Encouraging Walking as a Form of Transportation in Cuenca, Ecuador

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ENCOURAGING WALKING AS A FORM OF TRANSPORTATION IN CUENCA, ECUADOR

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Abstract

Pollution is a growing problem around the world, including Ecuador. In Cuenca in 2014, it was found that 70- 90% of air pollution was caused by motor vehicles emissions alone. Our team combatted this issue by developing and pilot testing alternatives that could assist *La Empresa Pública Municipal de Movilidad Tránsito y Transporte de Cuenca* in encouraging people to walk short distances rather than drive. Through our initial surveys, our group found that increased car use due to parents driving their children to school in Cuenca was a problem that could be improved through school walking programs such as school route maps, walking buses, and school competitions. We then determined that walking buses coupled with school route maps would be the most effective in encouraging walking. From this, we conducted a pilot test of these initiatives and created a manual to aid in the expansion of the program to other schools in Cuenca.

Sinopsis en Español

Contaminación del medio ambiente es un problema global que ha estado creciendo rápidamente. En Cuenca en el año 2014, nuestro patrocinador reportó que las emisiones de vehículos motorizados han contribuido 70% a 90% de la contaminación en la atmósfera. Nuestro grupo planea combatir este problema con el desarrollo y la implementación de algunas alternativas que puedan ayudar a La Empresa Pública Municipal de Movilidad, Tránsito y Transporte de Cuenca en su meta de alentar caminando para viajes muy cortos en vez de manejar. A través de nuestras encuestas iniciales, nuestro grupo descubrió que el uso del carro debido a los padres quien conducen a sus hijos a las escuelas en Cuenca era un problema que podría mejorarse mediante los programas escolares de caminatas. Entonces determinamos que los buses para caminar juntos con los mapas de rutas escolares serían los métodos más eficaces de alentar el caminar. De esto, hemos realizado una prueba piloto del bus para caminar y hemos creado un manual para ayudar a nuestro patrocinador en la expansión de este programa a otras escuelas en Cuenca.

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Our team would like to extend our deepest gratitude to all of the employees at EMOV-EP who helped us during our time in Cuenca. Our project would not have been possible without all of the help from the members of both the Non-motorized Transit Department as well as the Department of Signage. We would like to thank you for all of the time and effort you have put towards our project, for not only making us feel welcome and comfortable at EMOV-EP, but for also helping us with anything we may have needed. Furthermore, we want to deeply thank the Agents of Civil Traffic without whose continued support, we would not have been able to run our pilot test.

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Authorship

Susan Elliott contributed to the conduction of surveys in schools and the parks; the compilation and analysis of data; the photography and analysis of the neighborhood around Escuela Ricardo Muñoz; the making of the Google map used to identify necessary improvements to pedestrian infrastructure; the presentations to schools and parents; the presentation to parents and volunteers for the walking bus training program; the writing of the walking bus manual; the creation and presentation of the poster; the translation of walking bus manual, surveys, forms, pamphlets and presentations; and the writing and editing of each section of the report.

Danilo Lozada contributed to the conduction of surveys in schools and city parks; the compilation and analysis of data; the photography and analysis of the neighborhood around Escuela Ricardo Muñoz; the creation of walking bus pamphlets for parents and volunteers; the presentations to schools and parents; the creation and presentation of the poster; the translation of walking bus manual, surveys, forms, pamphlets and presentations; and the writing and editing of each section of the report.

Cassy Rios contributed to the conduction of surveys in schools and city parks; the compilation and analysis of data; the photography and analysis of the neighborhood around Escuela Ricardo Muñoz; the making of the Google map used to identify necessary improvements to pedestrian infrastructure; the creation of walking bus pamphlets for parents and volunteers; the presentations to schools and parents; the writing of the walking bus manual; the creation and presentation of the poster; the translation of walking bus manual, surveys, forms, pamphlets and presentations; and the writing and editing of each section of the report.

Noah Rockwell contributed to the conduction of surveys in schools and city parks; the compilation and analysis of data; The photography and analysis of the neighborhood around Escuela Ricardo Muñoz; the construction of the safe route neighborhood map on ArcGIS software, the making of the Google map used to identify necessary improvements to pedestrian infrastructure; the presentations to schools and parents; the creation and presentation of the poster; and the writing and editing of each section of the report.

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Executive Summary

Introduction and Background

Air pollution is a problem affecting many large cities throughout the world. A study conducted in the United States by the Union of Concerned Scientists concluded that a large percentage of the carbon monoxide and nitrous oxides in the atmosphere was due to motor vehicles (2014). Furthermore, the "stop and start" type of city driving yields a much higher concentration of vehicular pollutants than the continuous flow of highway traffic (De Vlieger, De Keykeleere, & Kretzschmar, 2000).

There are several detrimental health and environmental effects incurred by air pollution. In the short term, pollution affects health by causing difficulty in breathing and irritation of the throat and nose. In the long term, it also increases the exposed person's risk of heart and lung disease. Environmentally, certain air pollutants trap heat, leading to an increase in global temperatures (Massachusetts Department of Environmental Protection, n.d.). This is a problem as higher global temperatures cause multiple adverse effects including rising sea levels and destruction of coastal areas (Union of Concerned Scientists, n.d.).

Pollution has become a problem in Cuenca over the past several decades as private vehicle usage has increased significantly. Between the years of 1975 and 2013, Ecuador experienced an increase of 240,000 residents (Sander, Mila- Salama, & Feuerbacher, 2015). In a similar time frame, the number of private vehicles registered has increased annually by 12% and the number of people using motorized transit as their main source of transportation throughout the city has increased to 38% of the population (Sander, Mira- Salama, & Feuerbacher, 2015 and EMOV-EP, 2015).

To combat air pollution caused by the increasing use of motor vehicles, *La Empresa Pública Municipal de Movilidad Tránsito y Transporte (EMOV-EP)* – the municipal company in charge of mobility and transportation for the city – has taken a number of measures to combat motorized transit use. They have developed several programs to promote non-motorized means of transportation. These include initiatives such as Mobility Week, a week devoted to promoting cycling, and Parking Day, a day where parking spaces are turned into public spaces. They have also worked to make positive changes in pedestrian and cyclist infrastructure throughout the city (EMOV-EP, 2016).

Many other initiatives have been utilized around the world to encourage people to walk or bike instead of use motorized transit. The main initiatives found to have been implemented worldwide include: distance indicators, school maps, walking buses, and school competitions. Distance indicators are signs that are posted around a city educating the public on the time required to walk or bike to popular destinations from specific intersections. School maps are maps noting important pedestrian infrastructure so that parents can decide which route is safest for their children to walk. Walking buses are groups of students who walk to school together along with an adult supervisor for increased safety. Finally, school competitions are contests between classes whereby the class with the furthest distance walked in a given time wins a prize.

The goal of this project was to aid EMOV-EP in their promotion of non-motorized transit. Specifically, our project worked to develop and pilot test alternatives that could assist EMOV-EP in

encouraging walking distances less than five kilometers. To achieve our project goal we developed five main objectives:

1. Assess the feasibility of distance indicators
2. Assess the feasibility of school program initiatives
3. Determine pedestrian safety in the neighborhood surrounding chosen schools
4. Pilot test strategies to promote walking
5. Evaluate the quality of the program and gather recommendations for the continuation of future walking programs in Cuenca

Assessment of Researched Initiatives

To assess the feasibility of distance indicators, our team passed out surveys in El Centro, the historic center in Cuenca, over the course of three days. These surveys were aimed at determining if there was a large misconception of the time required to walk to specific locations within the historic center, as distance indicators specifically work to address this misconception. The results of our surveys showed that 64% of the 68 people surveyed in the historic center either correctly guessed the time required to walk to each destination, or underestimated it. Due to the adequate understanding of commuting time within El Centro as revealed by our surveys, we concluded that distance indicators would not be effective and therefore, other types of educational programs and events would be more useful in encouraging walking.

FIGURE 1: Our team passing out surveys in El Centro

Our team also simultaneously worked with schools to assess the feasibility of school route maps, walking buses, and school competitions while assessing the feasibility of distance indicators. To properly implement any of the above programs, there needed to be interest and support within the community. Therefore, to properly evaluate the viability of these programs, we passed out surveys to three different schools – Rafael Aguilar, Herlinda Toral, and Ricardo Muñoz – to gauge parental interest and support. These surveys also contained questions regarding the modes of transportation students used to get to school. To determine at which school we wanted to perform our pilot test, we looked at the demographic of the school, the parents' interest and support, and the reasons why parents drove their children to school. Our sponsor had also informed us that Ricardo Muñoz was one school that had been identified as having high traffic congestion. Due to the above factors, we chose to focus our assessment on Ricardo Muñoz. To create a program which properly addressed the reasons for which parents drove their children to school, our team decided to pilot test school route maps and walking buses at Ricardo

Muñoz. We also suggested school competitions that could be implemented at Ricardo Muñoz in the future after full implementation of the school route maps and walking buses.

Implementation of School Walking Programs

To begin the implementation of the school route map and walking bus, we evaluated the safety of the neighborhood surrounding Ricardo Muñoz. We walked around the neighborhood and identified the locations of stop signs, crosswalks, parks, busy streets, and moderately busy streets. After gathering this information, we created a complete district map that depicted all of the collected information. After this, another survey was passed out asking parents who wished to participate for their addresses. The compilation of the information in the school map and the addresses of the participants allowed us to create the safest routes possible along which kids could walk to school and determine the specific bus stops at which children could be picked up along the route.

We then identified in the neighborhood and specifically along the designated routes that were in need of infrastructural improvements and suggested these improvements to EMOV-EP. We created a separate map that included the suggested locations for both new crosswalks, repainted crosswalks, and pertinent pedestrian signage. Our team then met with multiple departments at EMOV-EP and the municipality to start working on repainting degraded crosswalks and performing engineering studies in order to paint new crosswalks.

Once we had fully organized the program, we held a training session in conjunction with EMOV-EP to discuss the logistics of the pilot test with the parents prior to launch. The following two days, we pilot tested our program to determine areas of improvement for the future continuation of our program.

FIGURE 2: Day One of the pilot test for Ricardo Muñoz

Conclusion and Recommendations

Through initial feasibility assessments and a pilot test of the walking bus at a local school, our team compiled recommendations for the continuation of a comprehensive walking school bus program to encourage walking at schools throughout the city of Cuenca. To improve the program in the future, our team compiled the following recommendations for our sponsor:

- Collaborate with *El comité de los padres de las familias* when they first establish a walking bus program in a school
- Work closely with the teachers and faculty of the school

- Focus on a younger age demographic of ten and under
- Ensure that routes only cross a busy street once
- Determine specific meeting places with participants both before and after school

There was a large amount of enthusiasm from both the parents and faculty at Ricardo Muñoz about the walking bus program. The pilot test ran with only a small sample of the school but even so, included a student who used motorized transit prior to the test. Therefore, our team projected a great potential in the successful creation of walking bus programs throughout schools in Cuenca.

Resumen Ejecutivo

Introducción e Investigación Inicial

Contaminación es un problema que afecta muchas ciudades grandes sobre todo el mundo. Un estudio hecho en los Estados Unidos por la Unión de Científicas Preocupadas dijo que un gran porcentaje del monóxido de carbón y óxidos de nitrógeno en la atmósfera es por los vehículos motorizados. Además, conducir en la ciudad produce una concentración más grande de contaminantes que conducir en las autopistas. Y eso es por el tipo de condicionamiento que ocurre en la ciudad específicamente durante la hora pica (De Vlieger, De Keykeleere, & Kretzschmar, 2000).

Han algunos efectos de la contaminación que son detrimentales para la salud y el medioambiente. En el corto plazo, contaminación afecta la salud por hacer más difícil respirar e irritar la garganta y la nariz. En el largo plazo, contaminación también aumenta el riesgo de la enfermedad del corazon y pulmon. Para el medioambiente, unas ciertas contaminantes atrapan el calor y hacen una aumenta de la temperatura global (Massachusetts Department of Environmental Protection, n.d.). Estas temperaturas más altas afectan el mundo por causar una aumenta en el nivel del mar y destruir los áreas costales (Union of Concerned Scientists, n.d.).

Contaminación ha cambiado a un problem en Cuenca durante las últimas décadas por la aumenta del uso del vehículo privado. Entre los años 1975 y 2013, la población del Ecuador ha crecido en 240,000 residentes (Sander, Mila- Salama, & Feuerbacher, 2014). Durante el mismo periodo del tiempo, la cantidad de vehículos privados en Cuenca ha aumentado por 12% cada año. También, el número de residentes que usan transporte motorizado como su método de transporte principal ha aumentado a 38% de la población (Sander, Mira-Salama, & Feuerbacher, 2014 and EMOV-EP, 2015).

Para combatir la aumentación del uso de los vehículos como la manera de transporte principal, y por último la contaminación, *La Empresa Pública Municipal de Movilidad, Tránsito, y Transporte (EMOV-EP)* ha hecho algunas cosas para luchar el uso de los vehículos motorizados. Ha desarrollado algunos programas para fomentar los métodos de transporte no motorizado. Estas iniciativas incluyen "*La Semana de Movilidad"* y *"Parking Day"* (EMOV-EP, 2016).

Han muchas otras iniciativas que ha sido implementado sobre todo el mundo para fomentar caminar o ir en bicicleta en vez de transporte motorizado. Las iniciativas principales desde todo el mundo son: indicadores de distancia, mapas de rutas escolares, buses para caminar, y competencias escolares. Indicadores de distancia son señales que están alrededor de la ciudad para informar el público sobre el tiempo necesario para caminar o ir en bicicleta a destinos populares desde intersecciones especificadas. Mapas de rutas escolares son mapas que notan infraestructura importante para los peatones para que los padres pueden decidir cuál de las rutas son más seguras para sus hijos caminan a la escuela. Los buses para caminar son un grupo de estudiantes que caminaran juntos a la escuela con uno o más adultos voluntarios para la seguridad. Por fin, las competencias escolares son competencias entre las clases en que la clase que camina la mayor distancia en un tiempo especificado gana un reconocimiento.

La meta de nuestro proyecto fue ayudar a EMOV-EP en su promoción de transporte no motorizado. Específicamente, nuestra meta fue desarrollar y probar algunas iniciativas que pueden ayudar EMOV-EP en fomentar caminar como una forma de transporte no-motorizado. Para lograr esta meta, hemos creado estos cinco objetivos:

1. Evaluar la viabilidad de los indicadores de distancia
2. Evaluar la viabilidad de los programas escolares
3. Determinar la seguridad peatonal en el barrio alrededor de la escuela elegida
4. Hacer una prueba piloto para nuestra iniciativa
5. Evaluar la calidad del programa y recopilar recomendaciones para la continuación de programas caminatas en Cuenca en el futuro

Evaluación de iniciativas investigadas:

Para evaluar la viabilidad de los indicadores de distancia, Nuestro equipo distribuyó encuestas en El Centro, el centro histórico de Cuenca, en el transcurso de tres días. Estas encuestas fueron dirigidas a determinar si había un gran malentendido del tiempo necesario para caminar a lugares específicos dentro del centro histórico, ya que indicadores de distancia trabajan específicamente para hacer frente a este malentendido. Los resultados de nuestras encuestas demostraron que 64% de las 68 personas encuestadas en el centro histórico correctamente adivinaron el tiempo necesario para caminar a cada destino, o lo subestimaron. Debido a la comprensión adecuada de tiempo de transporte en El Centro revelada por nuestras encuestas, concluimos que los indicadores de distancia no serían eficaces Si se instalaran en El Centro y por eso, otros tipos de programas educativos y eventos serían más útiles en alentar el caminar.

FIGURA 1: Retiramos Encuestas en El Centro

Trabajando con escuelas fue otro método investigado para promover el uso de los modos no motorizados de tránsito. Por lo tanto, al mismo tiempo trabajamos con las escuelas para evaluar la viabilidad de los mapas de rutas escolares, buses para caminar, y competencias escolares y también evaluar la viabilidad de indicadores de distancia. Para iniciar correctamente cualquiera de los programas anteriores, se necesitaba el interés y el apoyo de los padres de los alumnos. Por lo tanto, para evaluar correctamente la viabilidad y la eficacia de estos programas, distribuimos encuestas a tres diferentes escuelas – Rafael Aguilar, Herlinda Toral, y Ricardo Muñoz – para medir el apoyo y el interés de los padres. Estas encuestas también contienen preguntas sobre el modo de transporte que los padres utilizan para llegar a la escuela. Para determinar en qué escuela queríamos hacer la prueba piloto, miramos la demográfica de la escuela, el interés y apoyo de los padres, y el número de padres que condujeron a sus niños a la escuela. Nuestro patrocinador también nos informó que Ricardo Muñoz era

una escuela que había sido identificada por tener una congestión de tráfico alta. Debido a los factores mencionados, elegimos enfocar nuestra evaluación en Ricardo Muñoz. Debido al apoyo de los padres revelado a través de nuestras encuestas, Nuestro equipo decidió hacer una prueba piloto de los mapas de rutas escolares y buses para caminar en Ricardo Muñoz. También hemos sugerido competiciones escolares que podrían ser implementadas en Ricardo Muñoz en el futuro después de completamente implementar los mapas de rutas escolares y buses para caminar.

La implementación de los programas escolares de caminar

Empezar la implementación de los mapas de caminatas y el bus para caminar, evaluamos la seguridad del barrio circundante Escuela Ricardo Muñoz. Caminamos alrededor del barrio e identificamos los ubicaciones de señales de pare, los pasos cebras, y parques – usar para las paradas del bus – calles concurridas, y calles moderadamente ocupadas. Después de recolectar esta información, hicimos dos mapas: el primero tiene pasos cebras decolorados y lugares recomendados para pasos cebras para EMOV-EP; el segundo tiene un mapa completo del distrito que representa toda la información arriba. Una otra encuesta se reparte y esta encuesta preguntamos los padres para sus direcciones. Podemos hacer la ruta más segura que los hijos pueden caminar, y determinar las paradas específicas para recoger los hijos a largo de la ruta con la información del mapa y las direcciones de los participantes.

Después, identificamos lugares en el barrio a largo de la ruta que necesitan mejoras infraestructuras como pasos cebras y señales de pare. Sugerimos las mejoras a EMOV-EP. Hicimos un otro mapa que sugiere lugares para pintar pasos cebras nuevos, mantener los pasos cebras decolorados y poner señalización peatonal y señales de rendimiento. Encontramos con varios departamentos en EMOV-EP y el Departamento municipal a empezar trabajo en los pasos cebras decolorados y empezar estudios de ingeniería a obtener pasos cebras nuevos.

Después de organizamos la programa, hicimos una reunión con EMOV-EP a hablar sobre las logísticas de la prueba pilota con los padres e hijos antes del comienzo de la programa. En el próximo dos días, hicimos la prueba pilota a evaluar nuestra programa y determinar mejoras para la programa o cambios a implementar en el futuro.

Conclusión y recomendaciones:

A través de evaluaciones iniciales de factibilidad y una prueba piloto de un bus para caminar en una escuela local, nuestro equipo ha compilado recomendaciones para la continuación de un programa comprensivo de bus para caminar para alentar el caminar en las escuelas de toda la ciudad de Cuenca. Para mejorar el programa en el futuro, nuestro equipo examinó los resultados de nuestra prueba piloto y ha compilado las siguientes recomendaciones para nuestro patrocinador:

- Colaborar con El comité de los padres de las familias cuando empiezan a establecer un programa de bus para caminar en la escuela.
- Trabajar muy de cerca con los maestros y profesores de la escuela
- Enfocarse en una edad demográfica más joven de diez y menor

- Asegúrese de que las rutas sólo cruzan una calle muy ocupada, cuando estén planeando las rutas
- Determinar lugares específicos de reunión con los participantes antes y después de la escuela

FIGURA 2: El primer día de nuestra prueba piloto

Había una gran cantidad de entusiasmo de parte de los padres y Facultad en Ricardo Muñoz sobre el programa de los buses para caminar. La prueba piloto fue solamente con una pequeña muestra de la escuela pero aun así, incluyo un estudiante que utilizaba un modo motorizado de tránsito antes participar en la prueba. Por lo tanto, nuestro equipo proyecta un gran potencial de éxito con la creación e implementación de los programas de buses para caminar a través de las escuelas de Cuenca.

1. Introduction

Air pollution is a problem in many cities around the world due to the resulting environmental and health impacts (Bravo, Son, Gouveia, & Bell, 2016). It not only increases the percentage of greenhouse gases in the atmosphere causing a gradual increase in global temperature (American Chemical Society, n.d.), but also causes human health to suffer because it leads to increased risks of certain diseases, such as heart disease(American Lung Association, 2016) and asthma (Victorin, 1993).

Vehicular emissions are responsible for a majority of this air pollution. In 2013, a study conducted by the Union of Concerned Scientists concluded that in the United States, more than 50% of carbon monoxide and nitrous oxide in the atmosphere stemmed from these emissions (2014). Additionally, the amount of vehicular emissions per car significantly increases with traffic congestion because of higher fuel consumption rates per mile traveled due to the constant stopping and starting during rush hour(De Vlieger, De Keykeleere, & Kretzschmar, 2000). Therefore, many places around the world have identified traffic congestion as a main contributor to air pollution.

This has also been found to be true in Cuenca, Ecuador. In 2015, *La Empresa Pública Municipal de Movilidad Tránsito y Transporte (EMOV-EP),* the governmental department in charge of transportation for the city, determined that for most common pollutants, vehicular emissions were the largest contributor. Furthermore, the percentage of people using private motor vehicles as their main source of transportation had grown from 20% to 43% of the population of Cuenca between the years of 1992 and 2012(Sander, Mila- Salama, & Feuerbacher, 2015). This trend foreshadows more growth in the coming years potentially leading to increased traffic and air pollution within the city if no attempts to combat this are implemented.

There have been attempts to combat this projected increase in motor vehicle usage around the world. Along with implementation of public transportation and improved infrastructure, one of the predominant means of trying to reduce vehicular usage is the encouragement of walking short distances. This has been done around the world through the use of distance indicators, neighborhood maps and school programs. For example, in the United States, Walk Your City has implemented a program where signs denoting how long it would take to walk to popular areas were put up at intersections to educate the populace on actual as opposed to perceived distances (Walk Your City, 2017). Furthermore, in Seattle, Washington, many schools have implemented school walking maps. These maps have been created to reduce morning traffic, increase child safety, and promote a healthy lifestyle from an early age (Seattle Department of Transportation, 2017). Finally, various communities worldwide have implemented walking buses. These programs ensure child pedestrian safety and thus increase the quantity of students walking to school (VicHealth, 2015). All of these measures have reported an increase in the amount of pedestrian activity where these initiatives have been implemented.

Measures being implemented in Cuenca by *EMOV-EP* mainly consist of educational programs including Mobility Week and Parking Day. These measures also include infrastructure improvements such as the creation of bicycle paths and additional crosswalks (EMOV-EP, 2016). Furthermore, EMOV-

EP has collaborated with the University of Azuay to produce air quality reports to educate the public on the effects of vehicular usage and emissions (EMOV-EP, 2016). Despite the success of the initiatives in Cuenca, there were other programs from around the world that had also increased walking and biking rates that had yet to be attempted. Therefore, our goal while in Cuenca was to compare several initiatives that could assist EMOV-EP in their promotion of non-motorized transit and to pilot test the most feasible option. To achieve this goal, we formulated 5 main objectives:

1. Assess the feasibility of distance indicators
2. Assess the feasibility of school program initiatives
3. Determine pedestrian safety in the neighborhood surrounding chosen schools
4. Pilot test strategies to promote walking
5. Evaluate the quality of the program and gather recommendations for the continuation of future walking programs in Cuenca

In Ecuador, we assessed the feasibility of distance indicators and school walking programs in order to choose the best option of the two to pilot test in an effort to alleviate vehicular usage around the city and thus reduce the environmental and health impacts of pollution.

