o negarse a responder una pregunta en cualquier momento.

Si desea ponerse en contacto con el equipo en el futuro, puede comunicarse con nosotros en:
gr-Urban-Development-D23@wpi.edu
Nuestros asesores pueden ser contactados en:
Robert Kinicki
rek@wpi.edu
Gary Pollice
gpollice@wpi.edu

Appendix B: Formal Observation Guide

Observation Guide (F= female M=Male Y=yes N=No)			
Name of Observer:			
Date:	**School:**	**Time of day:** **Start:** **End:**	**Weather:**
	Pedestrian Traffic		
Area of observation	**Location (within school area)**	**Proceed with caution***	**Proceed w/o caution**
		Number	Number
At a crosswalk			
Not at a crosswalk			
Side of the road			
Other (please specify)			
Notes			

* Looking before crossing the street, not running, etc.

Appendix C: LlactaLAB Child Perspectives Interview

Appendix C.1: LlactaLAB Child Perspectives Interview - Spanish

General topic areas:

1. **How long has the LlactaLAB team been working with EMOV and the four schools?**
2. **How did the LlactaLAB coded their data.**
3. **Comparison of observation and problem identification between the Urban Development team's data and LlactaLAB's data.**
4. **What is LlactaLAB currently doing?**
5. **What would LlactaLAB do similarly/differently.**
6. **Recommendations for schools to focus on.**
7. **Suggestions for Urban Development to collect data.**
8. **What stakeholders would be useful to consult.**
9. **Any other suggestions?**

Appendix C.2: LlactaLAB Child Perspectives Interview - Spanish

Áreas temáticas generales:

1. **¿Cuánto tiempo lleva el equipo de LlactaLAB trabajando con EMOV y las cuatro escuelas?**
2. **Cómo se codificaron los datos de LlactaLAB.**
3. **Comparación de la observación e identificación de problemas entre los datos del equipo de Desarrollo Urbano y los datos de LlactaLAB.**
4. **Qué está haciendo actualmente LlactaLAB.**
5. **¿Qué haría LlactaLAB de manera similar/diferente?**
6. **Recomendaciones para que las escuelas se enfoquen.**
7. **Sugerencias de Desarrollo Urbano para recopilar datos.**
8. **Qué partes interesadas sería útil consultar.**
9. **Cualquier otra sugerencia?**

Appendix D: LlactaLAB Child Perspectives Interview Transcript

Date: March 28th 2023
Interviewer: Lili (Primary Interviewer speaking in bold), Finn (Secondary Interviewer speaking italicized), Owen (Took Notes speaking underlined)
Interviewee: Adriana Quezada, LlactaLAB Profesora
00:01
First, what is the school of student workbooks?
Field journals?
Yes, field journals.
In the response, he was looking for the presentation that the student was showing them. Give me just a minute, I'll show you some results that we have from this.
00:31
More than one school?
Yes. Let's see, we work the field diary with a playful methodology, that is, a game methodology. We wrote a story about an alien named Lucilda that she needed help to investigate in the city of Cuenca why children do not go to school by bicycle or on foot. So, she invited them to be part of the research team of a network. So, in that network, through that, with this story, what we did was a parent survey, to parents to find out in the survey which children walk to school or use public transportation. So, from those children we selected those who had this type of mobility and from there we randomly selected 8 children per school, in the four schools 8 children. 8 children.
02:01
Eight?
Yes, we had thirty-two children.
Thirty-two?
Yes Yes. Thirty-two. Thirty-two.
Thirty-two children per school?
No, in all four schools altogether. Yes, so there were eight per school. So, each child was given this field journal that was part of their jobs as researchers, Lucida's helpers. We gave them material so that they can fill out all the questions in the field diary carry out the activities that the field diary requested. So, do you want me to bring the field journal for you guys to see?
Yes, yes.
03:22
For example, this is the field journal. Each child had a field journal and homework.
When did you do this?
03:42
We did this in February more or less.
In February?
Yes. Or in January. January or February more or less.
03:56
And was it part of a class at school?
The process consisted first of this lottery of children. So, what we did was present them with a video with Lucilda.
Is Lucilda a person?

Lucilda is a Muppet. The children watch a Muppet video before doing the research. The idea was that the kids didn't feel like they were researching like adults but were part of the game with Lucilda. Well, with this video, we introduced them to the project, and she invited them to the investigation. We also worked with them asking them some questions about immobility, about how they went to school, what they liked about the neighborhood, what they didn't like about the neighborhood, and then we would come back and ask who said what.

06:53

Did 8 of the 32 walk to school?

Most walked to school and walked back from school. But if we couldn't find children who walked to school, they had to be children who at least took public transportation.

8 children took public transport?

We (LlactaLAB) couldn't get all children who walk to school because for us to work in the school we have to receive permits from the Ministry of Education that allows us to work in the schools, we have an ethical protocol where we tell the ministry what activities we are just going to do and we tell the parents about the activity and receive their permission to complete it. Because I remember we talked about it a bit before and you sent some WhatsApp messages to the directors, but I think we have to do it more formally. So, then we convince the directors to participate in the study. So, then we talk about it to see how it can be depending on the activity you do.

08:23

We only want to work with the teachers and the parents and possibly get help working with the parents through the administration of the school.

To work with the parents and teachers it will require protocols. You have to visit and speak directly with the director and that's why I told you to work with the LlactaLAB to contact them and when you visit the schools go with a member of EMOV. Because after COVID the schools have many responsibilities and were hit very hard economically and especially because classes are ending soon in May the schools may be less willing to talk to you.

09:23

Could you give us an example of the notebooks the children used to record their activities?