2. Background

2.1 Air Pollution

2.1.1 Air Pollution Causes and Effects

Vehicular emissions have been found to be the main cause of air pollution in various cities around the world. For example, in Victoria, Australia in 2006, 72% of all carbon monoxide emissions were found to be due to vehicles (EPA Victoria, 2016). Furthermore, in 2013, half of the carbon monoxide and nitrous oxides emitted into the air in the US were due to vehicle emissions (Union of Concerned Scientists, n.d.).

Air pollution presents a problem for both health and environmental reasons. From a health standpoint, air pollution has multiple possible detrimental effects. In the short term, pollutants can cause irritation of the nose and throat and breathing difficulties. However, in the long term, pollutants from vehicular emissions worsen pre-existing heart and lung conditions (Massachusetts Department of Environmental Protection, n.d.). Furthermore, they can severely affect asthmatics and increase a person's susceptibility to pneumonia and influenza (Victorin, 1993 and Union of Concerned Scientists, 2014).

Air pollution also poses a serious threat to the environment. The main air pollutants coming from vehicular emissions are carbon monoxide, nitrous oxides, sulfur dioxide and ozone (Union of Concerned Scientists, 2014). These specific pollutants affect the atmosphere by trapping in heat leading to an increase in global temperature (Massachusetts Department of Environmental Protection, n.d.). This poses a threat to humans as it leads to a rise in sea level which causes floods and destruction for many coastal areas (Union of Concerned Scientists, n.d.) In addition to this, forest trees are affected as the uptake of pollutants by the trees leaves them vulnerable to insects. Acidic rain and drought, both caused by air pollution, also have negative impacts on trees as well as on different ecosystems (United Nations Emvironment Programme, n.d.).

Vehicular emissions have a detrimental impact on health and the environment under normal conditions which is only made worse by the fact that these emissions increase significantly under rush hour traffic conditions. During a study conducted in Belgium where researchers performed driving tests under various conditions, city driving consistently yielded higher emissions than highway driving (De Vlieger, De Keukeleere, & Kretzschmar, 2000). This was due to the fact that city driving entails lower speeds than rural driving and fuel efficiency decreases at lower speeds. Additionally, emissions are increased even more during traffic congestion. In the same Belgian study, vehicular emissions increased anywhere from 10% to 200% on highways between normal city driving conditions and rush hour traffic conditions due to the constant stopping and starting of vehicles (De Vlieger, De Keukeleere, & Kretzschmar, 2000).

2.1.2 Air Pollution in Cuenca

In recent years, EMOV-EP has begun to produce air quality reports for Cuenca, Ecuador to assess the levels of pollution in the city and the locations where high concentrations occur. They set up stations around the city that measured the levels of specific pollutants (nitrogen dioxide, particulate matter (PM), sulfur dioxide, carbon monoxide, and ozone) for a year to gather appropriate data. The most recent air quality reports available were from 2014 and showed that, with the exception of one, the levels of each pollutant were under the limit set forth by the World Health Organization (see Appendix A1 for more detail.) EMOV-EP has stated that, especially in the cases of sulfur dioxide and nitrogen dioxide, even though they were below the WHO safe levels, they still posed a threat because they are precursors to PM2.5 (Parra & Espinoza, 2015) which is one of the worst air pollutants from a health standpoint due to their small size and ability to easily get into the bloodstream (American Lung Association, 2016). Since this air pollution is greatly increased by amounts of traffic within Cuenca, programs aimed at helping alleviate traffic are useful to combat the problem of air pollution.

2.2 Traffic Congestion

2.2.1 Traffic in Cuenca

The traffic in Cuenca, Ecuador can be attributed to population growth and economic growth leading to more cars on the road. As shown by Figure 3, in the past 40 years, there has been an annual increase in the number of registered private vehicles by about 12% every year (Sander, Mira- Salama, &

Feuerbacher, 2015). This, in part, is due to the fact that Ecuador as a whole has seen a rapid growth of GDP since the early 2000s (Worldbank Data, 2016*).* This economic growth is in part due to a significant population increase. The population of Cuenca, Ecuador increased from 110,000 to 350,000 residents between the years of 1975 and 2013 (Sander, Mila- Salama, & Feuerbacher, 2015) and the population of Ecuador increased from approximately 7 million to 16 million during the same time frame (Worldbank Data, 2016). This increase in residents contributed to a higher capacity to make revenue which led to increased GDP and number of purchased cars. The increase in the number of registered vehicles in Cuenca specifically could also be attributed to urban sprawl. As the city grew, more people began using cars and taxis as their main form of transportation. This number rose to 38% of the population by the year 2015 (EMOV-EP, 2015). Cuenca is trying to address these issues of traffic by improving public transportation within the city and by encouraging non-motorized transit such as walking and biking.

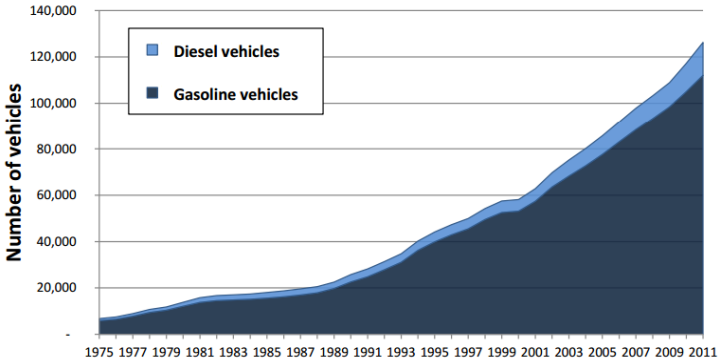

FIGURE 3: Number of Registered Vehicles in Cuenca (Sander, Mira- Salama & Feuerbacher, 2015)

2.3 Benefits of Non- motorized Transit

2.3.1 Benefits of walking

Walking has been found to result in numerous short and long term health benefits for both adults and children. In the short term, walking reduces stress levels and increases creativity levels (Breene, 2013). In addition, in the long term, walking has been found to have equal health benefits with running when it comes to reducing blood pressure, cholesterol levels and risk of diabetes (American Heart Association, 2016). Along with the aforementioned health benefits, it has also been shown that children who walk to school arrive more alert and have higher test scores than children who do not walk to school (Sustrans, n.d.). (More information regarding the health benefits of walking and studies relating to them can be found in Appendix A2.)

2.3.2 Benefits of cycling

Along with walking, cycling also positively affects health. Cycling has been found to combat

stress and depression (East Carolina University, n.d.) while augmenting the endorphins in your body to increase happiness (Harvard Medical School, 2016). It also increases the amount of grey matter in your brain (University of Montana, n.d.) which heightens intelligence (Sinicki, n.d.). A study conducted in the Netherlands found that the benefits of cycling outweigh the risks and can increase life span anywhere from 3-14 months (De Hartog, Boogaard, Niiland, & Hoek, 2010). (Additional information regarding studies and benefits of cycling can be found in Appendix A2.)

2.4 Barriers to Non-motorized Transit

The safety and infrastructure of an area play an integral role in determining whether the residents and guests of the area choose to walk or cycle. Some surveys conducted in the United States reveal that the most popular reasons for not walking or biking are perceived safety and a dearth of sidewalks (Alta- Planning + Design, RBF Consulting, 2013). Driver aggression can be detrimental to pedestrians' and cyclists' safety when cars do not respect pedestrian signage. However, motor vehicles are not the only hazards faced by pedestrians and cyclists, as lack of proper infrastructure also discourages the use of non-motorized transit.

2.4.1 Perception of Traffic in Ecuador

One possible reason for the lack of pedestrian or cyclist traffic is the dangerous and often unregulated driving in Ecuador. Motorists rarely follow traffic laws, often speeding, overfilling lanes, and barely respecting pedestrians or cyclists' right of way (Al Bourassa, 2016). This lack of respect for traffic laws affects the use of non-motorized transit in Cuenca as a survey conducted in 2015 revealed that 44% of people in the city felt that bikes were unsafe to use due to drivers not respecting pedestrian and cyclist signage (EMOV EP, 2015).

2.4.2 Infrastructure in Cuenca

Condition of infrastructure can also discourage people from walking or biking due to safety concerns. In an email correspondence, a resident of Cuenca, Ecuador who walks and bikes all around the city as her main form of transportation, said that while most neighborhoods have sidewalks, "they can be treacherous, with broken patches and sometimes iron rods sticking out." (Personal communication, November 11, 2016). This perception of the infrastructure in Cuenca is important to note as it can affect residents' willingness to walk

2.5 Attempts to Encourage Walking from Around the World

There have been many attempts from around the world to increase walking as a form of transportation. In order for our project to properly propose a possible initiative for Cuenca, it was necessary for us to fully understand the breadth and efficacy of initiatives that have been tried worldwide. The main types of initiatives we found were changes to infrastructure and implementation of educational programs. As our project looked to focus on possible solutions without changing the existing infrastructure of Cuenca, the global and national initiatives below focus on increasing walking

through the use of walking buses, walking maps, distance indicators and educational programs.

2.5.1 Walking Buses

In Victoria, Australia, VicHealth- an organization which promotes healthy lifestyles- created a Walking School Bus Program in an attempt to increase the physical activity levels of children. A walking "bus" is a group of young children who walk to school together while being supervised by adults. This initiative focused on teaching elementary aged students the rules of the road while safely escorting them to school. This program was effective as the children participating were at an age where they were receptive to instruction on pedestrian education and could continue to practice these safe pedestrian habits in the future.

In order to safely implement this bus, traffic hazards were identified prior to creation of the bus routes. Based on the safety assessment, bus stops were placed along a route where children would be picked up and dropped off during their daily school commute. In addition, children and adults wore bright vests so that they were easily visible while traveling to increase safety. On average, the routes took around thirty minutes to travel and were about two kilometers in distance. There were a number of benefits for all of the participants. For the students, the benefits included: safe travel to school, increased physical activity, a sense of independence, and pedestrian safety education. The parents also benefited by saving money, ensuring safe travel of their children, and reducing personal stress levels. In addition, the community incurred multiple benefits such as reduced traffic around schools and a sustainable, non-polluting mode of transportation (VicHealth, 2015). Our Lady of Fatima Catholic Primary School began the program in conjunction with VicHealth in 2010. They determined that overall from the first to third school quarters, greenhouse gas emissions were reduced by 3,448 kg due to participation in the program. Furthermore, the school saved approximately $440,340 in total from decreased spending on school transportation (Healthy Active by Design, n.d.).

A similar initiative, known as Pédibus or Vélobus, was implemented in Lyon, France by an organization called Pignon sur Rue. This initiative was taken on by the communities in which it was implemented and was met with overall acceptance. This program yielded many of the same benefits as the walking bus in Australia listed above. Given these benefits, the Pédibus/Vélobus initiative has grown substantially, having been implemented in 37 communities, 73 schools, and transporting upwards of 2,000 kids daily to school ("Pignon sur Rue," n.d.).

2.5.2 Walking Maps

In a large number of states across the US, such as California, Nevada, and Washington, schools have implemented school route maps. In this initiative, the students' parents use the school route maps to draw the safest and quickest route to school for their children. These maps have been implemented as part of the Safe Routes to School Program in the hopes of reducing morning traffic and vehicular emissions, increasing child safety, and promoting a healthy lifestyle from an early age. Under this initiative, the number of students walking and biking to school has increased.

All of the maps were created in a similar way. For the school route maps created for Adams Elementary in Seattle, Washington, a map of the school and the surrounding two mile area was obtained and important information was added such as crosswalks, crossing guards, busy neighborhood streets, and streets lacking sidewalks. Specifically in the Seattle maps, there were rings around the chosen school which indicated the average time to walk or bike to the school from the area within the circle (Seattle Department of Transportation, 2017). (An example can be seen in Appendix A3.)

In July 2010, a different walking map (for example, see Appendix A4) was also developed and distributed across eight neighborhoods in Edmonton, Canada (City of Edmonton, 2012). This map differed from the previous maps because it was created for neighborhoods as opposed to schools. The purpose of this map was to combat obesity through the promotion of physical activity, specifically walking, within the whole city. The map was created by superimposing all wanted information onto an aerial photograph of the neighborhood. Important community locations and amenities were clearly depicted with simple icons.

After the map was mailed out, a cross-sectional, post-test only survey was used to collect information on the effectiveness of the maps in encouraging walking in the community. Out of the 155 respondents, 89 reported that they had received a copy of the walking map. Out of the 89 respondents with the map, 43.8% of respondents had discovered new places in their communities with the map. 91% of recipients stated that they found the map helpful and 76.4% agreed that the routes and destinations depicting encouraged them to walk more (Nykiforuk, Nieuwendyk, Mitha, & Hosler, 2012).

2.5.3 Distance Indicator

Walk Your City is a social enterprise based in the United States whose mission is to educate people on the actual distances to different locations to encourage people to walk. As shown in Figure 4 below, the people put up signs in major intersections that denote how long it will take to walk to popular locations within the city such as museums, restaurants, and parks. With the help of this company these signs have been implemented in dozens of US cities. One such city was Santa Fe in 2014 where citizens chose two districts in downtown Santa Fe between which they wished to increase pedestrian traffic. These signs were met with enthusiasm by the city of Santa Fe and its residents and they are working to further this initiative to increase the amount of walking that occurs within the city (Walk Your City, 2014). Furthermore, these signs have been proven to be effective as it relates to behavior and increasing choice to walk or bike as opposed to driving (personal communication, 2017).

FIGURE 4: Distance indicators in San Jose, CA

2.5.4 Educational Programs

A study performed by the Safe Routes to School organization has shown that in the last four

decades, the number of students walking and biking to school has dramatically decreased (National Center for Safe Routes to School, 2011). Therefore, programs have been initiated in communities across the United States to promote the use of non-motorized methods of transport to commute to school. Safe Routes programs encourage a non-motorized commute through upgrades to infrastructure, enforcement of traffic laws on routes to school, educational programs, and incentives within the school. In Cococino County, Arizona, a pedestrian safety class was taught and led to a 19% increase in the number of students who walk or bike to school. Another school in Revere, Massachusetts implemented incentives within the school to encourage walking including the "Golden Shoe Contest" where whichever class had the most students who walked to school won the Golden Shoe. These competitions increased walking from 9% of students to 15% (National Center for Safe Routes to School, 2012).

2.6 Attempts to alleviate private motor vehicle usage within Cuenca, Ecuador

2.6.1 Public Transportation

In a move towards establishing sustainable transport and decreasing the amount of cars on the roads, the government of Cuenca has reformed and instituted two forms of public transportation for the citizens to use instead of private cars. They have completely revamped and improved the public bus system to maximize its usage and availability for the citizens (Alternatur, n.d.). They have also made strides in the construction of a tram in the city that is planned to be completed by the end of 2017 (Narea, 2016). (For more details on these forms of sustainable transport, see Appendix A5.)

2.6.2 Our Sponsor: EMOV-EP

La Empresa Pública Municipal de Movilidad, Tránsito, y Transporte de Cuenca (EMOV-EP) is an organization that is comprised of committed and motivated individuals whose mission is to manage a system of sustainable mobility to provide quality and safe accessibility of motorized and non-motorized transit to the citizens of Cuenca. The Non-motorized Transit Department of EMOV-EP has made many strives to decrease the use of cars in Cuenca. They focus on encouraging citizens to walk and bicycle instead of using motorized transportation. They approach this goal through educational programs, city wide awareness campaigns, Agents of Civil Traffic and infrastructure investments (EMOV-EP, 2016). (For further detail on all of their initiatives see Appendix A6.)

2.6.2.1 Educational Programs

Educational training programs developed by EMOV-EP focus on education for both pedestrians and drivers. The educational programs for pedestrians focus on important aspects of pedestrian safety such as how to properly cross streets and how to safely take a bus. The educational programs for drivers were developed by EMOV-EP in collaboration with the mayor of Cuenca to re-train drivers of all the different modes of transportation within the city (EMOV-EP, 2016).

2.6.2.2 Public Awareness Campaigns

EMOV-EP has established several public awareness campaigns to promote awareness of non-motorized means of transit. These programs manifest themselves in several ways that help promote non-motorized transit in the city by combating misuse of public space and promoting harmony between drivers, pedestrians and cyclists (EMOV-EP, 2016).

2.6.2.3 Traffic Officers

EMOV-EP has invested in the training of ACT (Agents of Civil Traffic) officers to ensure safety and adherence to traffic and road laws. ACTs are responsible for enforcing pedestrian safety and training people about the importance of using the crosswalks and bus stops. These actions are intended to prevent citizens from having a negative view of non-motorized mobility due to lack of safety (EMOV EP, 2016).

2.6.2.4 Investments in Infrastructure

Investing in infrastructure is another way EMOV-EP has attempted to reduce the traffic problem in Cuenca. They have invested in reflective paint and signage to create and maintain crosswalks around the city- especially near educational institutions. By purchasing the materials to make more sidewalks, they strive to make the streets of Cuenca safer and more pedestrian friendly.

Through all of these initiatives, EMOV-EP has made great strives towards encouraging citizens to walk or bike instead of drive to their destinations.

3. Analysis and Realization of Initiatives

The goal of this project was to develop and pilot test alternatives to assist *La Empresa Pública Municipal de Movilidad, Tránsito Y Transporte de Cuenca* in their promotion of walking as a form of transit for travel less than 5 km. We chose to use a policy analysis approach as we planned on evaluating the benefits and drawbacks of several different alternatives before selecting a final one for implementation (Bardach, 2012).

After determining the root of the problem to be air pollution caused by motor vehicles within Cuenca, we conducted background research on the various ways other cities have addressed similar problems. We discovered methods such as distance indicators and school programs, all of which have been used to encourage walking within different cities around the world. When deciding which initiative to pilot test, we analyzed each for their efficacy and feasibility in Cuenca. To determine and properly pilot test the initiative that would result in the greatest increase of walking in Cuenca, we established a list of objectives:

1. Assess the feasibility of distance indicators

2. Assess the feasibility of school program initiatives
3. Determine pedestrian safety in neighborhood surrounding chosen schools
4. Pilot test strategies to promote walking
5. Evaluate the quality of the program and gather recommendations for the continuation of future walking programs in Cuenca

3.1 Assessment of researched initiatives

To determine which initiatives researched in our background should be attempted in Cuenca, our team assessed the feasibility of each of the initiatives as they applied to the different demographics within the city. We achieved this by distributing different surveys as mentioned below to gain as large a sample size as possible.

3.1.1 Assessment of Distance Indicators

To predict the effectiveness of distance indicators, our team needed to understand how many people walked around El Centro, how far they were willing to walk and how accurate their perception of travel time was. This information was vital to assessing the feasibility of distance indicators because this initiative combats a misconception of the time required to walk from one location to another. If this misconception concerning travel time in the city was not prevalent in Cuenca, the distance indicator initiative would not have been helpful in encouraging walking.

We obtained this information through government issued research reports as well as through two surveys conducted by our team. We chose to use surveys as opposed to more in depth interviews to allow us to reach a larger population and gain a base understanding of the perceptions and feelings of the residents of Cuenca (Vilela, 2015).

We passed out these surveys in the historic center over the course of three days (see Appendix B for exact locations and times of surveys). This provided the largest variance among people walking in El Centro. The first survey we passed out (see Appendix C) gauged the public perception of mobility while the second survey we distributed (see Appendix D) focused on people's perception of travel time within the historic city center.

Each of the following questions on our surveys were pertinent to our assessment for the reasons explained below:

1. What mode of transportation do you use to get into El Centro? This question gave us information about people's primary mode of transportation.
2. What mode of transportation do you use to get around El Centro? This question provided us with information on whether most people walked around El Centro or if the majority of the people used motorized transit.

3. How far are you willing to walk? (In minutes) This question helped us gauge whether the general population was willing to walk to locations within El Centro. For example, if a majority of the population was not willing to walk five minutes, than other initiatives would be more useful.
4. How far do you think the following locations are from Parque Calderon? (a central park in Cuenca) This question gave us information on the perception of distance in the downtown historic center of Cuenca and allowed us to see if people properly understood how far specific destinations were. We used this information to assess whether or not there was a misconception of travel time.

From these surveys, our team found that 62% of people reported walking as their main form of transportation around El Centro as seen in Figure 5 to the right. In Cuenca as a whole, more than half of common services such as banks, coffee shops, and stores are within a 5-minute walking range, while only 2% of common services are over a 30 minute walk. In the city mobility plan published by our sponsor, the historic downtown area of Cuenca was ranked an 8.2 out of 10 in terms of walkability. This refers to the close proximity of common services such as schools, banks, and shops from any given location in Cuenca. This ranking is one of the highest in Cuenca, with the greatest being an 8.9. El Centro's 8.2 ranking was solidified with around 97% of the people our team surveyed viewing the historic center as walkable. (For further explanation on the distribution of services in Cuenca and a map showing the walkability of microzones in Cuenca, see Appendix E.)

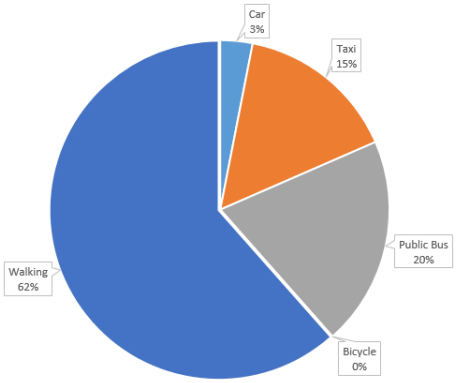

FIGURE 5: Methods of transportation used in El Centro

As shown in Figure 6 below, 61% of the people we surveyed were willing to walk more than 25 minutes to reach their destination. This trend was also mirrored by people who drove to El Centro as seen in Appendix E. Based on people's overall willingness to walk and the proximity of services in El Centro, we determined that a majority of the population of Cuenca would be willing to walk to their destinations within the historic city center.

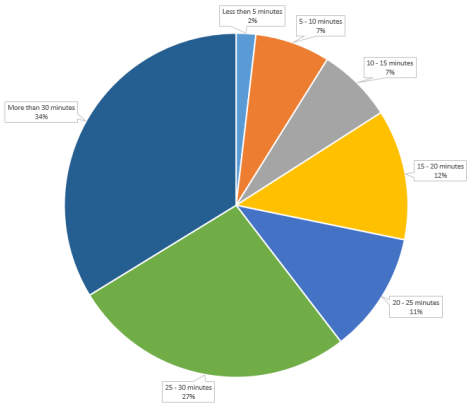

FIGURE 6: How long people are willing to walk in El Centro

We also surveyed the people of Cuenca to determine the accuracy of the perceived time required to walk to given locations. We needed to know if they correctly understood the amount of time it took to walk to certain places in El Centro to determine if distance indicators were the proper initiative to encourage them to walk. As shown in Figure 7 below, we found that 69% of the 68 people surveyed either correctly guessed or underestimated the time required to walk to the specified locations. Of the people who did overestimate the time, 22% overestimated the travel time by less than 5 minutes. Furthermore, those who did not walk around El Centro but instead reported using some form of motorized transit guessed even more accurately. When reviewing the results of the 24 people who reported using motorized forms of transit around El Centro, at least 83% of them either guessed the times correctly or underestimated the time required for each location. (For more graphs on the perception of time in El Centro for each specific location and for specific populations, see Appendix F.) From this data, we determined that despite the majority of people being willing to walk, there was not a prevalent misconception of time required to walk. As distance indicators combat misconceptions of travel time, we determined that other educational programs and events would be more useful in encouraging walking within El Centro.

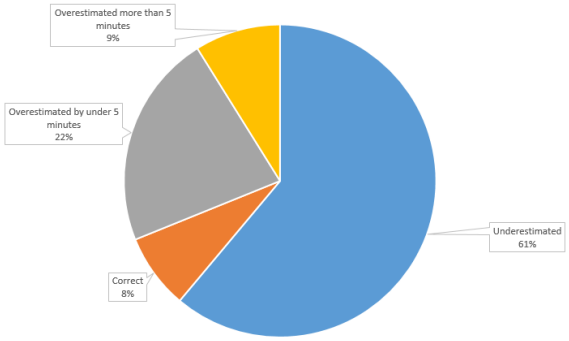

FIGURE 7: Perception of time required to walk within El Centro

After determining that distance indicators would not be a feasible initiative to encourage people to walk, we wanted to investigate the possibility of integrating them with the bike share program that our sponsor planned to implement. During our interview with Paul Calle (assistant in the Department of Non-motorized Transit at EMOV-EP), we gained useful information on how the bike share program would be organized. This allowed us to better understand whether or not we would be able to integrate distance indicators into the program. He informed us that the program was set to launch in March but that initially there would only be two bike share stations within the city. The system they planned to put in place would only rent bikes for an hour to allow for proper rotation of the available bicycles. Therefore, they were trying to advertise the bicycles as mainly for commuting into and out of the main downtown area. Due to this time restriction, the users of the bike share program would not have enough time to visit one of the places advertised on these signs and return their bike to a rental location. (For full transcript of the interview, see Appendix G.) As these distance indicators were planned to advise people to ride a bike to various locations in El Centro such as stores, markets and museums, we determined that this initiative would also not be compatible with EMOV-EP's proposed program.

3.1.2 Assessment of School Program Initiatives

To properly assess the feasibility of the researched school program initiatives- school route maps, walking buses and school competitions- we needed to gain insight into means of transportation to schools. We also needed to know why their parents preferred certain modes of transit over others. Furthermore, it was important that we gauge the enthusiasm and willingness of the parents to participate in the initiatives to assess which alternatives would be feasible to implement at local schools.

To collect this information, we surveyed parents at the following three schools about their current means of transportation and their perception on the researched initiatives (see Appendix H for the locations of each school and Appendix I for the full survey):

1. Rafael Aguilar
2. Herlinda Toral
3. Ricardo Muñoz

We chose to survey these schools because they represented varying demographics within the public schools of Cuenca. Rafael Aguilar was a rural public school while Herlinda Toral and Ricardo Muñoz were urban public schools thus representing higher economic levels. These responses allowed us to properly understand the differing commuting habits of various types of schools. Additionally, they also enabled us to project the success of these initiatives at other schools around the city to recommend further implementation to EMOV-EP.

Our team decided to focus on Ricardo Muñoz since our sponsor had identified it as a school facing a traffic congestion problem due to parents driving their children to school, as well as because the age range and economic level of the students were all conducive to the implementation of the initiatives we researched. Therefore, for the rest of the chapter, we focus our results on Ricardo Muñoz. (For complete results for the rest of the schools, see Appendix J)

We used the surveys from Ricardo Muñoz to determine which, if any, of the walking bus, school route map, or school competition initiatives would have an impact on the walking habits of the school. We received 124 responses to the 250 surveys we passed out. Based on the sample seen in Figure 8, walking and driving were the two most dominant means of transportation at Escuela Ricardo Muñoz with 48% of students walking to school and 31% of students being driven to school. Other means of transportation students used included bicycle, motorcycle, school bus, and public bus. Our surveys revealed that the most prominent reasons parents drove their children to school included ownership of a car, speed, and safety (for a complete list of the reasons people drove their children to school, see Appendix K). Due to the aforementioned reasons influencing parents to drive

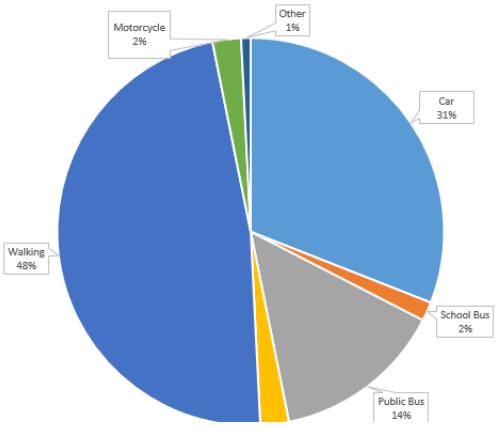

FIGURE 8: Different means of transportation used to commute to school

their children to school, we determined that our proposed initiatives would help increase the percentage of students who walk to school.

After determining that our initiatives had the potential to influence the commuting habits within the school, we evaluated which initiatives would have the greatest impact in order to select the best option. When determining which initiatives to implement at our chosen school we considered parental sentiments to ensure that whichever initiative we selected would be met with enthusiasm and have adequate support so it could be properly implemented.

We first focused on parental enthusiasm to determine whether we would have enough participation to properly implement the initiatives. Parents were asked to rank how much they liked each initiative allowing us to gauge which would be welcomed in the school. Figure 9 below shows the parental enthusiasm towards each initiative. The average of the parent rankings for the school route maps was 3.6/5. The average of the parent rankings for the walking buses was 3.0/5. The average of the parent rankings for the school competitions was 3.2/5. Overall, the averages for each initiative were valued at or above three.

In addition to enthusiasm for each initiative, there were a sufficient number of parents willing to participate in all of the initiatives presented, making them feasible to implement. (The distribution of willingness can be seen in Appendix L.) Based on our results, we determined that we had enough parental enthusiasm and willingness to participate in all three initiatives.

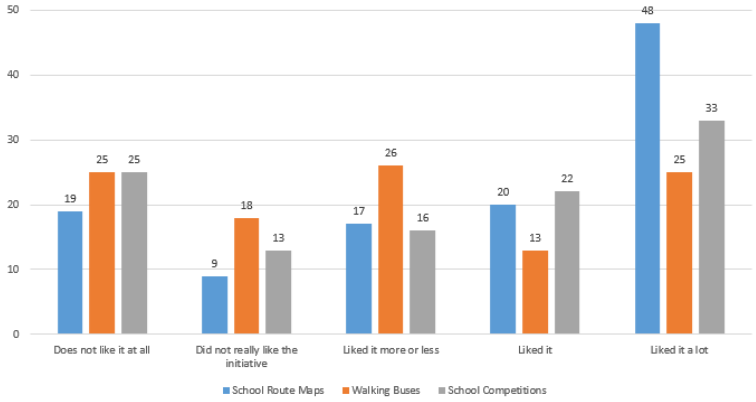

FIGURE 9: Parental sentiments about each initiative

We also wanted to know how the parents felt about their children's commute to school to ensure that our researched school initiatives would properly address these concerns. To effectively quantify the feelings of the parents, the responses to the question regarding perceived safety of commute to school were grouped into three categories. These categories included: positive responses regarding why parents felt the route was safe, infrastructure problems contributing to lack of safety, and societal problems creating unsafe conditions along the route. Examples of positive responses included increased safety due to the students walking to school with a family member and adequate signage along the route to school. Infrastructure related issues entailed inadequate signage or complete lack thereof. Societal problems involved a lack of respect from drivers and crime around the school. (See Appendix M for a list of all responses from each category.)

Over half of the parent's safety concerns regarded inadequate signage, lack of signage, and lack

of respect shown towards pedestrians from drivers. In addition, several parents said that they felt the route was safe when their child walked to school with an adult. Therefore, we determined that any initiative involving the schools needed to not only encourage the students to walk but also address these safety concerns. This would help increase the number of people walking while simultaneously ensuring the safety of the participating pedestrians.

Therefore, we determined that all three of the researched school initiatives would cause an increase in walking in schools as walking buses and school route maps would address safety concerns while school competitions and other incentives would work to encourage students to walk to school. We felt that the walking buses would make the route safer for the participants through adult supervision. Furthermore, walking in a group would increase safety because drivers tend to respect groups more than individuals. By instituting a program whereby children walk to school together under adult supervision as part of a walking bus along a safe route as denoted by school route maps, parents would be more likely to view their child's route to school as safe and would be more likely to allow their child to walk to school. Therefore, we focused on implementing school route maps and walking buses to address the concerns raised by the parents and therefore encourage walking within a select population of Cuenca. As school competitions received enthusiasm from parents, we decided to also research and recommend various school programs and incentives that could be implemented by our sponsor in the future.

3.2 Implementation of School Walking Programs

To safely implement a school walking initiative at Ricardo Muñoz we needed to ensure that the route we designed was safe for the participants and that the program was well organized. We therefore assessed the surrounding neighborhood and gave recommendations to EMOV-EP for improvements to the pedestrian infrastructure. We then distributed sign-ups to collect information on the participants and create a safe route for the walking bus. After holding an informational training session for the parents, we conducted a two day pilot test of the walking bus.

3.2.1 Assess pedestrian safety in neighborhood surrounding chosen school

To create safe school route maps and walking buses, we walked the neighborhood surrounding the chosen school to determine the safety of the area. Our team manually recorded all pedestrian infrastructure that could affect the safety of a student's walk to school. We focused mainly on intersections in need of crosswalks, yield signs or stop signs. Our team also recorded the level of traffic during the time of the morning commute to school to identify streets that could threaten the safety of student pedestrians.

Our team then compiled all of the collected information into two comprehensive maps to aid us in repairing the neighborhood infrastructure as well as determining the safe routes along which children should walk to school. As shown in Figure 10 below, the first map our team created compiled all of the data we collected about locations of crosswalks, stop signs, and conditions of sidewalks onto one map to properly display the information to our sponsors. In the portion of the map displayed below, the blue

rectangle is Ricardo Muñoz, the double headed arrows represent crosswalks, and the red circles represent stop signs (for the full route map created, see Appendix N).

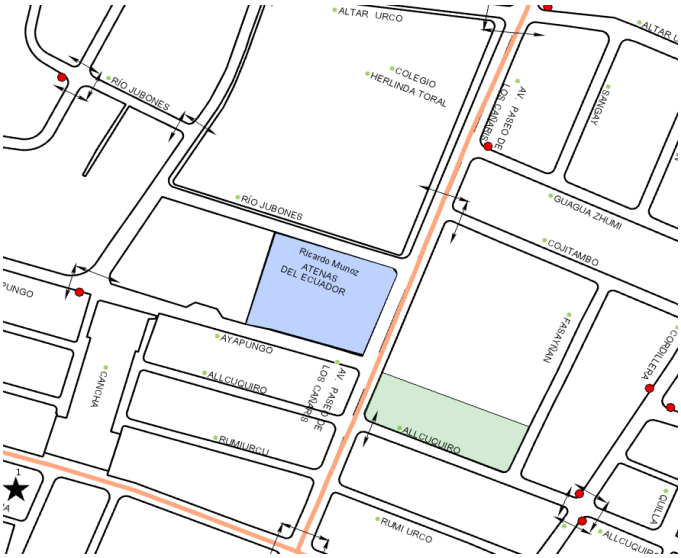

FIGURE 10: Map depicting location of crosswalks and pertinent pedestrian signage

As shown in Figure 11 below, the second map displayed the locations lacking in crosswalks or containing degraded crosswalks through symbols and linked pictures of the intersections (see Appendix O for entire map). The yellow lines placed across streets represent faded crosswalks that needed maintenance and the green lines placed across streets represent places where the team felt a crosswalk should be placed based on heavy traffic and potential frequent usage of said crosswalks. The points relate different information about the specific pedestrian infrastructure at that location. In this map our team did not include any information about which intersections already had crosswalks and stop signs as we included said data on a separate map for use by EMOV-EP in the future.

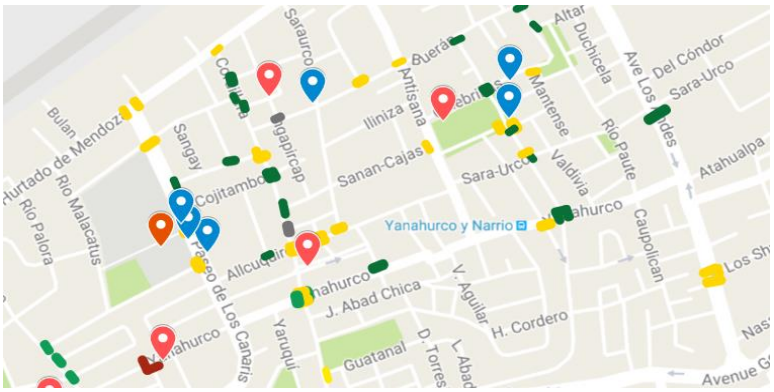

FIGURE 11: Map depicting location and state of pedestrian infrastructure

Our team then spoke with the department in charge of signage at EMOV-EP and the Municipality of Transit to discuss painting crosswalks as well as repairing faded crosswalks. We showed them the map displayed in Figure 11 above to explain specific intersections needing attention and why they were important not only to the safety of the children participating in the walking bus, but to the

safety of the neighborhood as a whole. We then utilized this comprehensive information about locations with crosswalks, pedestrian signage, and locations lacking in crosswalks to determine on which streets to create the walking routes to ensure the participants' safety while walking to school.

3.2.2 Organization of Pilot Test

To pilot test the chosen initiatives, we worked to organize the walking bus program and create the route maps before holding a training session with the participating adults and children in collaboration with EMOV-EP. To help us in our organization of the walking bus, our team informally interviewed the principal of Ricardo Muñoz to obtain information about the educational norms in Ecuador. He was very helpful in his insights into the organization of many schools in Cuenca as well as how they contact parents of the students. We took these suggestions into account when organizing the walking school bus and making suggestions for the future continuation of the program.

He informed us that many, although not all, public schools in Ecuador operate on a morning and afternoon schedule whereby half the students only attend in the morning and the other half only attend in the afternoon. He also informed us of the existence of a "*Comité de los padres de las familias*" which is a committee in the school consisting of at least one representative from each grade that helps the school with various projects. The way he contacts parents through the school is by sending home slips of paper with the students to give to their parents. He also talked to us about how the schools deal with injuries. There is a secretary in charge of risk at the school who we used as our contact person in case of emergency along the route; however, there was no nurse at the school. Instead they deal with any injuries themselves and, in more serious cases, they call 911, their emergency line.

To fully organize the route and the participants of the walking school bus, our team required certain information. We distributed initial sign-ups (see Appendix P) for the pilot test to the students, so they could give them to their parents as suggested by the principal. This sign up included the following questions:

1. Do you want your child to participate in the walking bus to school?

   If parents did not want their children to participate, then we did not need any of the subsequent personal information from them.

2. What is your name and what is the name of your child?

   Parents were asked this question if they decided that they wanted their children to participate in the program. This was necessary to organize the information received from the rest of the survey and to identify when and where each participant would meet their walking bus during their school commute.

3. At what intersection do you live?

   To determine the meeting points for the walking bus at which parents will pick up and drop off their children, we needed to know the general locations of the homes of students to make sure these locations are near where participants live.

4. How can we contact you?

We needed to gather contact information prior to their school vacation period to be able to contact them about informational and training meetings regarding the walking buses.

Using the responses from the parents about where the participants lived and the collected information compiled in the above maps about pedestrian infrastructure, our team determined the safest and most efficient route that the children could follow to safely walk to school during the walking bus as outlined in blue in Figure 12.

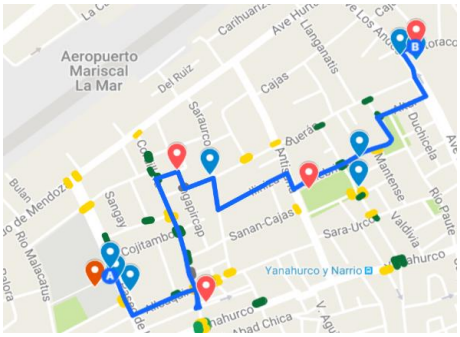

FIGURE 12: Map depicting route for Ricardo Muñoz

3.2.3 Discussion with Parents about Pilot Test

We discussed the walking bus program with both parents of the participants during the training and parents who were not participating in the program as they waited for their children to be dismissed from school. Due to the different contexts in which talked with the two types of parents, they had very different perspectives of the program, both of which were important to our recommendations.

In the meeting with the parents about the logistics of the walking bus, we focused on the parents' thoughts about the current organization of our project. The main topics and concerns brought up by the parents were that some of them lived relatively close to the school and to participate in the program, they would have to backtrack to reach the nearest bus stop. They also expressed that many of their students were ages ten and above and therefore were already able to walk themselves to school without a parent supervising them. Since their children did not require supervision to walk to school, the parents did not see the purpose in their students participating in the walking bus program. Finally, multiple parents brought up the problem that their children's backpacks were too heavy for them to carry back home as it would be bad for their posture and health and this was a contributor to parents' picking their children up from school. During this meeting we also spoke with three teachers at Ricardo Muñoz, all of whom were very receptive to our ideas. They also suggested that we grow our program further at Ricardo Muñoz by coming in and talking to each individual class during the school day to reach more children.

FIGURE 13: Meeting with the parents of Ricardo Muñoz

Our team also informally interviewed parents of students at Ricardo Muñoz who were not in the sample for our pilot test. We spoke with them about the possibility of joining the bus in the future. We showed the parents our route as well as briefly explained the purpose and benefits of a walking bus. This program was met with a large amount of support and enthusiasm from the parents we spoke to, though few could participate in this particular route. This was due to the fact that the route was planned

based on the responses from the initial sample and did not pass near their houses. Everyone to whom we talked, however, expressed excitement for the possibility of this project in the future with more participants and more routes.

3.2.4 Implementation of Pilot Test

Our two day pilot test began in the afternoon of the day following the training session and included both students who normally walked to school and students who did not walk to school prior to the pilot test- one of the girls had taken a taxi to school every day in the past. Beginning the walking bus in the afternoon made it easier to gather the students and ensure they understood the route and general procedures. The following day we walked the students both to school in the morning and from school in the afternoon. The following section focuses on the personal observations gathered from our pilot test.

FIGURE 14: Pilot Test of the walking bus

For our initial test walk, our team gathered outside the school twenty minutes before the school let out for the day to ensure that we would be able to meet all of the students who were participating in the program. We had established the meeting place as the main gate; however, we observed that it was difficult to differentiate between the parents coming to participate in the walking bus and the parents simply picking up their students from school. We also noted that while walking along the route that it was difficult to determine or remember at which stop each of the students were leaving the bus.

We also performed a test walk in the morning to practice the walking bus as it would run during the commute to school. We met the two students at the first stop at 6:20 AM continued along the route with them, picking up more students at each bus stop. During the walk to school, we noted that it was difficult to be sure of where the bus was planning to meet the students at each stop due to the size of the parks we chose. Therefore, noting a more specific meeting place both in the morning and the afternoon would be useful for increased organization of the bus.

3.2.5 Steps for future implementation of walking buses

After completing the two day pilot test of the walking bus, we created a manual on how to implement a walking bus for EMOV-EP to use with future schools (see Appendix Q). The manual was composed of a step by step plan for implementation of walking buses and recommendations on how to improve and continue the bus after initial implementation. The manual and the recommendations included in it were based off our observations during the pilot test and the problems we faced while implementing the walking buses. The following chapter focuses on our main recommendations for EMOV-EP as determined by the results of our pilot test.

4. Conclusions and Recommendations

Through initial research and pilot test of the walking bus at a local school, our team saw great potential in the continuity of the walking bus program throughout the schools in Cuenca. We ran the pilot test with a small sample of students at Ricardo Muñoz, which included a child who normally took a taxi to school prior to participating in the walking bus. This shows that even on a small scale, the walking bus program has the ability to encourage students who had normally taken motorized transit to school to walk. Additionally, the program received a large amount of support and enthusiasm from both the parents and faculty at Ricardo Muñoz. The levels of interest and enthusiasm from the other schools we surveyed were comparable to the interest and enthusiasm at Ricardo Muñoz. Furthermore, the reasons parents drove their children to school were similar at all three schools. Due to these similarities, our team predicted successful implementation of this program in the public schools within the city of Cuenca- especially in lower to middle economic level schools similar to Herlinda Toral and Ricardo Muñoz.

Our team identified several aspects of our program that could be improved to increase the efficiency through which the program will be implemented in the rest of the Ricardo Muñoz as well as other schools. From personal observation and discussions with parents of the school, our team formulated the following recommendations for the Non-motorized Transit Department of EMOV-EP as they work to further promote this program:

- **EMOV-EP should collaborate with *El comité de los padres de las familias* when they first start to establish a walking bus program in a school.** *El comité de los padres de las familias* is the Ecuadorian equivalent of a Parent Teacher Association (PTA). It is important for the leadership of the program to be community driven so that the walking bus can continue and grow even after EMOV-EP has initially established the program. The PTA and any involved community members would have more time to devote to the growth of the program in any particular school which would lead to increased success of the program.

  The PTA would also have more connections within the school and the community. They therefore would be able reach more parents and work within the school to implement school competitions and other incentive programs as mentioned in our Walking Bus Manual to increase participation.

- **EMOV-EP should work closely with the teachers and faculty of the school.** Working with faculty and administration within the school is an excellent way of reaching out to parents and advertising the walking bus. EMOV-EP should talk with the teachers of the school directly when they first start to implement a walking bus in a school so that they can present to classes about the project as this would be an efficient way to spread information about the buses to the entire school. Collaboration with the schools would also allow EMOV-EP to establish incentives alongside the PTA within the school as the teachers we talked with were willing to have the volunteers in the walking bus program to work personally with the children in the classroom.

- **EMOV-EP should focus on a younger age demographic of ten and under.** As mentioned in the results, many children aged ten or older walk to school without adult supervision. Due to the

aforementioned observation and the fact that many of the children under the age of ten were accompanied to school by their parents, we determined that working with younger children would increase parental enthusiasm and participation in the program. Furthermore, the children would enjoy walking to school more due to the social aspects of the walking bus.

- **When planning routes, EMOV-EP should ensure that routes only cross a busy street once.** Crossing busy streets with large groups of children can present safety concerns. As there are usually multiple busy streets near a school, making multiple routes for children such that these routes do not cross the same busy street more than once. This could be accomplished by creating two separate routes- one route on one side of the street and another route on the other side of the street.
- **EMOV-EP should ensure specific meeting places with participants for both before and after school.** Picking up the students before and after school can be challenging as many common meeting locations are either busy locations (such as the school main gate) or large locations such as parks. Having a designated sign posted inside the school main gate or vertical signage at the parks and other bus stops will allow children to congregate at a specific location thus making it easier for the walking bus leader to locate them.
- **EMOV-EP should ensure stringent record keeping of the participants of the walking bus.** One of the more difficult facets of the walking bus is keeping track of which children will be picked up and dropped off at each stop. Extra measures to increase the organization of the students and assist the adult volunteer will be useful for the future creation of a bus. Examples of these measure include nametags for the students with the name of their bus stop on the nametag and a comprehensive list of all student participants. This list has the ability to grow as more students join the bus.