We sent them this notebook and the children had about 10 days to fill out all the activities in the notebook. We wanted to know how long it took them to get home after school, and to tell us about their feelings. For example, if they are tired, they put a heart in this section, and they filled in the normal art if they felt normal, in the sense that they are not tired of walking. Since the children did not have an obligation to complete all the tasks, it was their freedom to answer or not answer, so what we did to not bore and lose them is to ask them questions like if they were king or queen, what decrees or what orders would they give so that the children would be more interested. The LlactaLAB collected a lot of perceptions of the children, for example here, in this activity the children had to use chalk and with the chalk they had to mark the obstacles they encountered and what they had to do on this page was mark how big the chalk was after they completed the activity. They also had to do interviews with their classmates about how they envisioned the transport of the future. And there are some half-joking responses because for example someone put a bed to get to school sleeping. And this activity here they had to make a drawing of how they would improve the space. We asked them who would be their ideal companion to walk with to go to school, and what powers that person might have and children said their companion fly, or teach me how to do my homework, or simply do my homework, they would help me to be smart, or just protect me in the rain.

Additionally, we asked them to talk to an older person in their house, their grandparents, so they can tell them what it was like to walk to school in their day. And we asked the children what they would like to exist for in the places where they walk. And these results surprised us because few to none of the children or mentioned good sidewalks. They mentioned that they enjoyed and wanted nature, games, and things that make the journey fun. They are not so concerned about the intersections, or the vehicular traffic, but they are concerned about a better environment. But most of the children don't worry about the cars, if you ask them how they think they can improve their trip to school they typically answer about improving nature or activities on the way to school.

14:23

What information did you get from surveying the parents?

We did a survey of the parents and in that survey the parents answered questions like whether or not they would let their child walk to school or if they think it seems dangerous for the child to walk to school. Most of them are very afraid to let their children walk to school. If there is a very low socioeconomic level, the household income is low, the children have no choice, they have to walk. And in the case, when you ask them, in the case of people who tell you that their children don't walk to school and when you ask them at what age would you let them walk, they say girls at 15 and boys the earliest age is 12. Parents do not think that children can walk alone or in groups until they are 15 years old.

15:38

We want to do interviews with the parents to complement the LlactaLAB's work with the schools, but only in the school of Luis Cordero and Alvarado Tamariz but we don't know the best way to contact the children's parents.

It is difficult to contact the parents. This you will see. For example, we sent the survey, and it was difficult for them to answer the survey. Perhaps, I think that if they see you, that you are students who come from another place, perhaps they have the openness to give their time to talk. Because there is a political situation when LlactaLAB develops a project and as foreigners you don't have the same political problems. In February Cuenca chose a new mayor so anyone who came to the school was a bit less connected to the municipal government, so parents saw us as being in an electoral campaign, as in favor of the mayor or something like that. So, they didn't have much confidence in us even though they already knew us. I think it's better to ask for a meeting to talk to the directors and tell them exactly what you want to do with the parents and see when that can be done. And with how many people and with how many parents.

18:08

Yes, exactly, but we want to talk to the administration of the schools first, then teachers and we hope that they will help us to talk to the parents of the school children. Is better to visit the school to talk with them, or it is better to ask for an appointment?

I can tell Maria Augusto there is this interest, but I do think it is important that having Guilherme accompany you would be important. It's important for him to go in the sense that he understands the whole program that you belong to, why you're here, and why you linked up with us. So Guilherme and the administrators can make a date and talk. The administrators are interested in knowing things like how long each activity will last and also how many parents you will want to talk with. So, when we worked with them on the project, any activity we had with the parents we had to have a meeting where we communicated the results to the school.

20:08

When we receive the results of the interviews with the teachers, we are going to use the results to create a map or chart of the parents' fears.
If you wanted to use the data from the interviews of professors and from the administrations. It would be easier if the schools already have the tools, the interview tools and methods, that you will use to conduct the interview, things like what is it about, that is, what is the content of the survey or interview that they do, so that the directors can determine if the interview is appropriate. The directors will want to know what the results of the interview will be used for and if it will it be useful for the schools. If you already have the parent survey that you want to use, take it printed out to show them what it is about. Okay and you will need to explain to them how many teachers you want to talk to because the teachers are not always available to talk.
22:08
We wanted to interview 6 or 7 teachers, three from one school and three from another. To interview the parents, we plan to use a table near the school gate and interview parents when children arrive at and leave school we will give the parents a very short interview that will take less than 5 minutes.
So, you want to do the parent interviews outside the school, perhaps when the school starts or when the children leave. Because that is important to the logistics of completing these interviews. It is very different if you ask the director to call a meeting of parents to do the interview, then what you are telling me, I think an interview like this will be more appealing and accessible to administrators if you were to apply the interview outside the school. I think is important both schools are public schools so sometimes the education level of parents is not very high so in order to interview them you have to be super clear when asking for them to fill out the survey because there may be parents who understand the survey and there may be parents who do not understand the survey. Ah, I can't read? You can read, yes. So, maybe if they want, we can help them do a revision of the language in order to improve the test for most parents understand better. That is because different countries speak different variations of Spanish. You need to focus on the types of Ecuadorian Spanish. So, I do recommend that you review and contextualize the survey and take this survey to the director and show here what it is about. I will call the directors and see if they can schedule a day and time to meet. I'm not sure if I can be present, but that's why it would be useful to have a member of EMOV with you. They can tell them a little about what work you are doing, that you are working with EMOV and complementing the LlactaLAB study.
28:47
Any time for a meeting is fine for us because we are flexible, and this interview or meeting is very important for our project.
You say that you help with contacting the directors? I can make a first contact because I don't know if they answered you on WhatsApp, right?
No they did not, I think they are very busy.
I can call them, I will call them on the phone and I will tell them about what you are doing and I'm going to tell them a little about what the project is about. So to see if this... what do you tell me? Yes, yes, yes, I can send an email with the details of how many people and when and how many teachers you want to interview.
31:18
We went to both schools last week to observe during start and dismissal times. But we're confused with the times school starts and different times for the different ages of children, it's very different from the United States.