By integrating these suggestions into the program, we believe that walking buses can be successfully initiated in schools in Cuenca, while simultaneously reaching out to both students who previously walked to school and those that did not. Walking buses will help decrease the amount of traffic around the schools in the morning which will ultimately lead to a decrease in the amount of air pollution caused by vehicular emissions.

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Appendix A1: Pollution in Cuenca

How much vehicular emissions contribute to each pollutant: (Parra & Espinoza, 2015)

De acuerdo al último inventario de emisiones del cantón Cuenca, elaborado con año base 2011 (EMOV EP, 2014), las fuentes más importantes de emisión por contaminante primario son las siguientes:

Monóxido de carbono (CO):	tráfico vehicular 91.9%.
Óxidos de nitrógeno (NO_x):	tráfico vehicular 76.4%, térmicas 11.8%.
Compuestos orgánicos volátiles diferentes del metano (COVNM):	tráfico vehicular 34.4%, uso de disolventes 25.3%, vegetación 21.4%.
Dióxido de azufre (SO_2):	industrias 48.2%, tráfico vehicular 30.2%, térmicas 21.1 térmicas%.
Material particulado fino ($MP_{2.5}$):	tráfico vehicular 42.7, ladrilleras artesanales 40.9%, térmicas 9.8%.
Material particulado fino (MP_{10}):	tráfico vehicular 39.9%, ladrilleras artesanales 36%, industrias 11.6%, térmicas 8.6%.

Pollutant levels in Cuenca in 2014: (Parra & Espinoza, 2015)

Pollutant	**Highest Amount Recorded ($\mu g/m^3$)**	**National Limit ($\mu g/m^3$)**	**WHO Suggested Limit ($\mu g/m^3$)**
PM_{10}	35.4	50	20
$PM_{2.5}$	6.1	15	10
Sulfur Dioxide	21	60	50
Nitrogen Dioxide	37.3	40	40
Ozone	58	100	100

Appendix A2: Benefits of Walking and Cycling

Walking

There are several health benefits from walking. Walking 30 minutes a day has the following benefits:

· Decreases the odds of developing lower coronary heart disease and stroke

· Helps maintain healthy blood pressure and blood sugar levels

· Reduces the risk of obesity and helps maintain healthy weight

· Reduces the risk of breast and colon cancer, as well as type 2 diabetes (American Heart Association, 2016)

The University of College London performed a meta-analysis of several studies that revolved around walking as exercise. There was a 31% decrease in cardiovascular disease and a 32% reduction in death in subjects who were found to walk 5.5 miles per week at speeds of at least 2 miles per hour.

In addition to this study, Harvard Health conducted a study that focused on several different groups. 10,269 male graduates who walked a minimum of 9 miles a day benefitted from a 22% lower death rate. The 44,452 health professionals who walked for at least 30 minutes a day reduced their risk of coronary artery disease by 18%. There was a 35% reduction in heart attack rate and a 34% reduction in stroke rate in the 72,488 female nurses who walked for 3 hours a week.

The living arrangements of people have also been found to impact their health status. Typically, people who live in cities are at a lower risk of being overweight and suffering from obesity than people who live in suburban areas. One case study was conducted in Atlanta, Georgia. Of the people living in the suburbs, 45% suffered from being overweight and 23% suffered from obesity. People residing in the city were found to have lower percentages of being overweight and suffering from obesity, 37% were found to be overweight and 13% suffered from obesity. The cause of this disparity was concluded to be the method of transportation in which people used to go to and from work, with people from the suburbs driving more often and people living in the city walking more (Harvard Medical School, 2009).

Walking also increases mental health. It has been linked to reductions in stress. Walking and physical activity as a whole increases norepinephrine in the body, which helps control the brain's maintenance of stress (Breene, 2013). Patients that suffer from anxiety have been told to walk because it was found to reduce the feeling of anxiousness (American Council on Exercise, n.d.). In addition to this, it combats depression. Walking releases endorphins which increases the overall mood of the person. Walking also increases the brain's mental capacity to remember. It does this by increasing the number of cells in the hippocampus. The hippocampus is the part of the brain responsible for memory and learning. Coupled with this, walking was found to be linked to brain development in younger children; creativity levels have been found to increase for 2 hours after walking or exercising (Breene, 2013).

The Lawrence Berkeley National Laboratory has found that running and walking incur the same health benefits. Walking can reduce your risk of high blood pressure, high cholesterol and diabetes.

33,060 runners from the National Runner's Health Study and 15,045 walkers from National Walkers' Health Study were compared over a 6-year period. It was concluded that when in the context of combating high blood pressure, high cholesterol and diabetes, moderate walking and intensive exercising resulted in equivalent reductions in all diseases (American Heart Association, 2016).

Walking to school with your children instead of driving has been found to have several benefits as well. Children will not only benefit in the classroom from improved concentration, but walking to school will allow them to meet the neighbors and establish a sense of independence that is essential in young children. It will also allow parents to spend more time with their children if they are walking them to school (Sustrans, n.d.). It was also found that neighborhoods with high rates of walking and cycling have low crash rates for motor vehicles. Drivers are usually more careful when there are more pedestrians on the streets. Private vehicle use to transport children to school is responsible for 10-14% of traffic during commuting times. If more people walk then there will not be as much traffic during peak commuting times, and this may encourage more people to walk because they will feel more comfortable. Walking to school also helps families financially. If parents walk their children to school then they will not have to spend money on gas for their car; additionally, community governments do not have to pay as much to repair roads and school districts do not have to pay for as much busing. One school district recorded $237,000 in annual savings from more parents walking their children to school. This saved money can be used to increase sidewalks and infrastructure to increase the monetary value of the neighborhood and its houses (Walk Bike to School, n.d.).

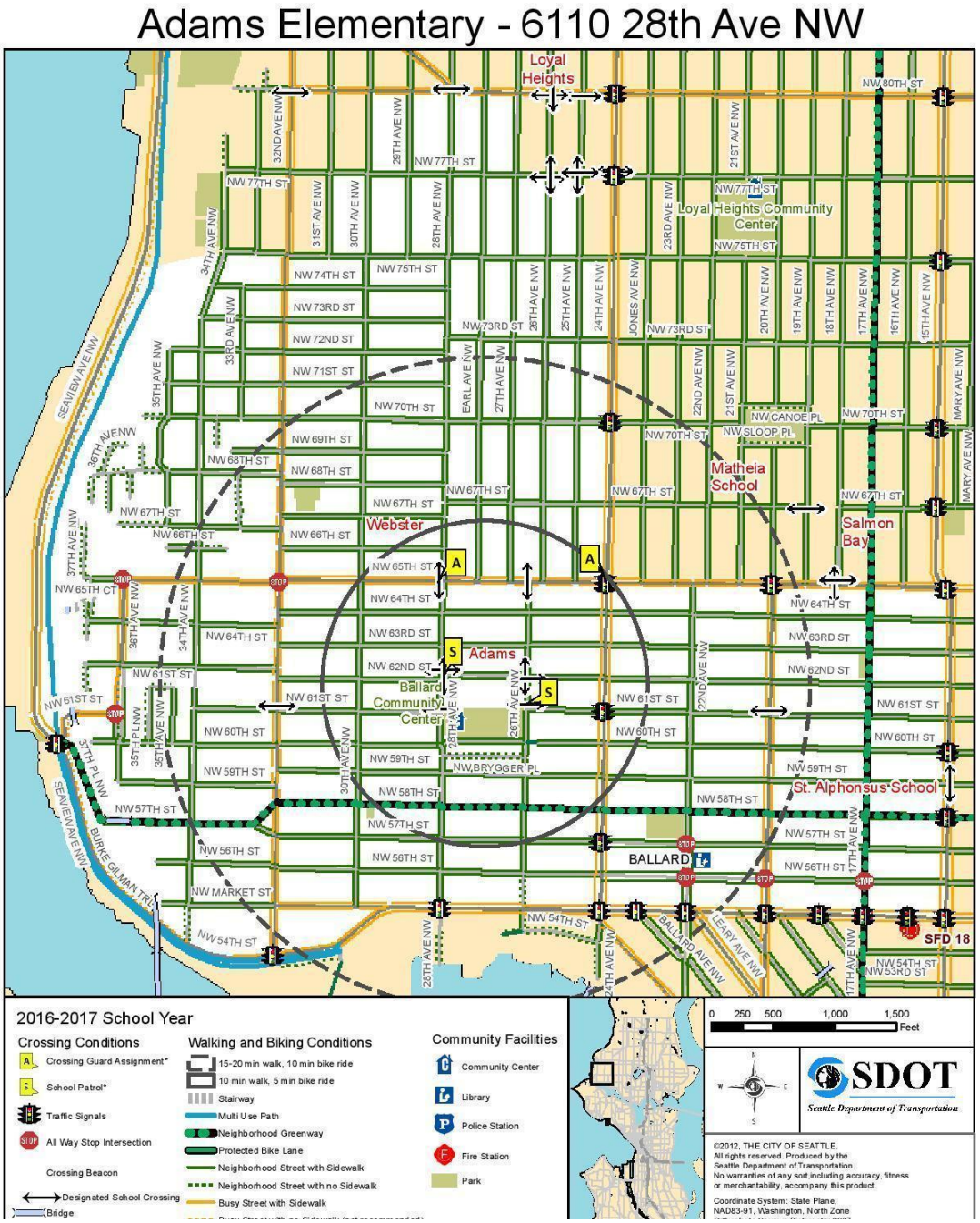
Cycling

There are several health benefits to cycling. Cycling incurs less damage to your body than walking. Cycling focuses most body weight on the pelvis region rather than the legs. It works several parts of your legs such as the buttocks, quadriceps, calves, hamstrings and thighs. Like walking, cycling releases endorphins which helps the cyclist feel good (Harvard Medical School, 2016), along with alleviating stress and depression. Biking helps control blood pressure levels, reduces the risk of coronary heart disease and aids in the treatment of cancer and diabetes (East Carolina University, n.d.). Mentally, cycling has been found to increase grey matter (University of Montana, n.d.); grey matter is located in the brain and is responsible for our level of intelligence (Sinicki, n.d.).

Studies have been conducted regarding people who have switched from driving to cycling to work. The British Chiropractor Association has concluded that short car rides to walk places immense stress on the back, and coupled with a desk job after the short car ride, the back experiences a large amount of negative posture and pressure. This can be combatted by biking to work (Sustrans, n.d.). Steady cycling has been found to burn around 300 calories an hour, and biking for 30 minutes a day for a year will burn about 11 pounds (Better Health Channel, 2013). A common factor when deciding to cycle is if the health benefits outweigh the risks when cycling. A study done in the Netherlands studied whether the health benefits do outweigh the risks when cycling. Researchers concluded that biking can increase your lifespan by 3-14 months and outweigh the risk of decreasing your lifespan by .8-40 days (De Hartog, Boogaard, Niiland, & Hoek, 2010).

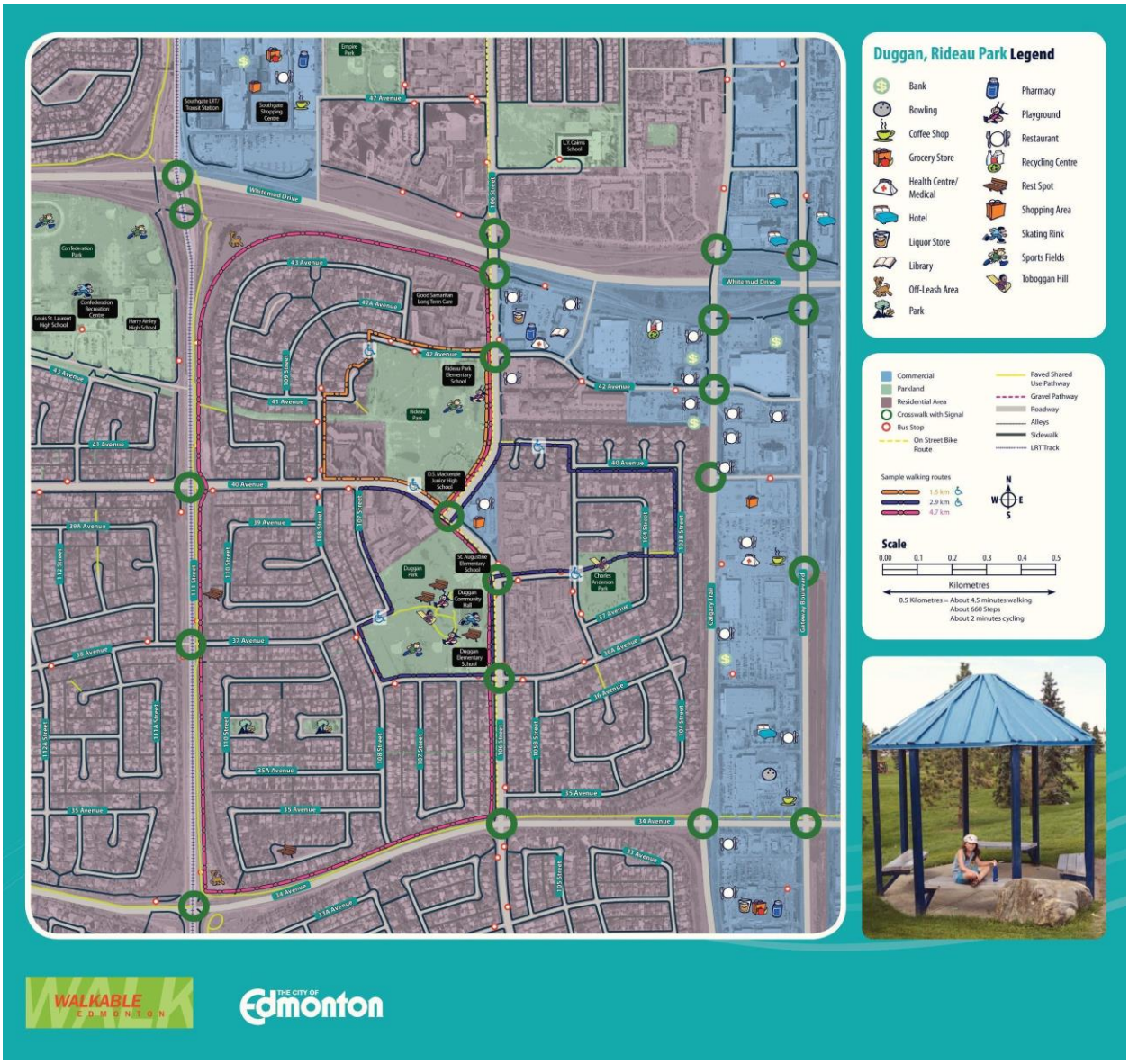
Appendix A3: School map from Seattle, WA

(Seattle Department of Transportation, 2017)



Appendix A4: Neighborhood map from Edmonton, Canada

(City of Edmonton, 2012)



Appendix A5: Public Transportation in Cuenca

Cuencan Bus System

In the early 2000s the Cuencan public bus system was privately operated through multiple different companies. These operators were unregulated by the government and were in high competition with each other, often taking the same routes. The drivers aggressively competed for the same passengers and worked over 12 hour shifts in the process. According to Wright (2001), the Cuencan Government stepped in, in 2001, and developed new bus plans for the city that consisted of formalizing the unregulated buses, decommissioning old buses, and increasing the availability to pedestrians.

Today, the current bus system in Cuenca has over 15 different routes that run eastbound and westbound daily (Alternatur, n.d.). Each bus makes over 30 stops along each individual route, making it easily accessible to pedestrians across the city. As a promotion of use to all citizens of Cuenca, there is even a subsidy for priority groups such as children, people with disabilities and the elderly. These priority groups only have to pay half of the fee required to ride the bus (EMOV-EP, 2016).

Tranvía de Cuenca

More recently the government of Cuenca has worked to create the *Tranvía de Cuenca,* a tram that will run through the city connecting the north and south sectors. The tram of Cuenca "will have 14 units, in which it will be possible to transport 120,000 passengers per day and an average of 43,800,000 per year" (Narea, 2016). The president of Ecuador, Rafael Correa, has expressed that the creation of the Tranvía will make Cuenca "the first Andean city to have a modern and efficient mass transit system." (Narea, 2016). The government has also been credited with funding over 80% of the Tranvía work and has made efforts to make sure that the construction is not abandoned. Due to having multiple contractors abandon the construction contract, the national government has promised to finance 67% of the additional resources required for completion of the tram. This will resolve many of the construction issues and allow the project to get back on track (Quizhpe, 2016).

Appendix A6: EMOV-EP Initiatives

Educational Programs

Educational programs for pedestrians mainly focus on students and children as EMOV-EP firmly believes that the children are the future of a society and by influencing children's behavior, they can work to change a society's behavior in the future. Therefore, EMOV-EP works closely with certain schools around the city to teach the students how to properly walk and cycle through the city. The school programs consist of training students, teacher and parents in separate training sessions designed specifically for them. The nature of the student's program depends on the age. Children under the age of 9 are taken to a park named Parque Vial. As shown in the photo below, EMOV-EP has constructed a park that mimics a mini city by including roads, stop signs, crosswalks, schools, etc. This allows young children to properly visualize and practice the safety measures being taught to them. Children over the age of 9 are given a presentation with similar safety information at their own schools instead.

On the other hand, EMOV-EP also works to educate drivers on road safety. There were a series of training sessions were held over a series of two months for rural drivers, mixed commercial drivers, school service drivers and many others. The main goal of this training was to use education to update knowledge regarding traffic laws and regulations and encourage them to respect and follow signage put up for pedestrian safety. (EMOV-EP*,* 2016).

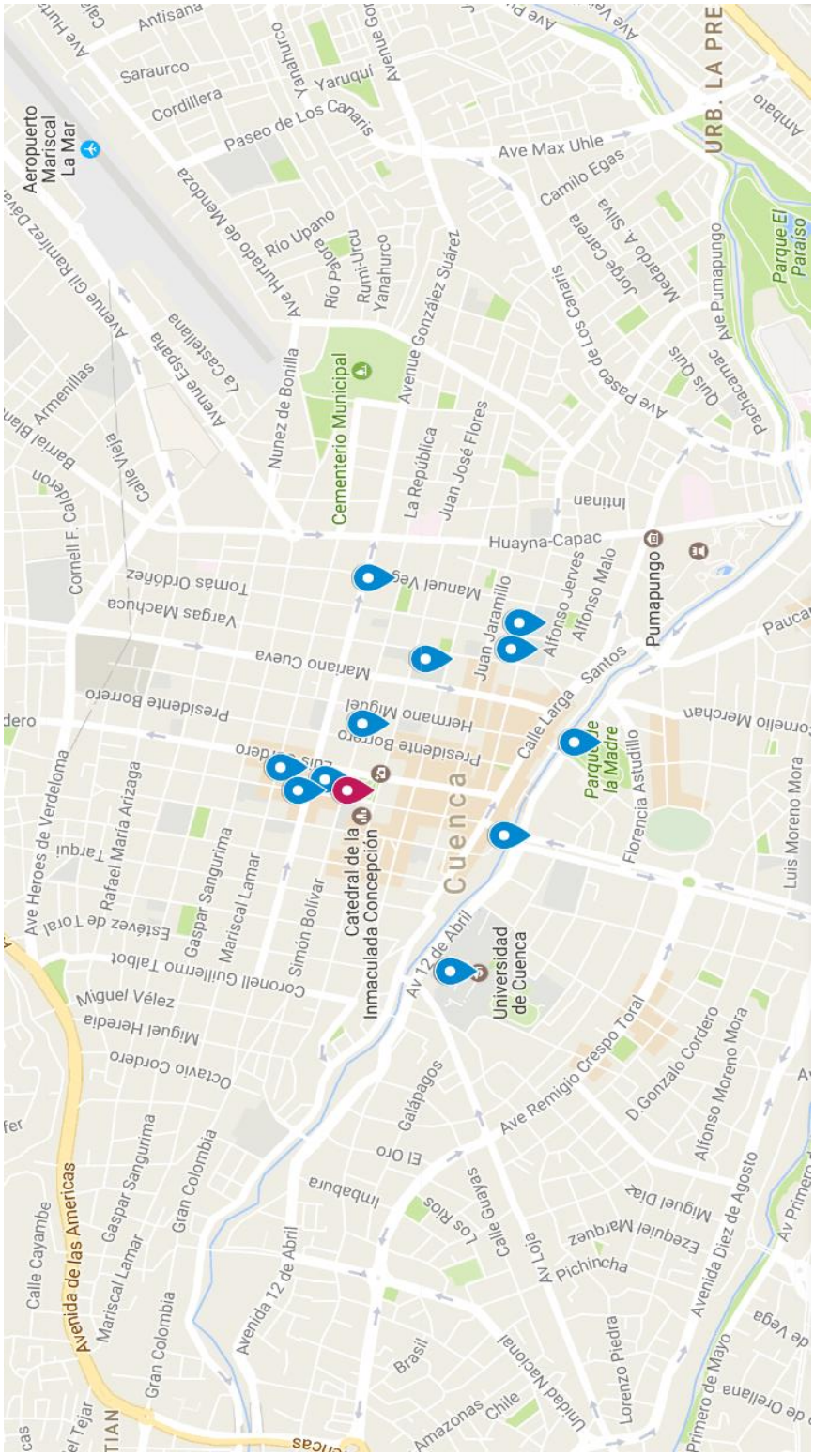
Public Awareness Campaigns

Public awareness campaigns are another important aspect of how EMOV EP promotes the use of non-motorized transit throughout Cuenca. "*Solo un Ratito, También Está Prohibido*" is a campaign which stands for "*'Only a Moment' is also prohibited*". The objective of the campaign is to bring awareness to -traffic laws regarding the use of public spaces to prevent illegal parking in zones reserved for buses, pedestrians, and cyclists (EMOV-EP, 2016). This is a campaign specifically to bring attention to cars misusing public spaces such as bus stops, walking paths and bike paths by parking or blocking them with their cars. Another campaign is "*El Respeto Nos Mueve*" which stands for "*Respect Moves Us*". The objective of this campaign is to promote respect and coexistence between all modalities of Cuenca (EMOV-EP*,* 2016). This campaign focuses on creating a safe and friendly environment between motorists, motorcyclists, pedestrians and cyclists. Representatives from each group come together to discuss the issues they are facing and the different ways to resolve them. Another event that EMOV-EP runs is *Mobility Week* which is a weeklong event to promote a culture of non-motorized transit through a series of free bike rentals and educational training sessions around the city.

Investments in infrastructure

Along with the materials for crosswalks, over 200 bicycles and safety helmets were purchased to strengthen EMOV EP's growing bicycle activities. They have also reopened the "Ruta Recreativa" or recreational route which is route along the river Tomebamba where every Sunday morning from 8am to 1pm citizens can rent a bicycle to use on the route (EMOV-EP, 2016).

Appendix B: Locations and Times of surveys



No.	Address	Date	Time	Name
1	Av. Solano y Av. 12 de abril	16/01/2017	7am-9am	Danilo y Cassy
2	Bolivar y Manuel Vega	16/01/2017	7am-9am	Susan y Noah
4	Parque Calderon	16/01/2017	9:30am-11:30am	Susan, Noah, Cassy, y Danilo
5	Universidad de Cuenca Campus Av. 12 de A	16/01/2017	5:00pm-6:00pm	Susan, Noah, Cassy, y Danilo
7	Universidad de Cuenca - puerta de Derecho	17/01/2017	9:30am-11:30am	Susan, Noah, Cassy, y Danilo
9	Gran Colombia y Luis Cordero?	17/01/2017	7:00am-9:00am	Susan y Noah
10	Presidente Cordova y Vargas Machuca	17/01/2017	7:00am-9:00am	Danilo y Cassy
11	Parqueaderos TOSI y PARK CUENCA	17/01/2017	5:00pm-6:00pm	Danilo y Noah
12	Parqueaderos Sucre y General Torres	17/01/2017	5:00pm-6:00pm	Cassy y Susan
13	Escuela Luis Cordero	18/01/2017	7:00am-9:00am	Susan y Noah
14	Unidad Educativa Oblatas	18/01/2017	7:00am-9:00am	Danilo y Cassy
15	Parque de la Madre	18/01/2017	9:30am-11:30am	Susan, Noah, Cassy, y Danilo

Appendix C: Survey about methods of transportation in El Centro

Age: _____

Sex: _____

What sector did you come from and where are you going?

_____

What method of transportation did you use to get here?

▢ Car ▢ Taxi ▢ Public Bus ▢ Bicycle ▢ Walk

▢ Other: _____

How many days a week do you use this method of transportation?

▢ 1 ▢ 2 ▢ 3 ▢ 4 ▢ 5 ▢ 6 ▢ 7

Why are you accustomed to using this method of transportation?

_____

How many days a week do you walk as a form of transportation?

▢ 1 ▢ 2 ▢ 3 ▢ 4 ▢ 5 ▢ 6 ▢ 7

How far (in minutes) are you willing to walk?

▢ Less than 5 minutes ▢ 5-10 minutes ▢ 10-15 minutes

▢ 15-20 minutes ▢ 20-25 minutes ▢ 25-30 minutes

▢ More than 30 minutes ▢ Never

Do you think that the pedestrian signage is adequate? Why?

▢ YES ▢ NO

_____

How safe is the pedestrian path to your destination? Why?

▢ Good ▢ Bad ▢ Regular

_____

(Please describe why on this line)

Appendix D: Survey about perception of distance

1. Why are you visiting El Centro today? _____

2. How do you get around El Centro?

___ Car ___ Taxi ____ Public Bus ____ Bicycle ___ Walking ___Other

3. Do you feel like El Centro is walkable?

YES ____ NO_____

4. How many minutes does it take to walk to the following locations?

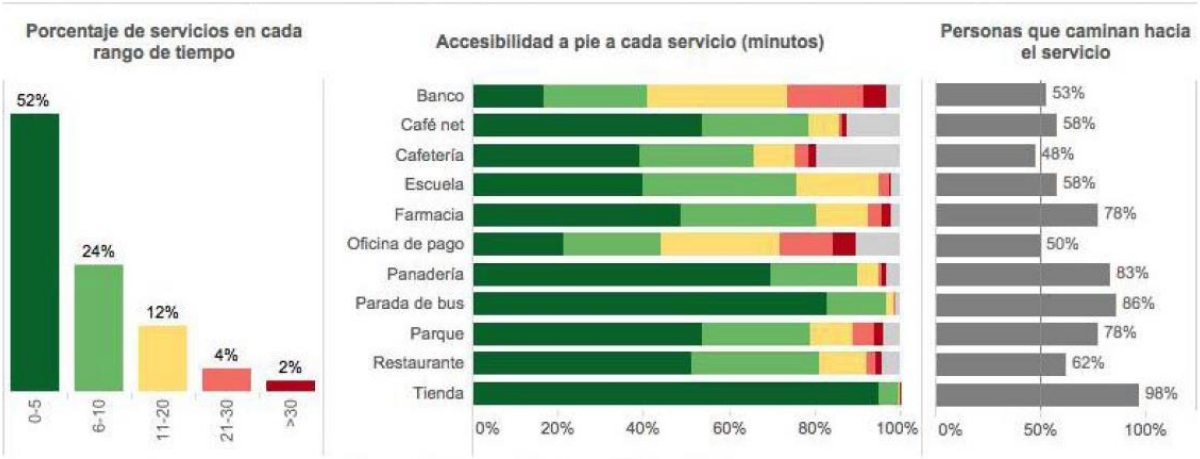
   a. El Mercado 10 de Agosto _____

   b. Parque de la Madre _____

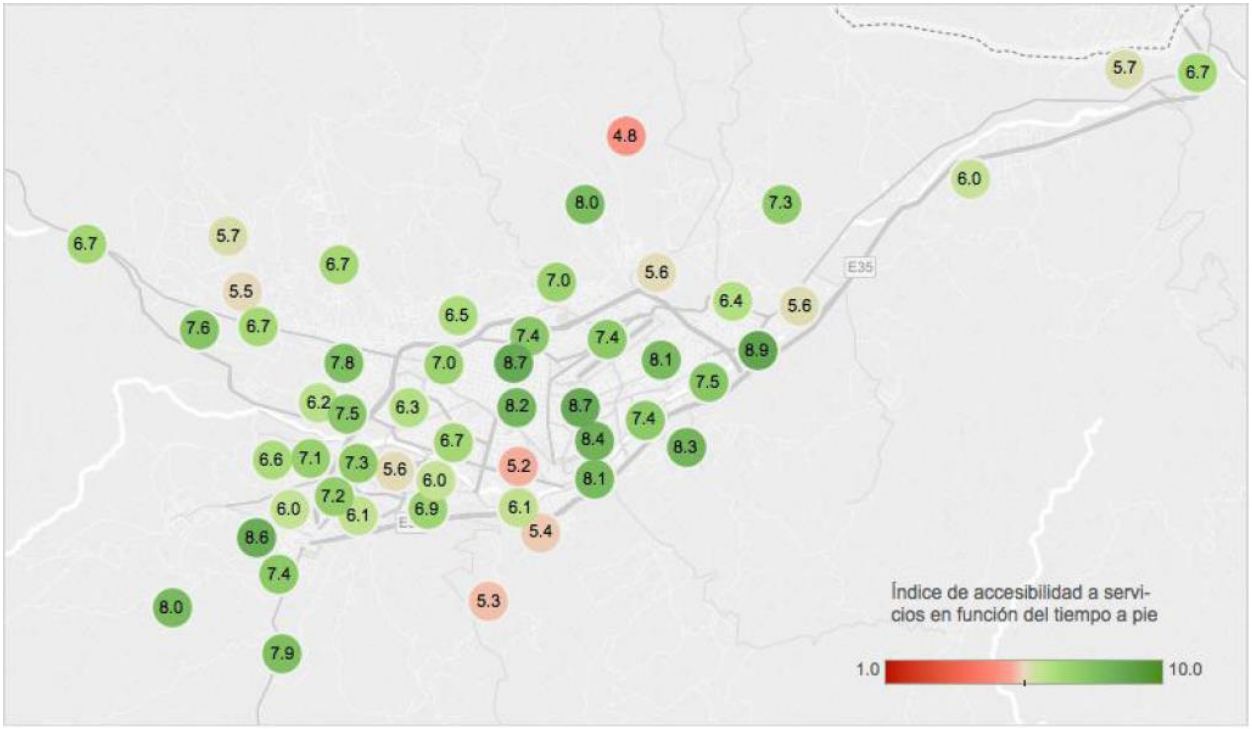
   c. La Iglesia de San Sebastián _____

Appendix E: Additional Graphs concerning walking in El Centro

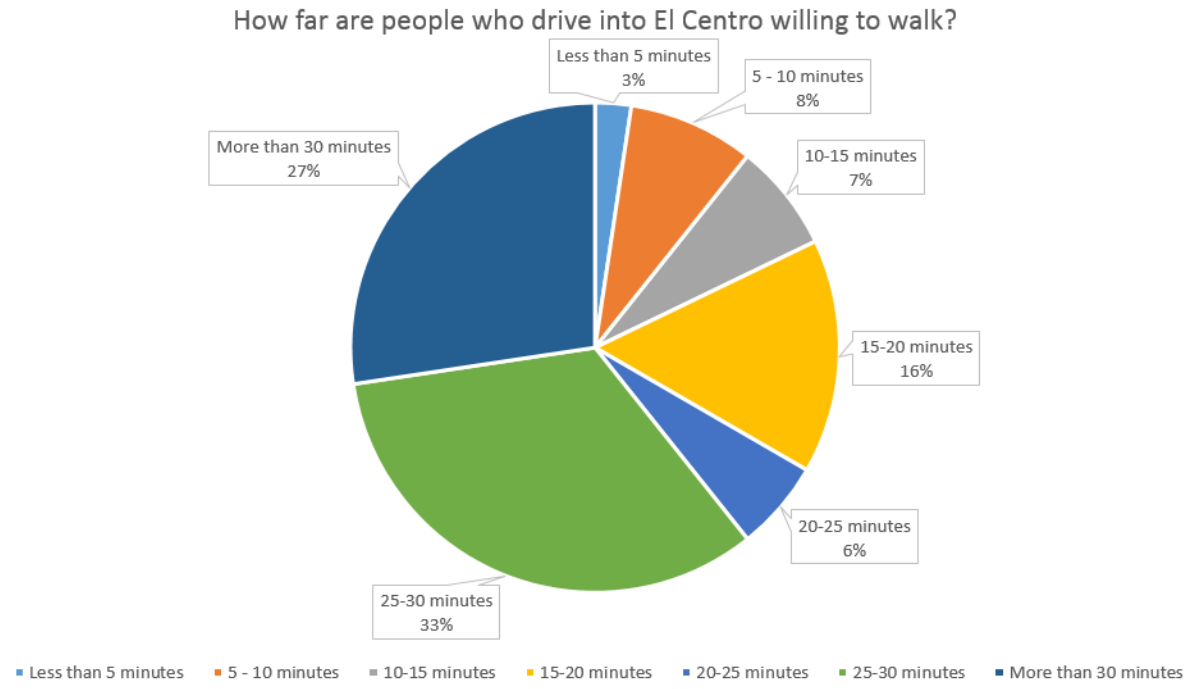
The following graph describes the percentage of services in each time range, what percentage of each kind of service is within a certain number of minutes from any given location, and the percentage of people who walk to each location (EMOV-EP, 2015).



The following map ranks different areas based on how close common services are from a given distance. Based on this map, the historic downtown area of Cuenca ranks between 8.2 and 8.7 (EMOV-EP, 2015).



The following pie chart shows how far people who said that they took some form of motorized transit (whether it was car or taxi) are willing to walk as a form of non-motorized transit.

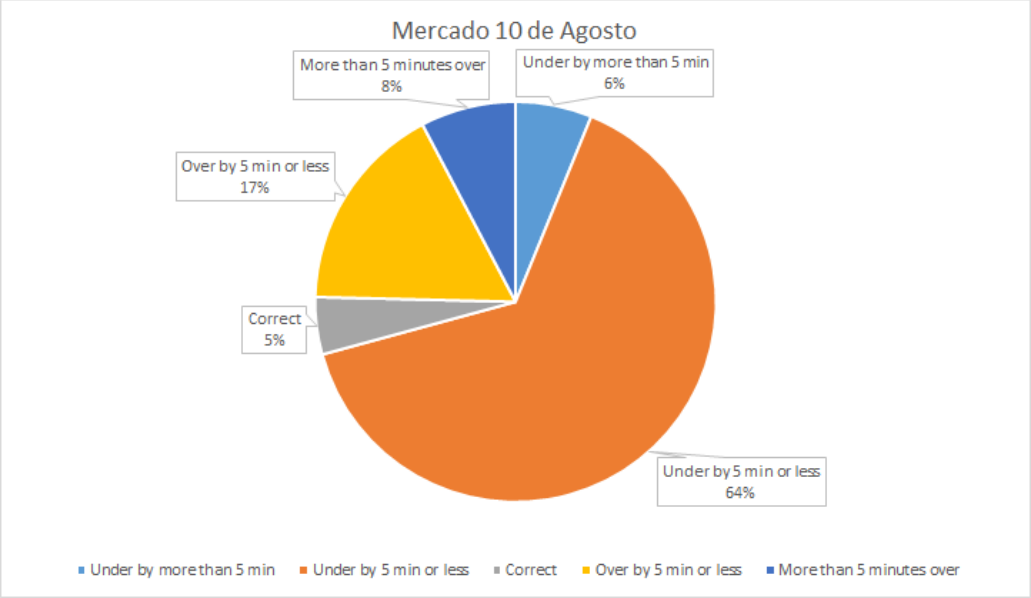


Appendix F: Further graphs concerning distance perception in El Centro

Distance perception for each location:

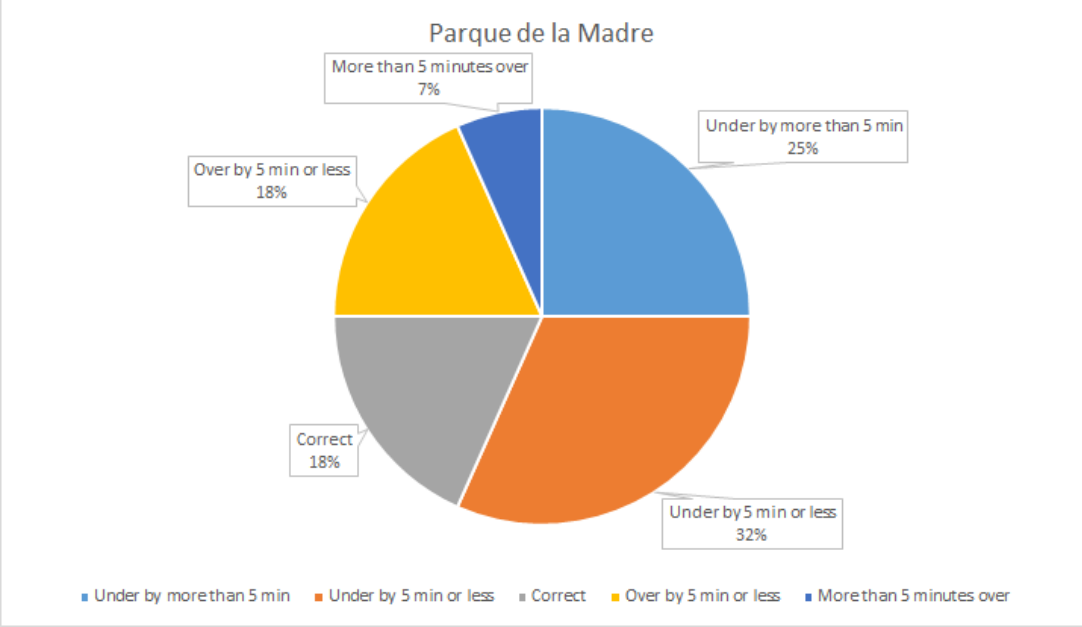
Mercado 10 de Agosto: Actual time to walk from Parque Calderon- 8 minutes

Average time guessed- 6 minutes 45 seconds



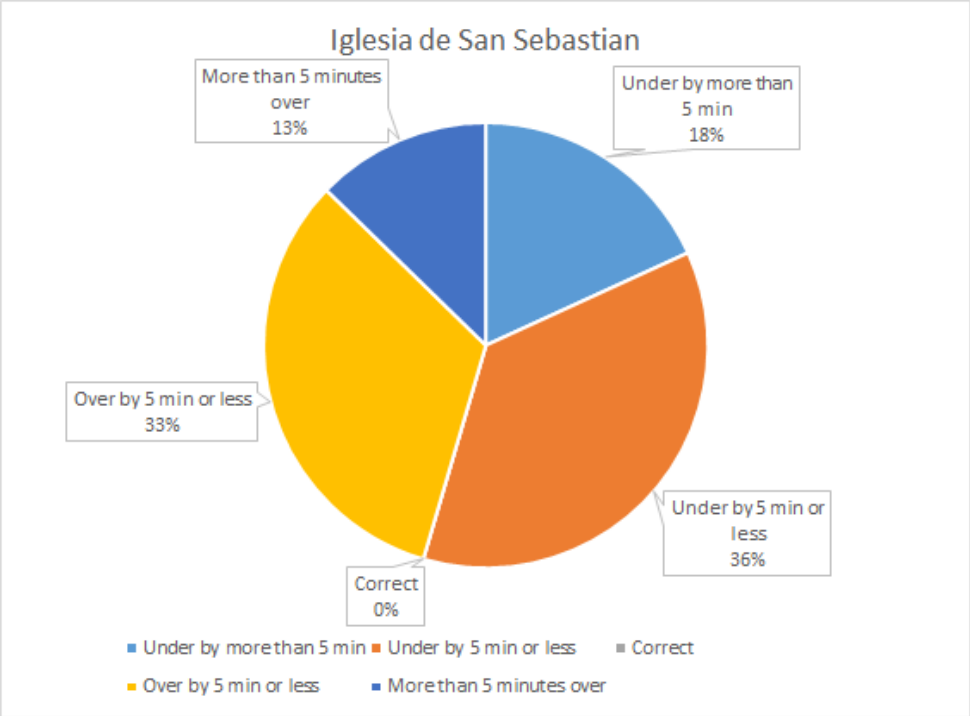
Parque de la Madre: Actual time to walk from Parque Calderon- 15 minutes

Average time guessed- 13 minutes

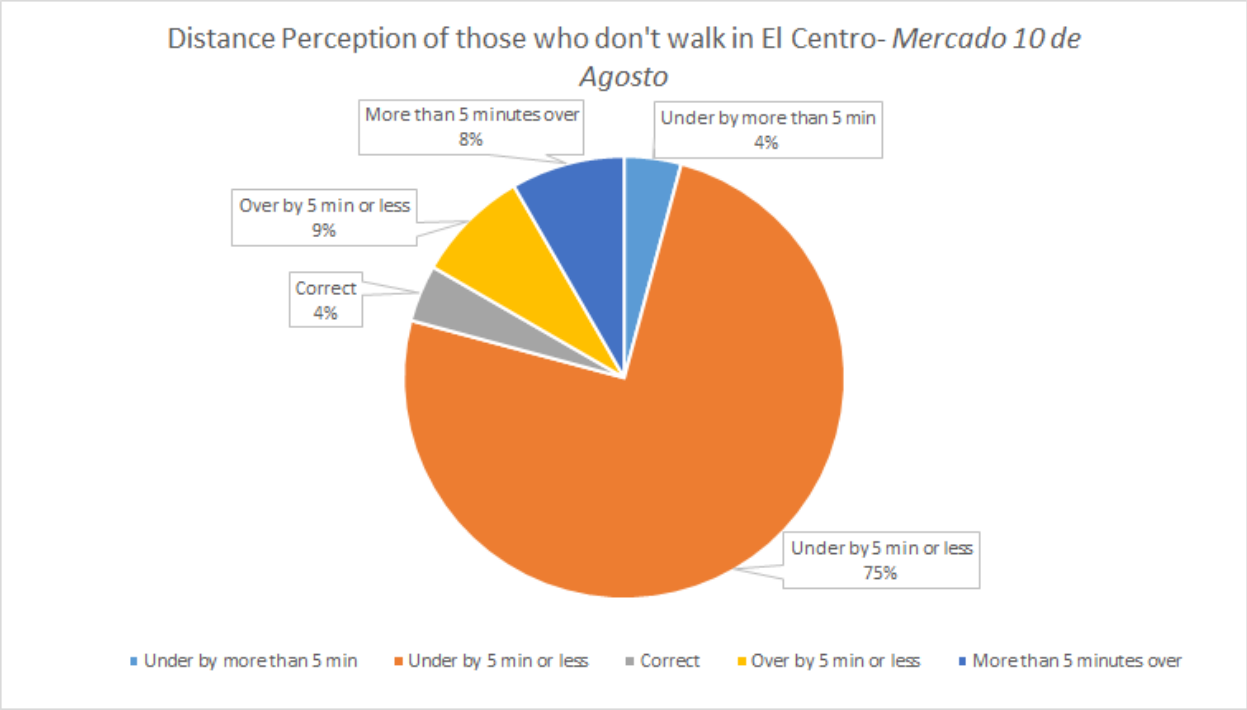


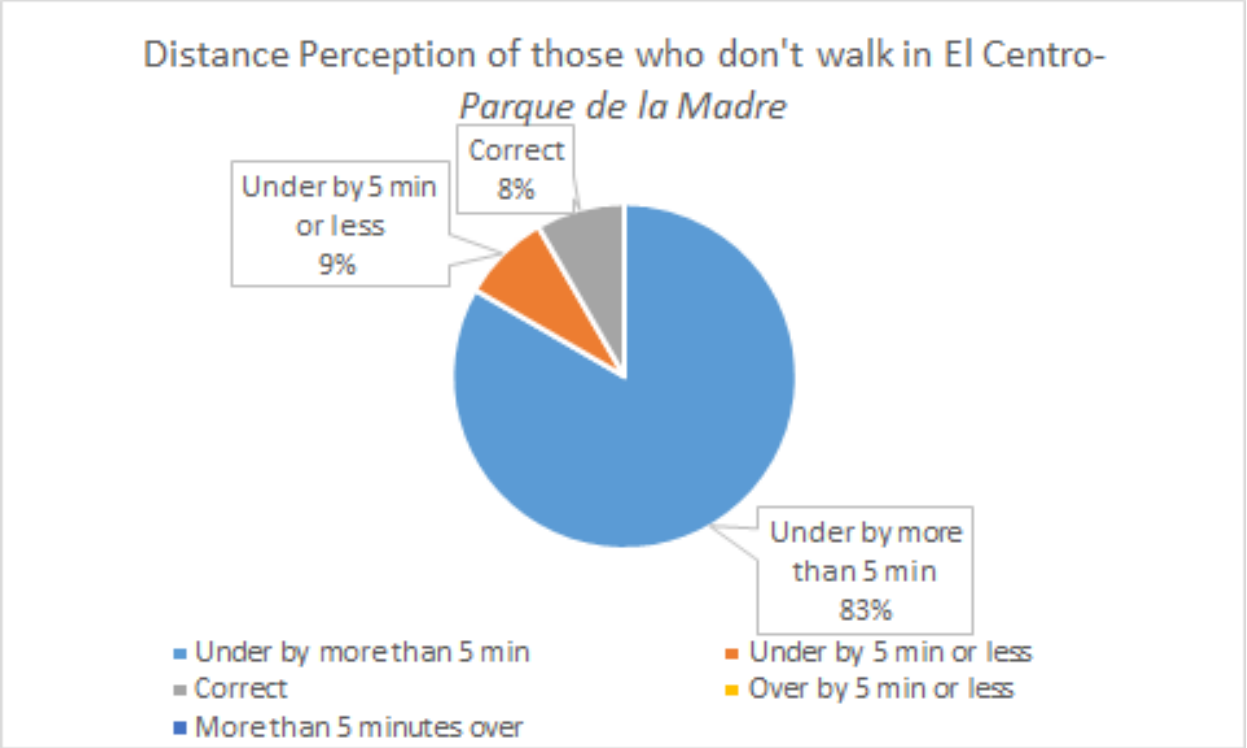
Iglesia de San Sebastian: Actual time to walk from Parque Calderon- 11 minutes