What happens is that schools have morning shifts and afternoon shifts. In other words, there is a group from both elementary and high school that enters more or less from 7 in the morning to 1 in the afternoon and another group of students enter from 1 until 6 in the afternoon, the school has the option of studying in the morning or studying in the afternoon.

Is it an option for the students? is, if only for elementary school or both?

No, both elementary and high school and college both school? So high or elementary schoolers can choose either. The times are for both. They have options from 7 to 1 and from 1 and a half more or less to 6. Except for the first grades, the first grades are 7 to 1 and from 1 and a half to 6 more or less. The schools have children of the same ages. Everyone has the option of morning period except the smallest children they are 7 to 1. The 2 groups are of equal sizes except the Kindergarteners who arrive only in the morning. After Kindergarten there is a choice of period.

35:18

Do the Kindergarteners have a different school from the first schools?

Yes, they have a different door, usually in a different part of the school.

35:48

Thank you, it's very confusing. And actually, I don't remember very well because we have four schools, do they have different entrances for the entrance of the elementary school or high school in the morning and different entrances in the afternoon? We have noticed at Abelardo Tamariz it is much simpler and more organized, whereas when we observed Luis Cordero, it was chaos.

It is because Luis Cordero has many students because it is in the center. There are more than 1000 students at Luis Cordero. Whereas Abelardo Tamariz is more local, it is more of a neighborhood school. That's why I told you more children walk to school there because they live closer. But Luis Cordero is located in the historic center and the historic center of Cuenca is a place of passage so there are many children who attend who do not live nearby. This is despite Ecuadorian legislation that state children who attend a public school have to live nearby to it. There are people who attend Luis Cordero all the way from Banos and they either get driven by their parents or take public transport to school.

38:48

Do you have the percentages or numbers of students who walked or drove to school?

I think it is important to note that we only surveyed seventh grade kids. Seventh grade is the last year of school, and the children are aged between 10 and 11. We only asked parents to fill out the survey, but like with the children it was not required. Because many families are going through economic problems post-COVID many people did not want to collaborate with the LlactaLAB's study. I will show you some results, but we haven't finished analyzing all the data we collected.

During the pandemic many children left school, dropped out or had problems so when we worked with the schools in 2020 we did not collect as good data. Before the pandemic, when we worked with the schools in 2017-18 parents were very enthusiastic and collaborative, but not anymore. We haven't finished fully analyzing this, but for Luis Cordero we only got responses from 70 parents. And for Abelardo Tamariz it was only 46 parents. So, in the case of Luis Cordero most of the children go to school by private car and most of them return home by public transport. And most of the children who walk are accompanied by an adult.

44:05

Can you tell us about how students get to and from school at the other schools we are interested in?

Ok so for Nicholas Sojos there is the opposite effect. Most children go to school by private car, and they usually return home by private car as well.
45:22
Why do the students leave in private cars?
In this school many people use private cars because the is little access to public transportation. There is little access to public transportation because Nicolas Sojos is in a very small neighborhood that is separated from most of the city. Whereas in the Luis Cordero neighborhood there are many, many options for public transportation.
46:22
Can you tell us about Abelardo Tamariz please?
Yes, here there are far more walkers. About 47% of all the children at this school walk. But there are also many students here who use public transport. Most transportation is only two or three blocks away and there is, in fact, a bus stop right next to the school that is very popular. There is actually 2 bus lines that use that bus stop.
For Luis Cordero there are bus stops all around the school. The buses usually arrive at the bus station at seven so the children who take the bus are always late and have to run to school. Sometimes they take the bus earlier though. There is also a small park here right next to the entrance to Luis Cordero and children are often waiting around here.
50:43
This is good to know because before now we were only focused on children who walked from home to school, however now we see it is important to improve safety for people walking from public transportation sites as well.
Yes, because as you can see the bus stops are not that far away, but they are far enough away that children have to cross multiple dangerous streets to get to school from a bus stop. Luis Cordero has many buses that children also use to get to school. Yellow buses.
I also think it is important to investigate the differences between the solutions and the problems at both schools. And also get data about the perceptions of parents and teachers of safety around the schools.
53:43
We are in contact with ECU911 to receive this data about crimes. We hear that teachers believe there are criminals in the nearby areas of schools and that they believe there is little security nearby. So we think it is important to investigate these perceptions.
Yes I think that contrast is important, to contrast these perceptions with the actual information about accidents and crime around the school environment. I think it would be useful to know as well the process that citizens use to report and accident. Because there is a possible loss of data in this process because for example if my cell phone is stolen in the street I have to go to the prosecutor's office to file a complaints and spend hours of my time filling out paperwork. So, there is a possibility the gaps between perceptions and realities are due to a lack of citizens reporting incidents.
57:13
What is the difference between the data the prosecutor's office and ECU911 might have?
ECU911 might have more precise data because for ECU911 to record an incident all you have to do is make a call, but in the prosecutor's office you have to fill out documents.
58:43
It is the plan of our project to help your work with the schools, with the help of the ECU911 data and the perceptions of parents. Could you possibly send us the PowerPoint of the data

you showed us so we can analyze it for ourselves? We don't need it in a perfect form, we just want the data because it helps us with our project. We want the perceptions of parents, children and teachers to compare with ECU911 and you guys have the data on children.
Yes, I understand, I have no problem with giving you the information, but the information is confidential right now because we have not yet finished the project. I am not the director of the project so I will have to talk a little with the director of the project so she can give you the green light to use this information. Each investigator has their own way of handling information so I am not sure she will give it to you.
01:02:57
Alright. And another question, do we have permission to use your name in our project? And the name of the LlactaLAB?
Yes, you have our permission.