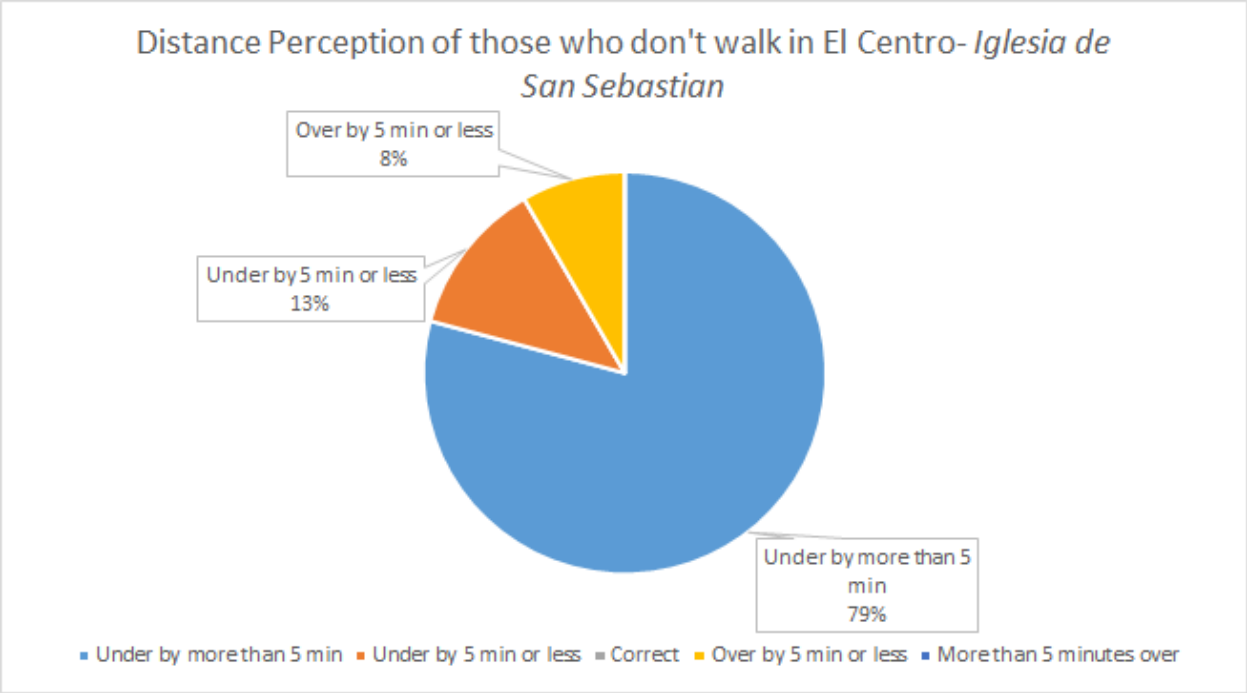
Average time guessed- 12 minutes



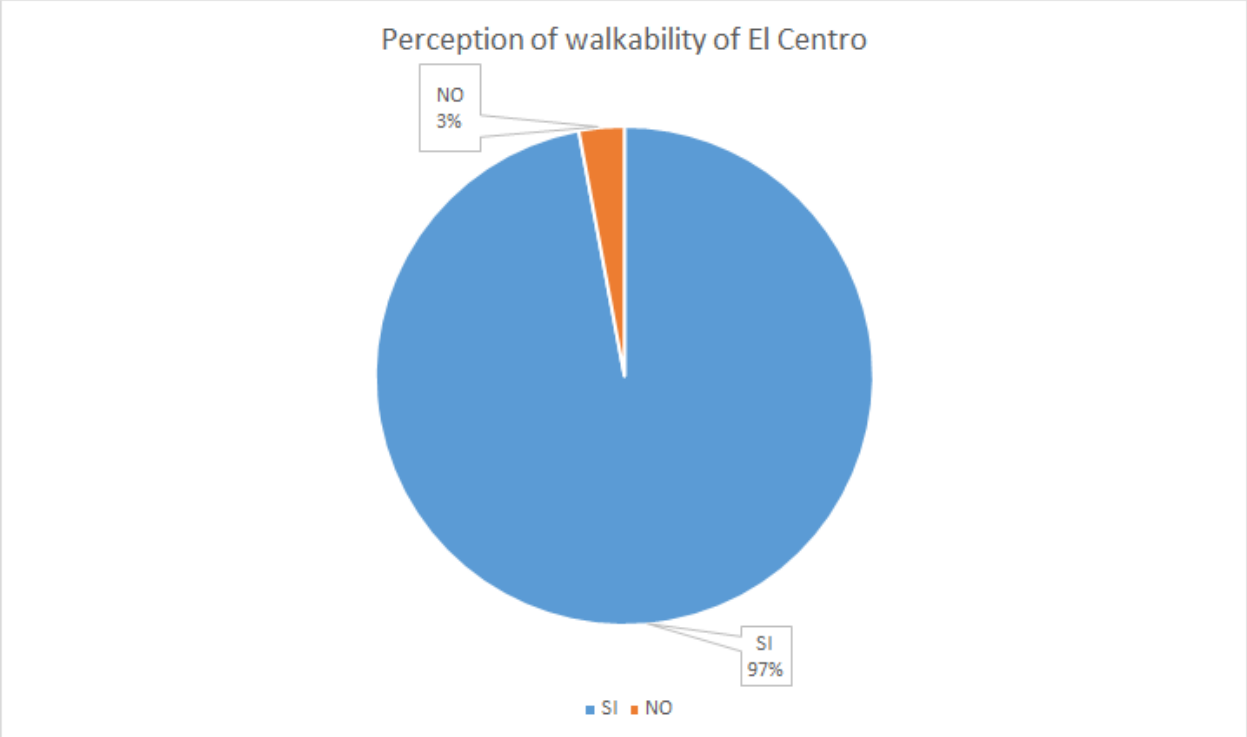
Distance perception of people who do not walk around El Centro:


Distance Perception of those who don't walk in El Centro- *Mercado 10 de Agosto*
More than 5 minutes over 8%
Under by more than 5 min 4%
Over by 5 min or less 9%
Correct 4%
Under by 5 min or less 75%
Under by more than 5 min
Under by 5 min or less
Correct
Over by 5 min or less
More than 5 minutes over


Distance Perception of those who don't walk in El Centro- *Parque de la Madre*
Correct 8%
Under by 5 min or less 9%
Under by more than 5 min 83%
Under by more than 5 min
Under by 5 min or less
Correct
Over by 5 min or less
More than 5 minutes over



Whether or not people felt El Centro was easily walkable:



Appendix G: Interview with Paul Calle about EMOV-EP's Future Bike Share

Interviewer: Susan Elliott speaking with Danilo Lozada, Cassy Rios, and Noah Rockwell present.

Interviewee: Paul Calle an employee in the non-motorized transit division at EMOV-EP

Interview Setting: EMOV Main building in the office of non-motorized transit and signage at 3:00pm on January 18, 2017.

Affiliation with interviewee: Paul is one of the EMOV-EP employees with whom we have been working closely on this project.

(Start of Interview)

Susan Elliott: ***When will the Bike Share Program be implemented?***

Paul Calle: Most likely the bike share program will start in the middle of March (around March 15-20.) Initially, we had wanted to start the program in February but we are a small department and need to hire more people to work at the rental locations in order to be able to start it.

Susan Elliott: ***Where will people be able to rent the bicycles?***

Paul Calle: The two locations to rent will be at Parque Calderon [Park in the center of the city] and the intersection of Bolivar and Huaynacapac. We will have a total of 50 bikes so 25 at each location.

Susan Elliott: ***Who do you anticipate will be the main population renting the bikes? (Eg. University students, tourists, locals, etc?)***

Paul Calle: We want this program to be for everyone. They need to be over 18 years old but other than that we want everyone to use these bikes.

Susan Elliott: ***How will one rent a bicycle? Will they need a telephone number?***

Paul Calle: If you are a tourist, you will need to have a copy of your passport and also leave the address of where you are staying while in Cuenca. What we really want is for them to leave their passport with us because that will be more likely to ensure that they return with the bike.

If you are a resident, you will need your state issued identification card.

At the same time we will record information about each person who rents a bike including: gender, telephone number, age, and reason for renting the bike

Susan Elliott: ***How will you assure that the bicycles will be returned?***

Paul Calle: We do not really have a system in place to ensure that the bikes will be returned but Cuenca does not really have a problem with bikes being stolen. Theoretically you would lose your ID if you do not bring back the bike but that is not a huge problem for the citizens because it would only cost around $15 to get a new ID. Our bikes have the EMOV logo on them and, for the entire 2 years which we have had the Ruta de Recreativa where we rented bikes out every Sunday we have never had one stolen.

Susan Elliott: ***Why can you only rent bicycles for 30 minutes?***

Paul Calle: You can actually rent the bikes for 45 minutes- 1 hour. This will allow proper rotation of the bikes for everyone who wants to rent them. We more want people to be renting them for shopping. We want them to rent from one location and ride them to the other location and return them there immediately.

We can't give someone a fine if they do not return the bike but we do have a repercussion system in place. The first time, we will give them a warning, the second time, they will be unable to rent bikes for a month, and the third time- they will not be able to rent bikes again.

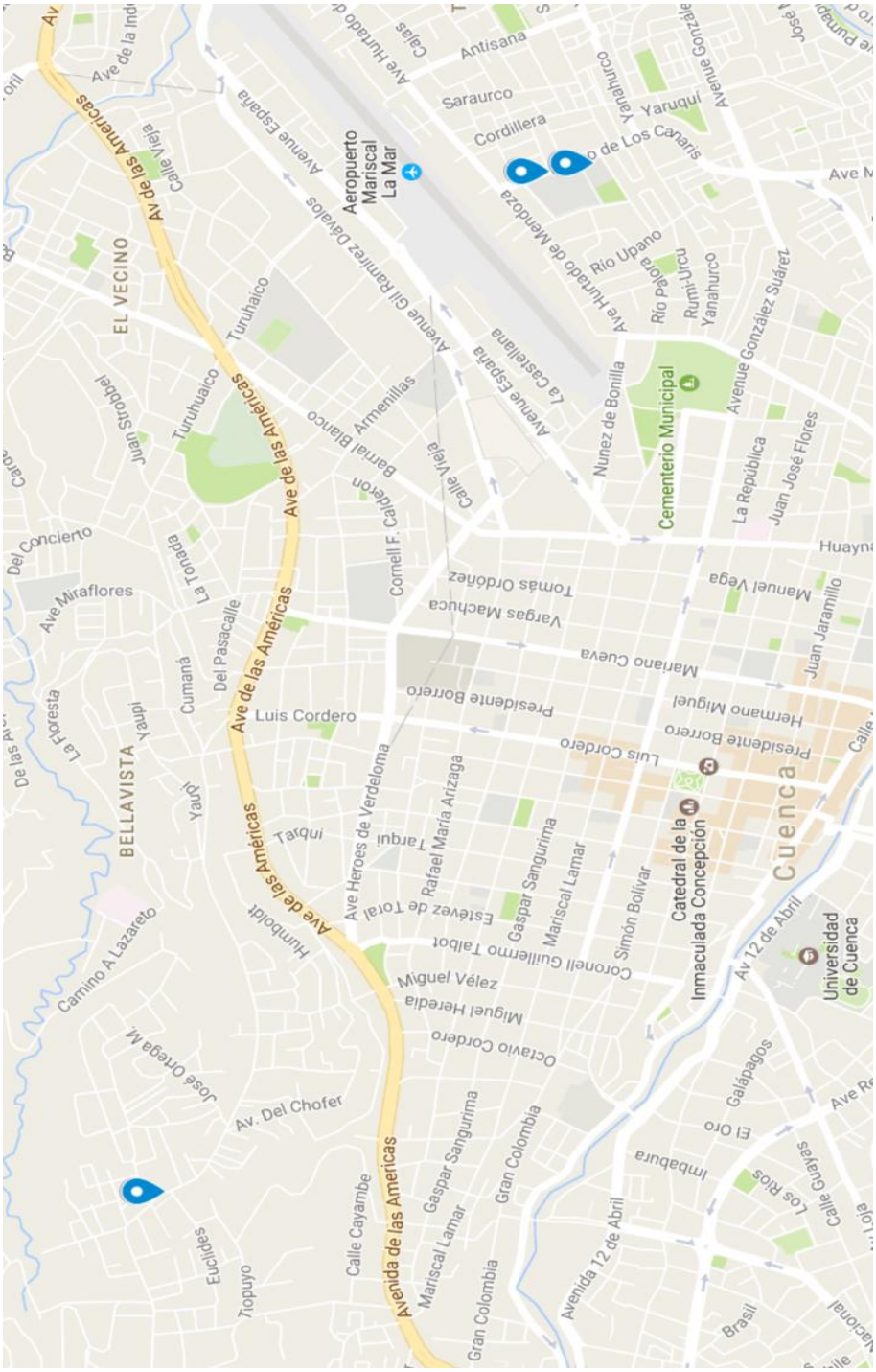
Susan Elliott: ***Will the bicycles have locks?***

Paul Calle: Yes

Susan Elliott: ***Are there bike racks around the city?***

Paul Calle: Not really but we plan to give them information about where to park their bikes in and around El Centro when they rent bikes at either point.

Appendix H: Locations of Schools surveyed



Appendix I: Survey for parents about perception of mobility

Age of your child(ren):

_____

What mode of transit does your child use to get to school?

▢ Car ▢ School Bus ▢ Public Bus ▢ Bicycle ▢ Walking ▢ Motorcycle

▢ Other: _____

How long does it take to get to school in the selected method of transportation?

▢ Less than 5 minutes ▢ 5-10 minutes ▢10-15 minutes

▢ 15-20 minutes ▢ 20-25 minutes ▢ 25-30 minutes

▢ More than 30 minutes

Why do you use this form of transportation?

_____

Do you ever use another form of transportation?

▢ YES ▢ NO

Which type?

_____

With what frequency?

_____

Do you think that the pedestrian signage close to the school is adequate? Why?

▢ YES ▢ NO

How safe is the pedestrian path to your school? ¿Why?

▢ Good ▢ Bad ▢ Regular

_____

(Please describe why on this line)

Please rank the following from 1 to 5 (1:very much dislike, 5: like very much) depending on how much you like them:

School Route Maps	▢ 1	▢ 2	▢ 3	▢ 4	▢ 5
Walking Buses	▢ 1	▢ 2	▢ 3	▢ 4	▢ 5
School Competitions	▢ 1	▢ 2	▢ 3	▢ 4	▢ 5

Please rank the following from 1 to 5 (1 being very unwilling and 5 being very willing), which initiatives would you volunteer for?

School Route Maps	▢ 1	▢ 2	▢ 3	▢ 4	▢ 5
Walking Buses	▢ 1	▢ 2	▢ 3	▢ 4	▢ 5
School Competitions	▢ 1	▢ 2	▢ 3	▢ 4	▢ 5

Appendix J: Complete list of reasons why people drove their children to school

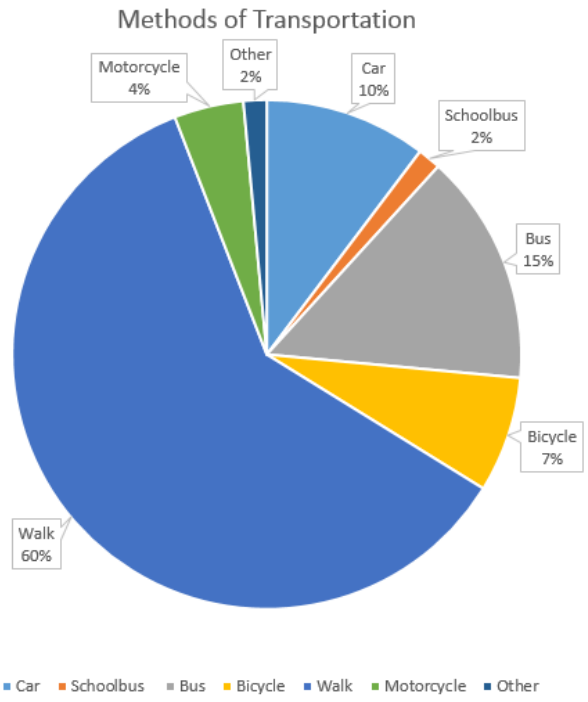
The following is a list of reasons why people who drove their children to school chose to drive instead of using other forms of transportation. It also contains the number of responses each answer received.

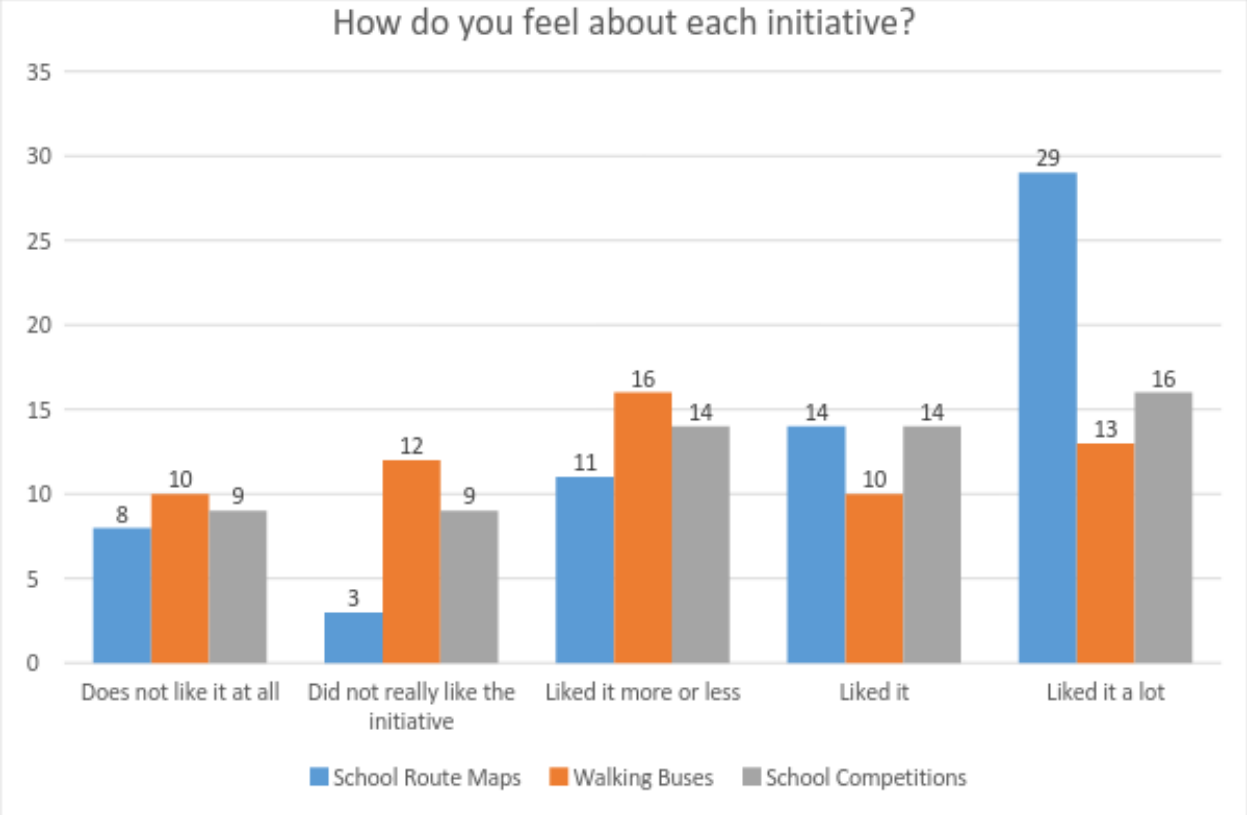
1. Because they have a car – 7
2. Because it is very fast – 7
3. Because it is safer – 4
4. Because they live far – 3
5. Because the parents work – 2
6. It is convenient – 2

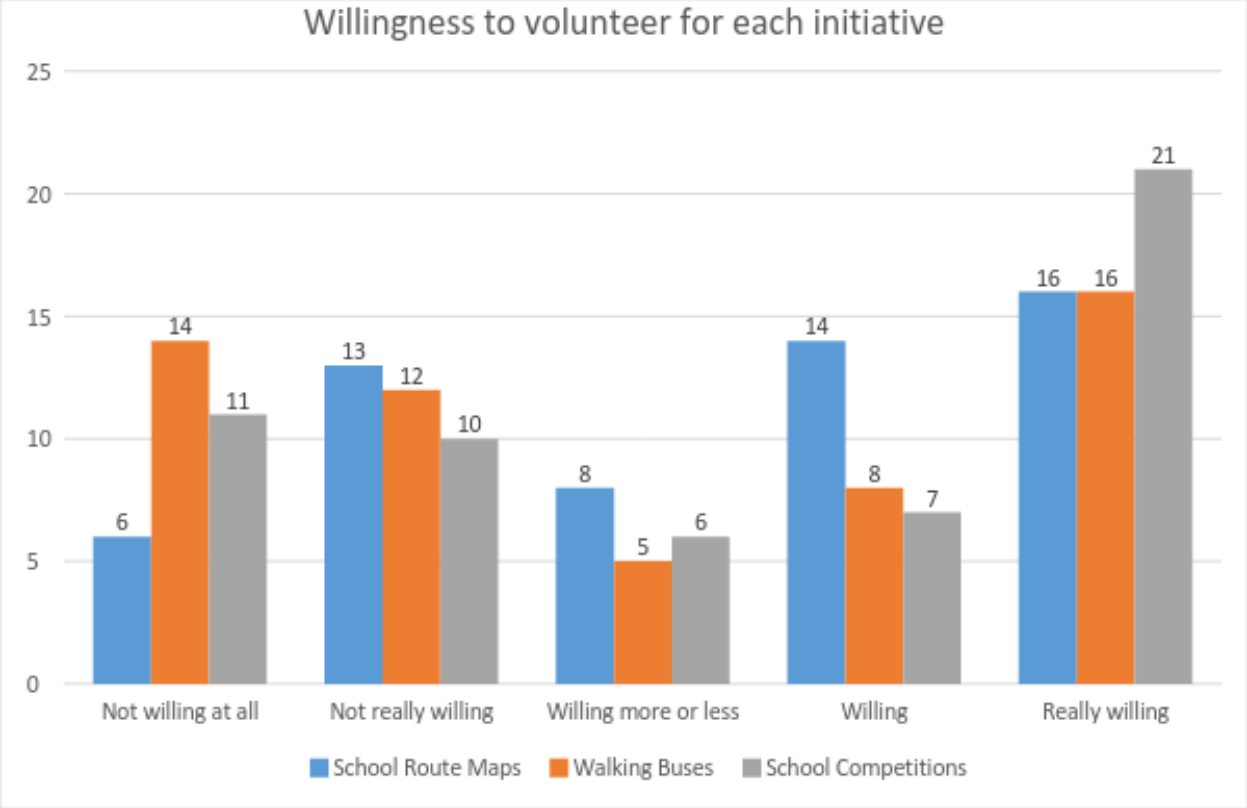
Appendix K: Survey results from additional schools

Rafael Aguilar

Rafael Aguilar was a public school for grades K-12 that was in a rural sector of Cuenca making it a school with students in the lower economic levels. This economic level could have affected the results from their surveys and is something we took into account when projecting the feasibility of these school initiatives in other rural schools in Cuenca.

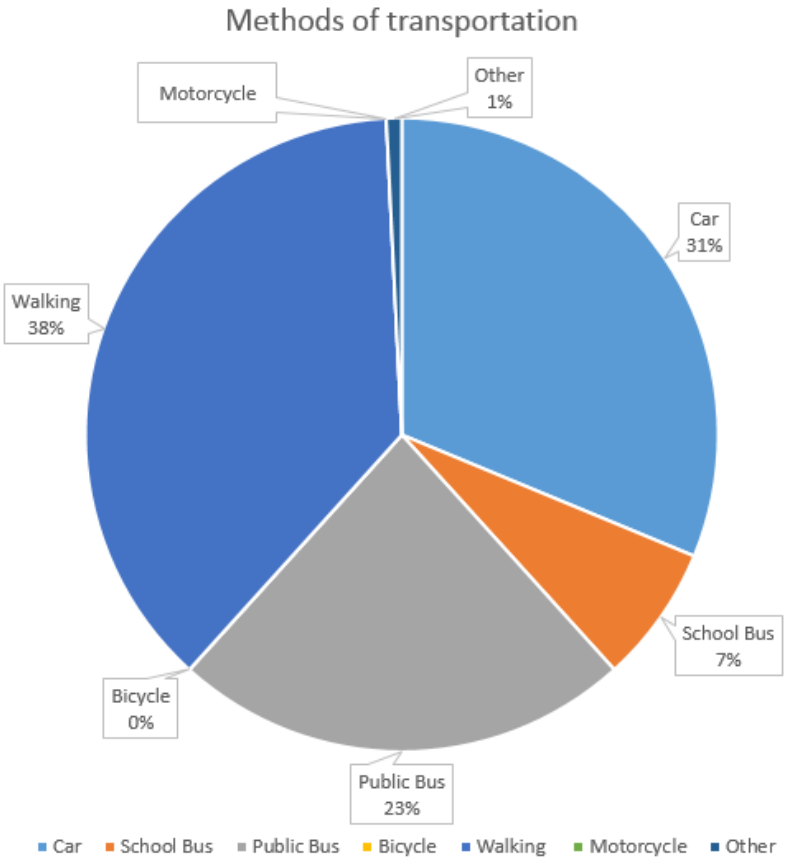


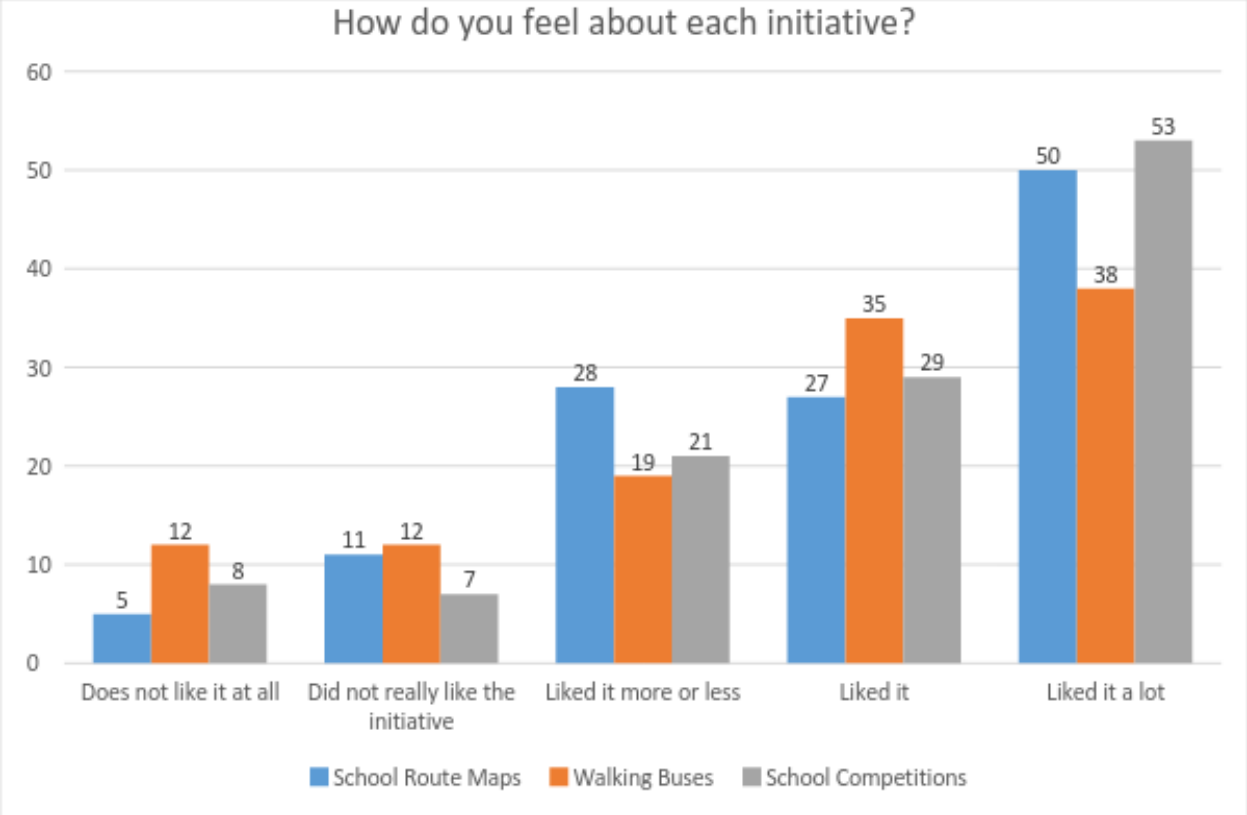

How do you feel about each initiative?
35
30
25
20
15
10
5
0
8
10
9
3
12
9
11
16
14
14
10
14
29
13
16
Does not like it at all
Did not really like the initiative
Liked it more or less
Liked it
Liked it a lot
School Route Maps
Walking Buses
School Competitions

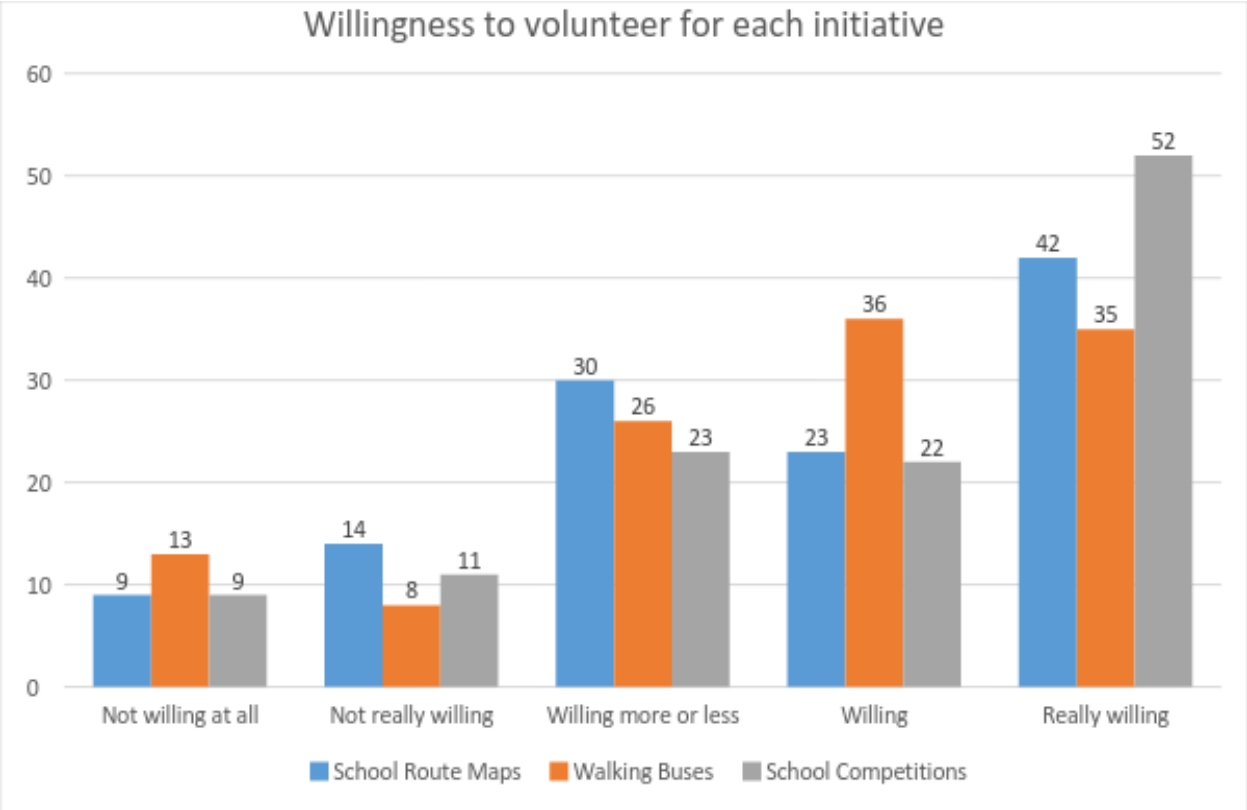

Willingness to volunteer for each initiative
25
20
15
10
5
0
6
14
11
13
12
10
8
5
6
14
8
7
16
16
21
Not willing at all
Not really willing
Willing more or less
Willing
Really willing
School Route Maps
Walking Buses
School Competitions

Herlinda Toral

Herlinda Toral was a school with children ranging from grades K-12 that is the school across the street from our chosen school, Ricardo Muñoz. Our sponsors focused their efforts on implementing the walking bus program at Herlinda Toral pending successful implementation at Ricardo Muñoz due to the proximity and the following results:

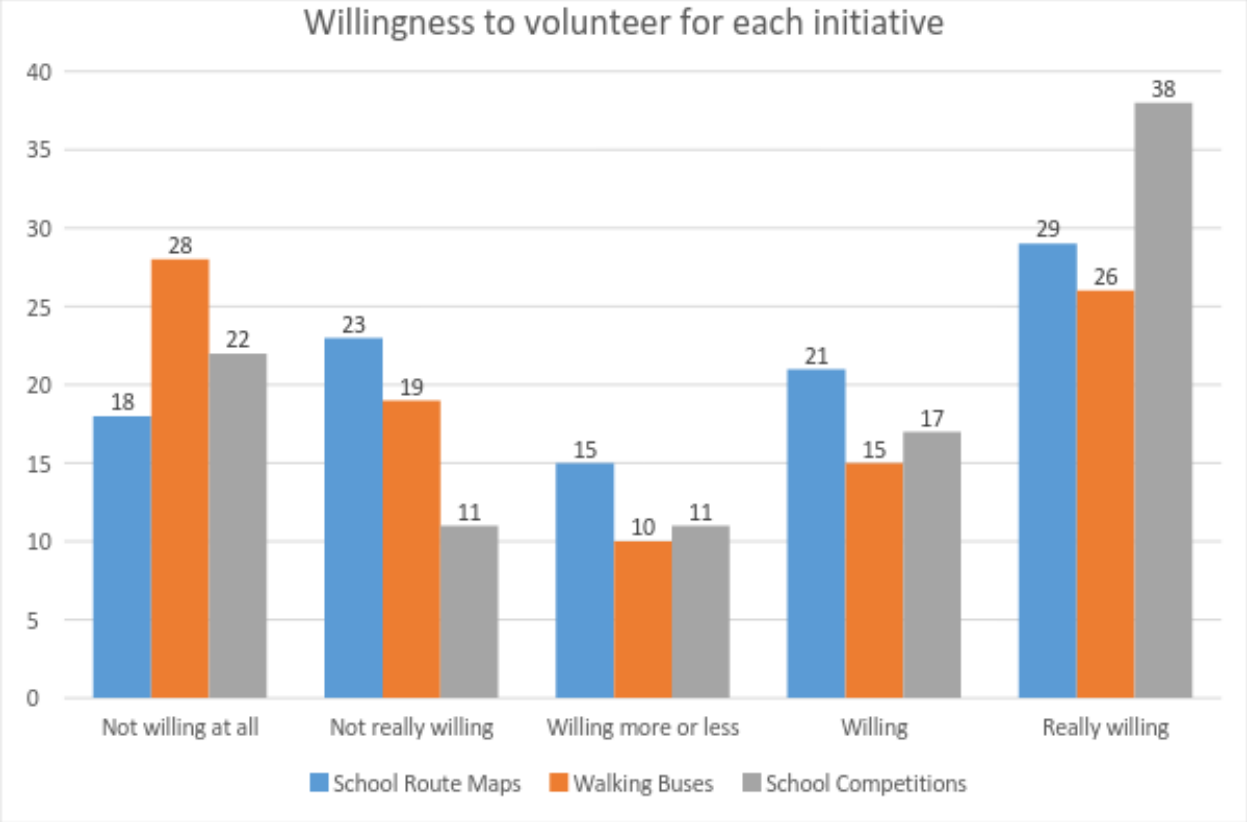



How do you feel about each initiative?
60
50
40
30
20
10
0
5
12
8
11
12
7
28
19
21
27
35
29
50
38
53
Does not like it at all
Did not really like the initiative
Liked it more or less
Liked it
Liked it a lot
School Route Maps
Walking Buses
School Competitions


Willingness to volunteer for each initiative
60
50
40
30
20
10
0
9
13
9
14
8
11
30
26
23
23
36
22
42
35
52
Not willing at all
Not really willing
Willing more or less
Willing
Really willing
School Route Maps
Walking Buses
School Competitions

Appendix L: Bar Chart displaying parental willingness to assist with initiatives

The following bar chart displays the distribution of parents' willingness to assist with the initiatives at Ricardo Muñoz.



Appendix M: Complete list of reasons for perceptions of safety

The following is divided into major categories as mentioned in the results section. The survey responses that fall under each major category and the number of responses each survey answer received for Ricardo Muñoz are listed below.

Positive Responses that brought about feelings of safety:

1. Walking to school with a family member – 3
2. Adequate signage – 5
3. Agents of Civil Traffic patrol the streets well – 2
4. The route traveled to school is safe – 5
5. Roads are in good condition – 2

Infrastructure Problems that brought about feelings of unsafety:

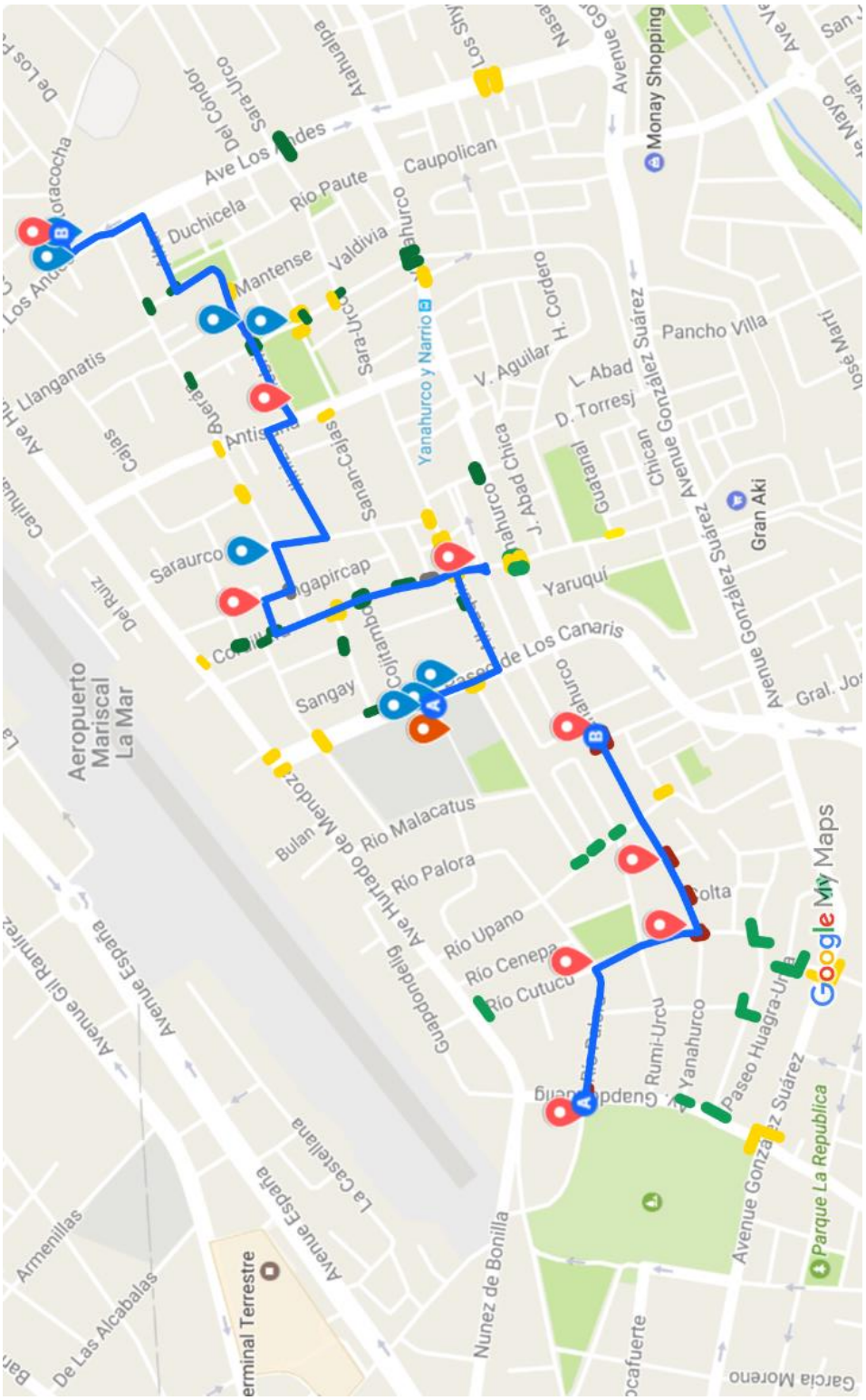
1. Sidewalks are in bad condition – 1
2. Inadequate/bad signage – 7
3. Lack of stoplights – 1
4. Lack of crosswalks – 2
5. Roads are in bad condition – 2

Human Interactions and Problems that brought about feelings of unsafety:

1. Crime – 3
2. Amount of vehicular traffic – 2
3. Lack of respect shown by drivers towards pedestrians – 10
4. Lack of police presence – 1

Appendix N: Map of pedestrian infrastructure in the neighborhood around Ricardo Muñoz

Appendix O: Map created to inform EMOV-EP on the condition of crosswalks



Appendix P: Sign Up for Walking Buses

Introduction: *We would like to invite you to the first ever walking bus at this school. We are trying to start a walking bus at Ricardo Muñoz to increase the number of students walking to school each day because of the health and environmental advantages of walking. A walking bus is a group of students, supervised by adult volunteers, who walk to school together and pick up kids on the way. To address the possible safety concerns of walking to school, we are working with EMOV-EP to ensure a safe routes exist and that these walking buses will follow these safe routes. In addition, walking in larger groups will increase pedestrian safety because drivers will be more likely to respect larger groups of pedestrians. This includes creation and maintenance of crosswalks, stop signs and safe sidewalks. To help us create and organize these routes, please answer the following questions.*

Please note: none of this information will be published on the internet or anywhere else. It will solely be used to create these routes.

1. *Do you want your child to participate in the walking bus?*

   ☐ Yes ☐ No

2. *What is your name and what is the name of your child?*

   _____

3. *What is the age and grade of your student?* _____
4. *Are you interested in the buses for the morning, afternoon or evening? (Please choose all times you are interested in)*

   ☐ Morning- Arrival ☐ Morning- Dismissal

   ☐ Afternoon- Arrival ☐ Afternoon- Dismissal

5. *At what intersection do you live?*

   _____

6. *Are you interested in volunteering for the walking bus?*

   ☐ YES ☐ NO

   If yes, how many days would you like to volunteer each week?

   ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

   Which days can you volunteer (please select all that you would be available)?

   ☐ Monday ☐ Tuesday ☐ Wednesday ☐ Thursday ☐ Friday

   Can you supervise a walking bus in the morning, afternoon, or evening?

   (Please check all that apply)

   ☐ Morning- Arrival ☐ Morning- Dismissal

   ☐ Afternoon- Arrival ☐ Afternoon- Dismissal

7. *Please provide the best method of contact:*

   _____

Appendix Q: Walking Bus Manual for EMOV-EP

Walking Bus Manual for *La Empresa Pública Municipal de Movilidad, Tránsito, y Transporte de Cuenca*

WPI

EMOV

Collaborating with the school:

1. **Have a meeting with the principal-** Having a meeting with the principal to begin the program is a necessary and helpful first step. Getting the principal to like the idea of a Walking Bus in the school is very important for the continued cooperation with the school. With increased support from the school, the program can grow and expand (with other facets such as incentives, safety trainings etc). These other parts of the program will attract more children and gain publicity for the program. In this meeting with the principal talk with them about getting in contact with *El comité de los padres de las familias* and the teachers.
2. **Have a meeting with *El comité de los padres de las familias*-** *El comité de los padres de las familias* can help you gain the support of the parents in the school, help you organize the program and help you keep it running after it has first been implemented. Try to keep them informed about every part of the program that you implement (especially the parts where you recruit participants and volunteers. So that they can run it after you are gone).
    a. Try to have one of them volunteer as the main coordinator of this program. They can act as the point person if someone wants to join in the future after EMOV-EP is no longer as involved at the school.
        i. Make sure to maintain good contact between the contact at EMOV-EP and whoever becomes the main point person in the PTA. This will allow easier coordination for meetings with parents and pedestrian safety trainings.

    b. Try to get time at a PTA meeting to talk to the parents about the initiative and possibly getting them to volunteer to help with spreading the news and enthusiasm to other parents in the school.
3. **Meet with the teachers of the school-** If you meet with the teachers, talk to them on their opinions about coming into the classroom and promoting the walking bus, implementing various walking incentive programs (discussed in the "Training" Section) and performing pedestrian safety trainings (either in the classroom or in a park such as Parque Vial depending on the age)
    a. Try to include *El comité de los padres de las familias* in this meeting if at all possible so that they can be included as much as possible in the entire process.

Gauging Interest:

1. **Parental Interest:** The way that many schools get information to the parents of their students is through take home surveys. Therefore, surveys sent home in each class is a good way to spread information about the walking bus.
    a. If this is the first implementation of this program in a new school, you can hand out a general interest survey (see Appendix A) to a gauge interest of a sample of the school. This will allow you to project the interest of the entire school in the

proposed initiatives.

i. When reviewing the results, focus both on the general interest of the respondents as well as the reasons why people drive to school to properly determine if the Walking Bus Program would address their concerns. For example:

1. School Route Maps: Provide safe routes for students to travel to and from school through advising them which streets are busy with cars, which streets have adequate crosswalks and sidewalks etc. This iniciative counteracts concerns of lack of safety.
2. Walking School Bus: Provides parental supervision and safety in numbers as students travel to and from school. This counteracts concerns of traffic around schools as well as safety and assists parents who lack time to walk their child to school

b. Once you gauge general interest, talk to the entire school about the program and send out sign up forms (see Appendix B):

i. If the professors agree, come in and meet with each class and discuss what a walking bus is, future incentives and school competitions to be implemented and possibly do a small pedestrian safety training. At the end of this meeting, pass out the sign up to the students.

ii. If professors do not want you to take class time, send out slips to parents informing them of a meeting outside of the school day to discuss the initiatives with the parents and to see if they want to participate.

iii. **Note: the signup forms we have created include a map on which they can draw where they live as well as the most common route they take to school if they walk*

**Note: when passing out the surveys and collecting responses, make sure to properly keep track of which students are morning students and which are afternoon students. To properly keep track of students who have signed up, record their responses in a response form (this excel spreadsheet is on the USB).*

2. **Volunteer Interest:** Try to get parents to volunteer. There is a spot on the signup form that allows them to sign up to volunteer. If, after the sign ups, there are not enough volunteers to run the program for each route, you can recruit more volunteers at the meeting with the parents. You can also start the program smaller, with the bus only running a couple of days a week before it grows large enough to have enough volunteers to run the bus every day.

a. You also can send home a volunteer request form (see Appendix C) to the parents of the students who have already signed up requesting them to volunteer.