Appendix E: Teacher Focus Group

Appendix E.1: Teacher Focus Group - English

Interview Guide

The team begins with a short intro of each of its members.

Goal of Focus group: To get more information on the perceptions teachers have of safety in their school zone and if/how they project that on their students.

Guiding Questions

1. **Do you feel safe walking to/from school zone?**
2. **Affinity map: What do you think are some safety concerns for both the children and yourself when you are walking to and from school (as many as you would like)?**
3. **Get three big poster size papers and use sticky notes to make groupings of problems and where they lie based on the thoughts of the teachers.**
    a. **Pre-determined Categories: Traffic, Crime, Other**
    b. **Let the first Affinity map carry the whole discussion****
4. **Discuss results of Affinity Map**
    a. **Why did you list these as safety concerns?**
    b. **Do you think certain safety concerns affect ages differently? Why?**
5. **Do you discuss safety in classrooms?**

**The team briefly explains Tactical Urbanism and asks participants to use it to help with following questions

6. **Present what Tactical Urbanism schools have done in Cuenca and explain that we plan to do something similar at Luis Cordero (presentation)**
    a. **Want to know their thoughts on feasibility (open discussion)**
    b. **Want to know what themes children are interested in for games/drawings.**

The recording failed during the interview and the audio was untranscribable therefore, instead the team has the notes resulting from the meeting

In-Depth Focus Group

Logistics (100% of the interview is in Spanish):

1. Name tags for teachers (name and grade they teach)
2. Conduct with Everyone sitting in a circle, or sitting in a way that they can talk
3. Ask to record the discussion

Roles:

- Lili and Juan Diego speaking/interacting with teachers
- Finn taking notes (minutes of meeting)
- Owen observing (observing body language, behavior, etc. and taking notes on observations)
- Ali will help Finn take notes and/or be part of discussion

Interview Guide

The team begins with a short intro of each of its members

Goal of Focus group: To get more information on the perceptions teachers have of safety in their school zone and if/how they project that on their students.

Meeting Minutes:

1. Do you feel safe walking to/from school zone?
    a. Everyone is safe near the school (Javier)
    b. Traffic is only major problem near the school (Tania)
    c. Problems for the kids using public transport and traffic are greater because they must walk further (Leonard)
    d. Women have more to worry about than men when walking (Betty)
    e. Near the school these crime problems do not occur a two-block radius works away it becomes much less secure (Javier)
    f. There are robberies but not close to the school. At least two blocks away (Patrick)
    g. More dangerous in afternoon or night few taxis and lots of traffic (Rosy)
    h. After 6:30 security ends and it is much more dangerous (Nuby)
    i. Thieves are around after 6:30 pm (Augusta)
    j. Morning and night are the same so 12-hour shifts of safety and danger (Nuby)
2. **Affinity map**: What do you think are some safety concerns for both the children and yourself when you are walking to and from school (as many as you would like)?
    a. There are problems when the kids leave school not when they are at school (Tania)
    b. The kids do fear walking to school or back home because 4th and 5th are the cutoff and at nine or ten years old, they are afraid of walking to school alone (Tania)
    c. The smaller ones do not fear because of parental assists (Tania)
3. Get three big poster size papers and use sticky notes to make groupings of problems and where they lie based on the thoughts of the teachers
    a. Pre-determined Categories: Traffic, Crime, Other.
    b. Let the first Affinity map carry the whole discussion**

i. People on one side say that there is a lot of crime others believe that traffic and other problems are more dangerous (evidenced by mapping activity)
ii. Violence, drugs, with robberies at physical violence point (Cathy)
iii. The students do not use sidewalks and could cause traffic problems (Luly)
iv. Part of the cultural education is street rules and Ecuadorian society does not care (Cathy)

4. Discuss results of Affinity Map
    a. Why did you list these as safety concerns?
    b. Do you think certain safety concerns affect ages differently? Why?
        i. Meet other school and there are, and large school gone to because of kids' groups plus police acting as crossing guards (Tania)
        ii. If the police helped with crossing like other provinces in Ecuador it would be easier and safer for children to walk to school (Agusta)
        iii. Children in other provinces walk in groups so they are safer from criminals and other malicious actors (Agusta)
5. Do you discuss safety in classrooms?
    a. Talks to kids about the traffic problems in Cuenca and how to stay safe (Agusta, Carla was the loudest on agreeing with this point)
    b. Police and that the help would be. nice, but officers do not want to help (Barbara)
    c. The teachers do fear for the kids and the parents obviously are nervous because of any perceived unsafety(all)
    d. Cathy thinks if a bit more security they would be fine to send kids solo (Cathy)
    e. Tania has kids and the bus waiting times are a major reason public transportation is not used as much (Tania)
    f. Ligia wonders about economic viability of school buses to drive the kids home (Ligia)

**The team briefly explains Tactical Urbanism and asks participants to use it to help with following questions

6. Present what Tactical Urbanism schools have done in Cuenca and explain that we plan to do something similar at Luis Cordero (presentation)
    a. Want to know their thoughts on feasibility (open discussion)
    b. Want to know what themes children are interested in for games/drawings.
        i. They do not think our strategy will solve all problems, but most teachers believe it will help reduce the dangers the students experience with traffic (Cathy)
        ii. The quality of our materials we plan to use were questioned and we informed them to what we know (Barbara)
        iii. Most students do not know why we are doing this project and a better system to educate on road etiquette will make the streets safer (Nuby)
        iv. More motorcycle deaths and accidents than any other types (Nuby)
        v. Motos do not respect the rules and suffer as a results (Tania)
        vi. Some are kids bigger than the professors and their physical size can be used to escort other younger students to school (Leonard said and Nuby agreed)

Appendix E.2: Teacher Focus Group – Spanish

Guía de entrevista

1. **¿Se siente Seguro caminando hacia/desde la zona escolar?**
2. **¿Cuáles crees que son algunas preocupaciones de seguridad tanto para los niño como usted cuando camina hacia y desde la escuela (tantas como desee)?**
    a. **Instrucciones de Affinity Map: Nosotros vamos a hacer una actividad donde ustedes escribirán cosas en papelitos que creen que son preocupaciones de seguridad para usted cuando camina hacia y desde la escuela. Entonces, pon tus respuestas en una de las categorías.**
3. **El groupo obtendrá tres papeles grandes del tamaño de un póster y usará notas adhesivas para agrupar los problemas y dónde se encuentran en función de los pensamientos de los maestros.**
    a. **Categorias: Crimen, Tráfico, otro**
    b. **Deja que esto lleve la conversación**
4. **Discusión de Affinity Map**
    a. **¿Por qué los enumeró como preocupaciones de seguridad?**
    b. **¿Crees que ciertas preocupaciones de seguridad efectan las edades de manera diferente? Por que?**
5. **¿Hablas de seguridad en tus clases?**

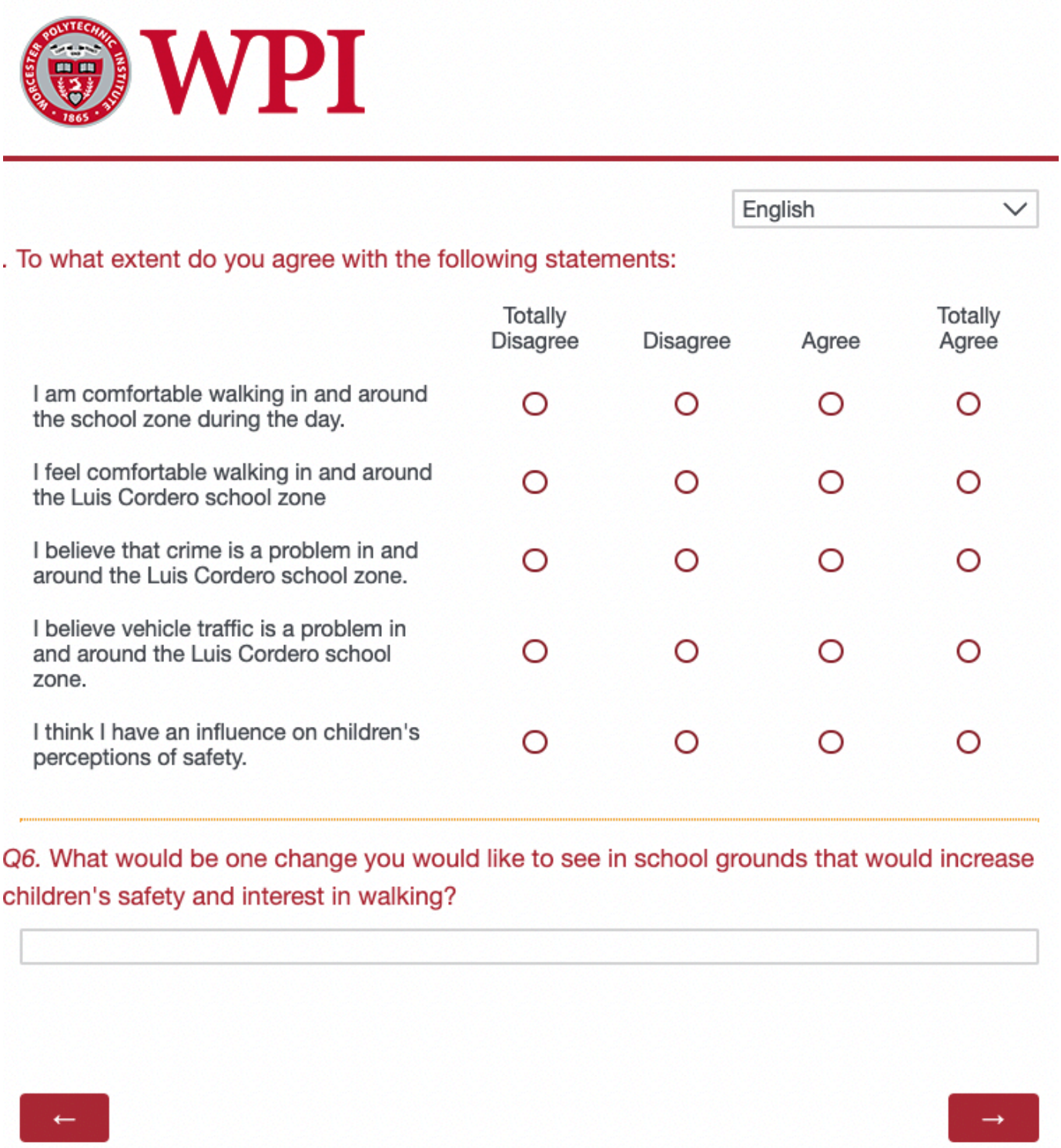
** Explicar tactico urbanismo**

6. **El equipo muestra ideas de diseño y pide comentarios**
    a. **Pensamientos sobre la viabilidad**
    b. **Temas que les interesan a los niños**

Appendix F: Teacher Survey

Appendix F.1: Teacher Survey (Page 1: Basic Information Both Schools) - English

Appendix F.2: Teacher Survey (Page 2: Luis Cordero Version) - English



WPI

English

. To what extent do you agree with the following statements:

	Totally Disagree	Disagree	Agree	Totally Agree
I am comfortable walking in and around the school zone during the day.	○	○	○	○
I feel comfortable walking in and around the Luis Cordero school zone	○	○	○	○
I believe that crime is a problem in and around the Luis Cordero school zone.	○	○	○	○
I believe vehicle traffic is a problem in and around the Luis Cordero school zone.	○	○	○	○
I think I have an influence on children's perceptions of safety.	○	○	○	○

Q6. What would be one change you would like to see in school grounds that would increase children's safety and interest in walking?

←

→

Appendix F.3: Teacher Survey (Page 2: Abelardo Tamariz) - English

WPI

English

To what extent do you agree with the following statements:

	Totally Disagree	Disagree	Agree	Totally Agree
I am comfortable walking in and around the school zone during the day.	○	○	○	○
I feel comfortable walking in and around the Abelardo Tamariz school zone during sunrise/sunset.	○	○	○	○
I believe that crime is a problem in and around the Abelardo Tamariz school zone.	○	○	○	○
I believe vehicle traffic is a problem in and around the Abelardo Tamariz school zone.	○	○	○	○
I think I have an influence on children's perceptions of safety.	○	○	○	○

What would be one change you would like to see in school grounds that would increase children's safety and interest in walking?

←

→

Appendix F.4: Teacher Survey (Page 1: Basic Information Both Schools) – Spanish

Appendix F.5: Teacher Survey (Page 2: Luis Cordero Version) - Spanish

. Hasta qué punto está de acuerdo con las siguientes afirmaciones:

	Totalmente en desacuerdo	en Desacuerdo	de Acuerdo	Totalmente de acuerdo
Me siento cómodo caminando dentro y alrededor de la zona escolar durante el día.	○	○	○	○
Me siento cómodo caminando dentro y alrededor de la zona escolar de Luis Cordero	○	○	○	○
Creo que el crimen es un problema dentro y alrededor de la zona escolar de Luis Cordero.	○	○	○	○
Creo que el tráfico de vehículos es un problema dentro y alrededor de la zona escolar de Luis Cordero.	○	○	○	○
Creo que tengo una influencia en las percepciones de seguridad de los niños.	○	○	○	○

Q6. ¿Cuál sería un cambio que le gustaría ver en las áreas escolares que aumentaría la seguridad y el interés de los niños en caminar?

Appendix F.6: Teacher Survey (Page 2: Abelardo Tamariz) - Spanish

Hasta qué punto está de acuerdo con las siguientes afirmaciones:

	Totalmente en desacuerdo	en Desacuerdo	de Acuerdo	Totalmente de acuerdo
Me siento cómodo caminando dentro y alrededor de la zona escolar durante el día.	○	○	○	○
Me siento cómodo caminando dentro y alrededor de la zona escolar de Abelardo Tamariz durante el amanecer/atardecer.	○	○	○	○
Creo que el crimen es un problema dentro y alrededor de la zona escolar de Abelardo Tamariz.	○	○	○	○
Creo que el tráfico de vehículos es un problema dentro y alrededor de la zona escolar de Abelardo Tamariz.	○	○	○	○
Creo que tengo una influencia en las percepciones de seguridad de los niños.	○	○	○	○

¿Cuál sería un cambio que le gustaría ver en las áreas escolares que aumentaría la seguridad y el interés de los niños en caminar?

←

→

Appendix G: Parent Survey

Appendix G.1: Parent Survey (Page 1: Both Schools) - English

English

Please answer each child. What is the gender of your child?

For example, if you have two daughters, put a 2 in the first column next to "daughter" and put both ages in the second column separated by a comma (ex. 5, 13).

	How many	Age
Daughter		
Son		
Other		

What time does your child or children go to school?

- [ ] Morning (07:00 - 12:00)
- [ ] Afternoon (1:00 p.m. - 6:00 p.m.)

←

→

Appendix G.2: Parent Survey (Page 2: Both Schools) - English

WPI

English

To what extent do you agree with the following statements (Skip questions that do not apply):

	strongly disagree	in disagreement	OK	Totally agree
I feel comfortable letting my child walk to and from school during the first session (07:00 - 12:00)	○	○	○	○
I feel comfortable letting my child walk to and from school during the second session (1:00pm - 6:00pm)	○	○	○	○

To what extent do you agree with the following statements

	strongly disagree	in disagreement	OK	Totally agree
I worry about crime when my child/children walk to school	○	○	○	○

To what extent do you agree with the following statements

	Strongly Disagree	in disagreement	OK	Totally agree
I am concerned about traffic hazards when my child or children walk to school	○	○	○	○
Your child or children are aware of the dangers of walking to school	○	○	○	○

To what extent do you agree with the following statements

	Strongly Disagree	in disagreement	OK	Totally agree
Your child or children have a desire to walk to school	○	○	○	○

Please explain your answer to question Q6.

What would be one change you would like to see in school grounds that would increase children's safety and interest in walking?

← →

Appendix G.3: Parent Survey (Page 1: Both Schools) - Spanish

Worcester Polytechnic Institute, WPI, Logo

Q1. Dar respuesta a cada hijo por favor.¿Cuáles son el genero de su hijo?

Por ejemplo, si tiene dos hijas, ponga un 2 en la primera columna junto a "hija" y ponga ambas edades en la segunda columna separadas por una coma (ej. 5, 13)

	Cuántos	La Edad
Hija		
Hijo		
Otra		

Q2. ¿A qué hora va su hijo o hijos a la escuela?

- ☐ Mañana (07:00 - 12:00)
- ☐ Tarde (13:00 - 18:00)

← →

Appendix G.4: Parent Survey (Page 2: Both Schools) - Spanish

WPI

Q3 . Hasta qué punto está de acuerdo con las siguientes afirmaciones (Omitir preguntas que no se aplican):

	Totalmente en desacuerdo	en Desacuerdo	de Acuerdo	Totalmente de Acuerdo
Me siento cómodo dejando que mi hijo camine hacia y desde la escuela durante la primera sesión (07:00 - 12:00)	○	○	○	○
Me siento cómodo dejando que mi hijo camine hacia y desde la escuela durante la segunda sesión (13:00 - 18:00)	○	○	○	○

Q4 . Hasta qué punto está de acuerdo con las siguientes afirmaciones

	Totalmente en desacuerdo	en Desacuerdo	de Acuerdo	Totalmente de Acuerdo
Me preocupa el crimen cuando mi hijo / hijos caminan a la escuela	○	○	○	○

Q5. Hasta qué punto está de acuerdo con las siguientes afirmaciones

	Totalmente en Desacuerdo	en Desacuerdo	de Acuerdo	Totalmente de Acuerdo
Me preocupan los peligros del tráfico cuando mi hijo o hijos caminan a la escuela	○	○	○	○
Su hijo o hijos son conscientes de los peligros de caminar a la escuela	○	○	○	○

Q6. Hasta qué punto está de acuerdo con las siguientes afirmaciones

	Totalmente en Desacuerdo	en Desacuerdo	de Acuerdo	Totalmente de Acuerdo
Su hijo o hijos tienen el deseo de caminar a la escuela	○	○	○	○

Q7. Por favor explique su respuesta de pregunta Q6.

Q8. ¿Cuál sería un cambio que le gustaría ver en las áreas escolares que aumentaría la seguridad y el interés de los niños en caminar?

← →

Appendix H: Translated Tables of ECU911 Data

Appendix H.1: Emergencies in San Blas by Addressing Service

Service	Year			Total Emergencies
	2021	2022	2023	
Citizen Security	3621	3814	837	8272
Transit and Mobility	752	1028	269	2049
Municipal Services	749	952	183	1884
Health Management	650	690	169	1509
Claims Management	98	150	32	280
Military Service	5	15	7	27
Risk Management	6	3	3	12
Total	5881	6652	1500	14033

Appendix H.2: Emergencies in Totoracocha by Addressing Service

Service	Year			Total Emergencies
	2021	2022	2023	
Citizen Security	5911	5415	1250	12576
Transit and Mobility	1136	1583	370	3089
Municipal Services	1874	1781	450	4105
Health Management	1463	1463	325	3217
Claims Management	193	248	58	499
Military Service	11	38	31	80
Risk Management	15	31	6	52
Total	10603	10525	2490	23618

Appendix H.3: Citizen Security Emergencies Coordinated in San Blas

Service	Year			Total Emergencies
	2021	2022	2023	
Private Scandal	141	231	48	420
Public Scandal	190	126	45	361
Drunk	143	119	21	283
Mugging	51	147	26	224
Theft	96	109	13	218
Illegal Substance	21	60	41	122
Scandal	41	39	19	99
Heist	19	47	7	73
Aggression	16	39	5	60
Tenancy Scandal	19	25	16	60
Consumption of Controlled Substances	15	26	1	42
Domestic Violence	9	14	2	25
Physical Aggression	8	11	3	22

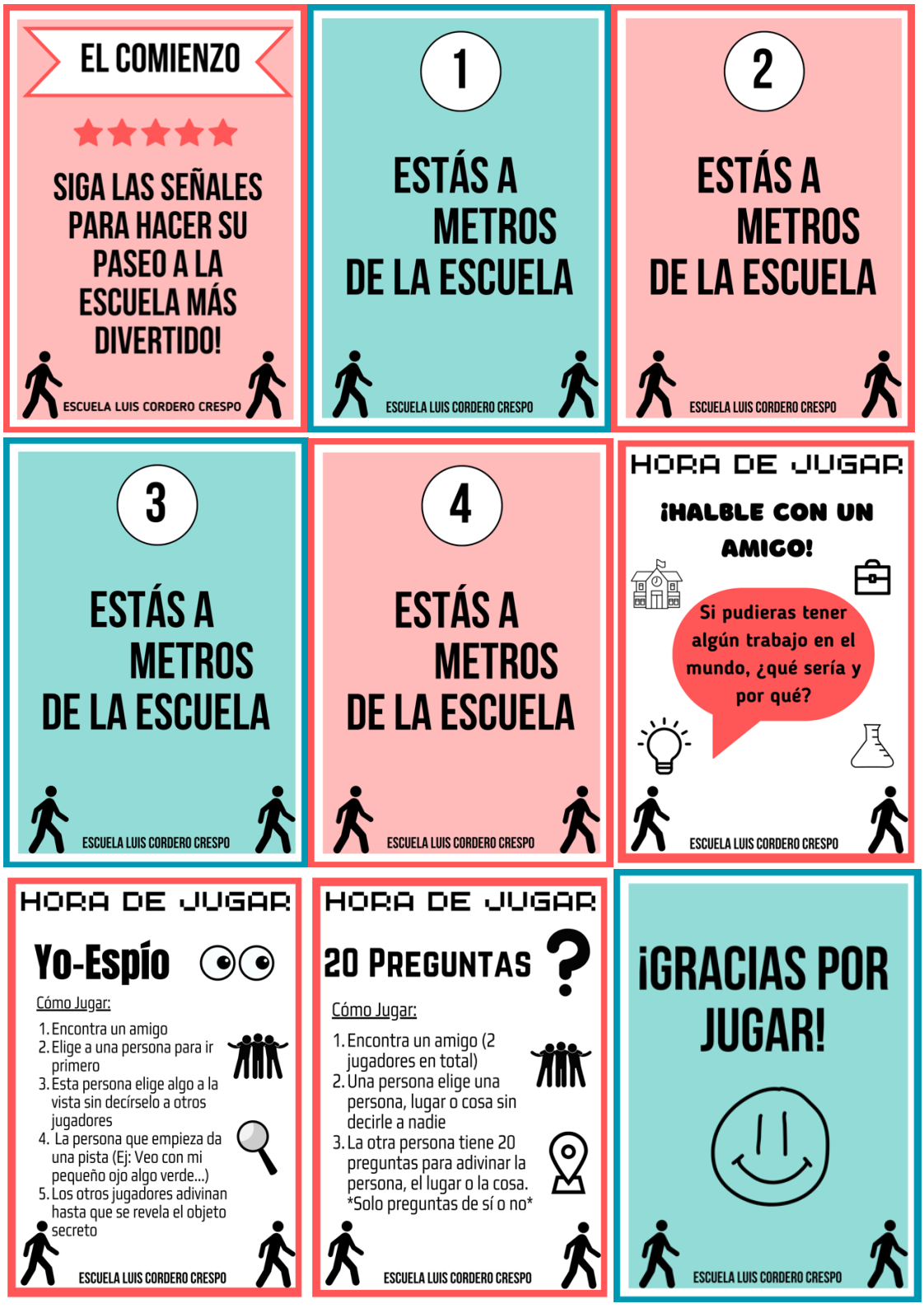
Inter-familial Violence	7	13	1	21
Burglary	5	9	6	20
Stealing Car parts	8	9	2	19
Stealing Attempt	1	11	5	17
Robbing Banks	5	8	2	15
Possession of Weapons	3	9	1	13
Psychological Domestic Violence	8	0	2	10
Carjacking	1	5	3	9
Immoral acts		5	1	6
Verbal Aggression		4	2	6
Sexual Crimes		4		4
Motorcycle Thefts	2	2		4
Stealing From School	1	1	1	3
Immoral Acts in Public View	0	3	0	3
Sexual Abuse	0		2	2
Sexual Harassment	0	1	1	2
Field Rushers	1	1	0	2
Stealing From Public Institutions	0	1	0	1
Armored Carjacking	1	0	0	1
Violence Against Kids	0	1	0	1
Stealing a Will	1	0	0	1
Knife Possession	0	1	0	1

Appendix H.4: Citizen Security Emergencies Coordinated in Totoracocha

Service	**Year**			**Total Emergencies**
	2021	**2022**	**2023**	
Scandal Private	322	373	92	787
Scandal Public	265	218	62	545
Drunk	300	258	30	588
Mugging	58	229	52	339
Theft	86	109	26	221
Illegal substance	18	25	30	73
Scandal	53	75	34	162
Heist	14	80	22	116
Aggression	25	50	7	46
Tenancy Scandal	35	25	11	71

Consumption of Controlled Substances	18	6	0	24
Domestic violence	28	54	7	89
Physical Aggression	21	18	7	46
Inter-familial violence	12	30	6	48
Burglary	13	14	4	31
Stealing car parts	23	29	11	63
Stealing attempts	3	19	5	27
Stealing from banks	4	2	1	7
Armed person	3	10	5	18
Psychological domestic violence	42	6	3	51
Car jacking	3	6	2	11
Immoral acts	3	1		4
Verbal aggression	4	1	1	6
Sex crimes	1	2	0	3
Motorcycle theft	2	2	0	4
Stealing from schools	1	0	0	1
Public immoral acts	2	2	0	4
Sexual abuse	2	2	1	5
Sexual harassment	2	1	2	5
Field Rushing	1	0	0	1
Stealing from Public places	0	0	0	0
Armored car jacking	1	0	0	1
Violence of minors	0	0	0	0
Stealing from will	0	0	1	1
Knife Possession	0	1	0	1

Appendix I: Luis Cordero Distance and Game Marker Designs



Appendix J: Pilot Test Observation Guide - Luis Cordero

Date	Session 1 Session 2	Arrival Dismissal	Weather
Distance Marker #			
	# of Children alone	# of Children with peers	# of Children with parents
Interact with chalk drawings			
Do not interact with chalk drawings			
Type of Interaction			
	# of Children	# of Parents	
Glances/read sign			
Brief interaction (<30sec)			
Long interaction (>30sec)			

Appendix K: Pilot Test Observation Guide - Abelardo Tamariz

Pilot Test Observation Guide: Abelardo Tamariz			
Name of observer:			
Date	Location	Start Time: End Time:	Weather
Mama-Ocllo Entrance			
	# of Children alone	# of Children with peers	# of Children with parents
1 tally = 1 child			
Using the space			
Not using the space			
Interacting with chalk drawings			
Do not interact with chalk drawings			