Determining Safety of Neighborhood:

In order to safely implement the Walking Bus program with safe routes along which participants can walk to school, you need to know the safety of the neighborhood and which roads are the safest to walk along. This can be achieved by:

a. Walking the neighborhood and manually marking down the locations of stop signs, crosswalks, yield signs, and stop lights. Also mark down which streets are busy and which have less traffic. This will give you an idea of what the best routes are and help you ensure that you always cross the streets at safe locations, either at a corner or at a crosswalk.
    i. As you walk, also mark down which areas have degraded crosswalks that are in need of repair so that you can work on improving them if they need to be fixed.

Program Structure:

1. **Choosing program organization:** This is done based on the availability of volunteers and participants. Based off of interest, decide if the program will run every day or only a couple of days a week. You must also decide if it will run both before and after school or only one of the two. If there are not enough volunteers or participants, you can run walking bus as often as you can and then add more days when you get more volunteers.
2. **Determine the walking route:** Based on where the student participants live and the location of crosswalks, stop signs and other pertinent pedestrian infrastructure, determine the safest route (or routes) with central meeting locations for the participants.
    a. *Things to keep in mind for the route:*

        i. It should not take longer than around 35- 40 minutes to walk the entire thing
        ii. There should be designated meeting points at every stop, including the school. The students should know exactly where to wait for the bus.
        iii. The route should not cross the street at mid-block locations. Only at corners or at crosswalks
        iv. The bus should not cross busy streets without crosswalks. It also should not cross busy streets more than once if possible.
        v. The route must have available sidewalks to walk on at all times.
        vi. The route should use local parks as stops as much as possible.
3. **Create a time schedule:** Once you have determined the route, walk the route two to three times to see how long the route will take and when you will arrive at each bus stop. Plan to add three extra minutes to your route for each bus stop along your route. Make sure you walk the route slowly and estimate extra time to walk the route as groups of children tend to walk slower than

an adult.

4. **Policies and Procedures:** The following are guidelines and suggestions for the organization of the walking bus:
    a. Procedures:
        i. Morning: One or more volunteers will have a copy of a map with the walking route and walking bus stops depicted and a list of the students at each stop. The volunteers will meet the bus at the earliest bus stop and then walk the entire route, picking up students along the way
        ii. Afternoon: One or more volunteers will meet the bus at the school and walk the students back to their designated bus stop along the same route as the morning.
        iii. If a student is not at the bus stop at the designated time, the leader will call the parents of the participant and wait two minutes for the participant to arrive.

        iv. If the student does not arrive after two minutes, the bus will continue along the route.
    b. Volunteer- to- child ratio:
        i. Ages 4 - 6: 1 volunteer for every 3 children
        ii. Ages 7-10: 1 volunteer for every 6 children
        iii. Ages 10 and above: Fewer volunteers needed
5. **Volunteer Responsibilities:**
    a. For the entirety of the route, only walk the designated route. Pick up the students in the walking school bus stops and bring them to school or pick them up at the school and bring them to their designated stop.
    b. Emphasize the importance of pedestrian safety during the route
    c. Every day, take note of which students walk
    d. During the route, you must always have the following ítems:
        i. A complete map with the times for pick up and drop off of the students at each bus stop
        ii. A list of all the participants for each stop in order to ensure that none of them are left behind
        iii. A list with all of the contact information for the parents of the participants
        iv. A first aid kit in case of emergency
        v. A charged telephone with the contact information of all the parents
6. **Parental Responsibilities:**
    a. Ensure your student is at the bus stop 5-10 minutes before the designated pick up time
    b. Inform the bus leader if your student is not going to participate in the bus that day
    c. Inform the bus leader if your student is going to arrive late

d. If your student misses the bus, they are no longer the responsibility of the volunteer. It is now the responsibility of the parents to take their child to school.

7. Safety Procedures:

a. The leader must be able to see all of the participants at all times
b. Neither the leader nor the students should go into a participant's house during the bus route
c. There should not be any other leaders running the bus, only the leader(s) designated for that day and any parents who also wish to walk with the bus
d. If there is a student who is not part of the bus but wishes to participate, they may.
e. The leader should not use any type of vehicle to transport the students.
f. The leader should not be smoking or drinking alcohol during the route.

8. Procedures in case of emergency:

a. For more serious injuries, have the leader call the secretary in charge of risk at the school. Ask the director who they are and what their number is for each different school. The following outlines the proper procedures to take care of the following potential injuries:
b. <u>Nosebleed</u>
    i. The student should sit and tilt their head forward. They should pinch their nose for 10 minutes and do this 2 more times or until the blood stops running.
    ii. If the bleeding does not stop after 30 minutes, call 911
c. <u>Small cuts</u>
    i. Use the bandages and disinfectant in the first aid kit
d. <u>Large cuts</u>
    i. If there is an object in the cut, work to take out the object. If it is too big, call the emergency number.
    ii. If there is not object in the cut, have the student apply pressure to the cut and raise it above the heart.
e. <u>Sprains</u>
    i. Have the student sit and apply ice if possible
    ii. Call the school and contact the parents
f. <u>Broken bones</u>
    i. Don't move the broken limb and call 911
g. <u>Asthma attack</u>
    i. Help the student relax and take their medication or inhaler. Afterwards, call 911
h. <u>Diabetic Emergency</u>
    i. Call the parents of the student and contact the school
i. <u>Epileptic Attack</u>
    i. If it is minor, have the student sit down and help them relax
    ii. If it is major, make sure that the student will not hit their head and call 911
        1. Throughout the entire attack, make sure the student is safe

9. Possible Problems:

a. **Inappropriate Behavior of Students**
    i. Leaders should take note of inappropriate behavior of students. The consequences for bad behavior are as follows:
        1. First infraction: Warning
        2. Second infraction: A phone call to the parents
        3. Third infraction: The student is prohibited from participating in the bus for one week
        4. Fourth infraction: The student is permanently prohibited from participating in the bus
    ii. The leader should use discretion for all of these consequences
    iii. The leader should not verbally, physically, or emotionally discipline the students
b. **Weather problems:**
    i. If it is raining, make sure that the students have appropriate clothing or umbrellas, etc.
c. **Blocked Route:**
    i. If the route is blocked, contact the leader to let them know so that they can take a different safe route.
d. **Volunteer problems:**
    i. If a volunteer cannot accompany the bus on a certain day, the volunteer should notify all of the other parents of the students in the bus and it is the responsibility of the volunteer to organize their replacement for the day.

Trainings:

1. Volunteer Training: Once you have your volunteers you need to properly train them on the logistics and procedures of the walking bus. We have created a volunteer booklet and PowerPoint that cover the basic logistics of the walking bus (without specializing it for each specific school) which can be found on the USB. This booklet should be personalized for each walking route to include:

a. The bus stops, the times of each and which students are at each bus stop
b. A list of the students with the best number of contact for them
c. Any pertinent medical information provided by the parents (see Parental Training)

You should discuss the following procedures in the training session:

a. General Procedures for the bus
b. Volunteer Responsibilities
c. Safety Procedures
d. How to deal with inappropriate child behavior
e. What to do in certain situations

f. Emergency Procedures

During the volunteer training sessions, a schedule should be made to ensure that volunteers are available on the specific days that are assigned to them. The sign up should have a place where potential volunteers can choose which days they would be able to volunteer and how often they would like to volunteer in order to initially organize the volunteers. It will be easier to make sure the volunteers agree with the decided upon schedule when they are all together. If a group of volunteers would like to, they can decide to split the route and one volunteer walks the first half of the route and then trades off with another volunteer at a later stop so that neither has to walk the entire route.

They should sign the volunteer forms at the same time found in Appendix D agreeing that they understand the responsibilities of being a volunteer in the program.

2. **Parental training:** Once you have participants, it is important to have a meeting with their parents to ensure that they fully understand their responsibilities to help the Walking Bus program. There is a pamphlet in Appendix E that describes their responsibilities as well as the general procedures of the walking bus. The most important procedures to make sure the parents understand are:
   a. They have to have their student at the bus stop 5 - 10 minutes before the bus is scheduled to arrive at the bus stop
   b. If they are not going to participate that morning, they need to call the leader in charge of the bus to make sure they know they won't be participating that day

   There are several forms that the parents should fill out at this meeting so that the organizer (whether it is EMOV-EP or a parent on *El comité de los padres de las familias)* can gather the final information to organize the walking bus. These forms are: the parental responsibility form (See Appendix E) and the health form (see Appendix F). This information includes:

   a. Whether or not their child can walk home by themselves from the bus stop (this should then be denoted on the child's name tag)
   b. Pertinent health information that might be needed if there is an emergency (this information should be recorded on the volunteer booklet (see USB) that each volunteer should be given)
   c. Phone number where the parent can be reached if there is an emergency or they do not show up to the bus

At the same time, give the parents the "Letter to Parents" (see Appendix G) that should be customized for each student and their parent.

3. **Student training:** It is also important to have a student training session on pedestrian safety like the ones run at Parque Vial. This can be done only with the participants or with entire classes of students. If you talk to the professor, you can try to hold a training session during class. During this training session make sure to stress proper pedestrian behavior such as:
   a. Walk on the sidewalks and not in the street
   b. Walk the route, do not run
   c. Only crossing the street at crosswalks or corner intersections

d. Looking both ways before crossing the street

During the Bus:

1. **Things to note during the bus:**
    a. Make sure to have a specified meeting place.
        i. In the morning, simply denoting a whole park (such as Parque Curiquingue) is not specific enough and it will still be difficult to find all the students. When the bus becomes more consistent, try getting vertical signage posted somewhere in the park that can be used as a specified meeting place (see Appendix H). This will also be good for publicity of the bus- especially if these signs have contact information for someone so that a parent can sign up (even if it just says contact the director of a specific school in order to sign up.)
        ii. In the afternoon, try to have a more specified meeting place than "the main gate". Try posting signs on the wall (such as the example in Appendix I) next to the main gate where the students can easily gather. (Try to meet inside the main gate instead of outside to avoid losing children.)
            1. If parents come to pick up their child's backpack as they might, let the child go give their backpack to their parent and then ask them to come back and wait at the specified meeting place
    b. Each student should wear a yellow vest to make them more visible to drivers and to the leader of the bus. It will make it easier to keep track of participants if all students are following this dress code.
    c. Each student should wear a nametag with their name and their bus stop on it. If they are allowed to walk home by themselves, it should be denoted by a little asterisk.
    d. The leader should take attendance before leaving the school to make sure that they have all their students and then should make sure that each student leaves the bus at their specified stop

2. **How to sign up for the bus after it has started:**
    In order for there to be a way for families to sign up for the walking bus after it has already started, there has to be a specific person in the community that anyone who wants to sign up can contact. There are a couple ways people can sign up:

    a. You should hold a monthly meeting with any interested parents to expand the walking bus. This should be an informational meeting about what the walking school bus is and how it runs.

        i. This can also become the parent training meeting where you discuss the specific logistics as well as have the parents sign the forms and everything else needed at the parental training.
        ii. The following Monday from this meeting can be a large event day such as a theme day to celebrate having the new members.

iii. You should also have a volunteer meeting to update all of the volunteer information such as the student registry with a list of all of the names of the participants, their contact information and medical information.

b. Advertise the Walking Bus program with posters around the outside of the school and main gate (as seen in Appendix J) with information about the walking bus, information about when and where the next information meeting is and a number to call to get more information or sign up.
c. Ask to speak at meetings of *El comité de los padres de las familias* and give the same presentation at that meeting to reach more parents
d. If there are any school-wide meetings and assemblies, ask to speak at those meetings to get more participants there. Hold a more in depth informational meeting after that meeting

3. Ways to keep the Walking School Bus Program Interesting:

a. In order to keep participants excited about the walking school bus, some of the following ideas can help keep the walking bus interesting and fun for participants:

b. Theme days- Have days that are themed while the children walk to school. For example, you could have a day where everyone wears red, one where everyone wears a jersey for their favorite sports team, etc.

c. Play games: I spy etc., ABC game (a kid sees something that starts with A along the route, the next kid does the same with B, it continues)
d. Personalize all the things: name the route, name the bus, make a mascot, have a logo etc.
e. Hold a special "Walk to School" day to invite a special person to walk and talk with the group such as the mayor, the principal, a veteran, a police officer, a grandparent or a local celebrity or mascot.

Possible Incentives and School Programs:

Most of these school programs can either be geared towards any student who walks to school or only students who participate in the walking bus to encourage students to join the walking school bus

1. School Programs:

a. Walking Passport

i. Students are issued a "passport" that will be marked with a sticker or stamp for every time they walk to school. When a student walks to school ten times, they

receive a special star sticker or stamp. Incentives are given as an award according to the number of stars a student has collected.

b. Advent Calendar Idea:

i. An Advent calendar is a calendar that counts down until Christmas and each day you take something (normally chocolate) from the calendar. In a Walking Bus Advent Calendar, each child has their own "Advent calendar" and each time they walked to or from school they get a different tile for the calendar.

c. Make it special to be part of the Walking School Bus

i. Have the students pick a name for the bus.
   1. If there are multiple buses at each school, it would make it more special for the kids to be part of a specific bus
   2. A corresponding drawing can also be selected and used on rosters, buttons, or emblems. This gives each bus its own identity and increases a sense of ownership.

d. Recognize the students achievements:

i. You can have parent volunteers track the total number of miles walked during the school year and announce it at an end of year assembly. They can either track and announce how much the entire walking school bus has walked in a year or how much specific students have watched

e. "Virtual walk around the world"

i. Assign a distance amount that each student travels for each trip to school (based on how much they actually walk) and see how long it takes for the school to collectively reach the amount it takes to walk around the world. You can also put a picture of the world and a bus, then fill up a paper as the students walk further around the world to make it more visual to the whole school.

2. Incentive Plan:

a. Giving students incentives and actual things for participating in the walking school bus can also encourage them to want to participate. Some ideas of incentives include:
b. Give students who participate in the walking bus, a specialized button, backpack tag, silicon wristband, etc.
c. Students receive rewards for every week they participate in the "bus para caminar". The leaders will turn in all attendance sheets to the school and the school will hand out the awards.
d. On the first day of the walking bus, each student gets a chain with a charm on it. Every week they participate they will get another charm to add to the chain and they will win a milestone pendant for every four weeks they have participated.

3. Ways to assess if the bus is effective:

a. Ask the teachers to take a count on three days in one week before the program is implemented and after it is implemented to see what the change in the number of students walking is. See Appendix K for an example of the form for the teachers.

Frequently Asked Questions:

What if my child wants to participate, but I am not able to walk with the kids?

- ➔ If your child wants to participate but you cannot volunteer that is okay. There will be other volunteers that will lead the bus.

Does my child have to walk both to and from school to participate?

- ➔ No your child can walk as it fits their schedule. If they only want to walk in the morning that is fine, the schedule just needs to be cleared with the person organizing the walking bus.

What if the weather is bad?

- ➔ The Walking School Bus runs no matter what the weather. It is important that the participants dress appropriately for that day's weather. Items such as rain boots, rain jackets, and umbrellas are recommended.

What if I don't feel comfortable letting my child walk with another adult?

- ➔ If you don't feel comfortable with letting your child walk with another adult, you can always volunteer to help walk your child to school. The other volunteers are usually other parents or relatives of the students. Any unusual activity should be reported to the school and walking bus coordinator.

I'm interested in having my child participate, but I don't want to be confined by a rigid schedule.

- ➔ The walking bus program is flexible and as long as you arrange a schedule beforehand with the coordinator and walking bus leaders there should be no problem. Just let the walking bus coordinator and the walking bus leaders know if there is any emergency cancellations, but in general try to contact them in advance.

Can I walk with my child if I am not a volunteer?

- ➔ Of course you are welcome to walk along or meet your child at the bus stop. If you would like to walk with the group on a regular basis, we ask that you register at school as a volunteer.

How do I become a leader of the Walking School Bus?

- ➔ Contact the Walking School Bus coordinator: There will also be a monthly recruitment meeting at the school to expand the walking bus. Contact the bus coordinator or the school to find out the nearest meeting date.

My child wants to participate; whom do I contact?

- ➔ Contact the Walking School Bus coordinator: **Insert name and contact information of the walking school bus coordinator here**

Appendix A: General Interest Survey

Age of your child(ren):

_____

What method of transportation does your child use to get to school?

▢ Car ▢ School Bus ▢ Public Bus ▢ Bicycle ▢ Walking ▢ Motorcycle

▢ Other: _____

How long does it take you to commute to school in the mode of transportation you selected?

▢ Less than 5 minutes ▢ 5-10 minutes ▢ 10-15 minutes

▢ 15-20 minutes ▢ 20-25 minutes ▢ 25-30 minutes ▢ More than 30

Why do you use this form of transportation?

_____

Do you ever use other forms of transportation?

▢ YES ▢ NO

What methods?

_____

With what frequency?

_____

Would you consider the pedestrian signage around the school adequate?

▢ YES ▢ NO

How safe is your commute to school?

▢ Good ▢Bad ▢ Regular

_____

(Please write here why you feel your route is good or bad)

*Please rank the following initiatives from 1 to 5 based on how you much you like them: 1 being not at all to 5 being very much (**Please see the reverse side for an explanation**)*

School Route Maps	▢ 1	▢ 2	▢ 3	▢ 4	▢ 5
Walking Buses	▢ 1	▢ 2	▢ 3	▢ 4	▢ 5
School competitions	▢ 1	▢ 2	▢ 3	▢ 4	▢ 5

*Please rank the following initiatives from 1 to 5 based on how much you would be willing to volunteer for them: 1 being not at all to 5 being very willing. (**Please see the reverse side for an explanation**)*

School Route Maps	▢ 1	▢ 2	▢ 3	▢ 4	▢ 5
Walking Buses	▢ 1	▢ 2	▢ 3	▢ 4	▢ 5
School competitions	▢ 1	▢ 2	▢ 3	▢ 4	▢ 5

Explanation of the initiatives

School Route Maps

This program consists of maps for children that their parents can use to plan safe and fast walking routes to school. This map shows the neighborhood around the school with important locations and pedestrian infrastructure marked such as busy streets, stoplights, crosswalks, parks, etc.

Walking Buses

A walking bus is a group of students who walk to school together with one or more adult volunteer. The group walks along a specified safe route and children are picked up at common bus stops along this route. In order for walking buses to run, it requires volunteers from the community to lead the bus. However, even though it requires volunteers, it still saves time for parents overall as they do not need to walk their child to school every day.

School Competitions

The final initiative is school competitions between classes or grades. An example of a possible school competition is that during one week, teachers will record the amount each class walked to school and the class which walked the most kilometers will receive a reward or recognition.

Appendix B: Walking Bus Sign Up

Introduction: *We would like to invite you to the first ever walking bus at this school. We are trying to start a walking bus at *insert school name here* to increase the number of students walking to school each day because of the health and environmental advantages of walking. A walking bus is a group of students, supervised by adult volunteers, who walk to school together and pick up kids on the way. To address the possible safety concerns of walking to school, we are working with EMOV-EP to ensure a safe routes exist and that these walking buses will follow these safe routes. In addition, walking in larger groups will increase pedestrian safety because drivers will be more likely to respect larger groups of pedestrians. This includes creation and maintenance of crosswalks, stop signs and safe sidewalks. If you would like to participate, please answer the following questions to help us create and organize these routes,*

Please note: none of this information will be published on the internet or anywhere else. It will solely be used to create these routes.

8. Do you want your child to participate in the walking bus?
   ☐Yes ☐No
9. What is your name and what is the name of your child?
   _____
10. What is the age and grade of your student? _____
11. Are you interested in the buses for the morning, afternoon or evening? (Please choose all times you are interested in)
    ☐Morning- Arrival ☐Morning- Dismissal
    ☐Afternoon- Arrival ☐Afternoon- Dismissal
12. At what intersection do you live?
    _____
13. Are you interested in volunteering for the walking bus?
    ☐YES ☐NO
    If yes, how many days would you like to volunteer each week?
    ☐1 ☐2 ☐3 ☐4 ☐5
    Which days can you volunteer (please select all that you would be available)?
    ☐Monday ☐Tuesday ☐Wednesday ☐Thursday ☐Friday
    Can you supervise a walking bus in the morning, afternoon, or evening?
    (Please check all that apply)
    ☐Morning- Arrival ☐Morning- Dismissal
    ☐Afternoon- Arrival ☐Afternoon- Dismissal
14. Please provide the best method of contact
    _____

Appendix C: Volunteer Request Letter

Esteemed parents of SCHOOL NAME,

Thank you for signing up to participate in the walking bus at your school! We are very excited for the implementation of this bus.

However, the bus will only be able to operate for the following days:

In order to allow the bus to function every day of the week, we need more volunteers. Right now, we are lacking volunteers for the following days:

The walking bus will begin for arrival at *TIME* and will begin for dismissal at *TIME*.

If you are able to help us and volunteer in our program, please fill out the following document and return it to NAME OF POINT PERSON by DATE.

Thank you,

NAME

____ I would like to volunteer to help lead the walking bus

____ I would like to volunteer to help organize the walking bus

Name of parent: _____

Method of contact for parent: _____

Appendix D: Volunteer Responsibility form

Volunteer Consent Form

As a volunteer, it is important that you adhere to certain policies to ensure that the walking bus remains a safe and fun environment in which children can walk to school together. Please review the following rules and responsibilities and sign below.

General Responsibilities:

1. For your route, you will walk the designated route at the designated time, pick up children at the Walking Bus Stops and drop them off at school or you will pick them up from school and walk them to the designated Walking Bus Stop
2. You will always stress the importance of walking safety during the route
3. You will keep track of which students walked
4. You will always have the following items on you during the walk:
    a. A map of the entire route complete with drop off/ pick up times
    b. A first aid kit in case of emergencies
    c. A complete list of contact information for the participants of the bus
    d. A charged cell phone with contact information for all the participants of the bus

Walking School Bus Code of Conduct:

1. A volunteer will never be alone with a single child where they cannot be observed by others
2. No adult guests other than approved volunteers can lead the Walking Bus
3. Walking School Bus participants will be supervised at all times
4. Volunteers will not abuse children including:
    a. Physical abuse
    b. Verbal abuse
    c. Sexual abuse
    d. Emotional abuse
5. Volunteers will portray a positive role model for youth
6. Volunteers should not leave children alone at a Walking Bus stop
7. Volunteers should never release children to anyone other than the school and at his/her designated Walking School Bus stop unless informed ahead of time by the parents of the child.

Appendix E: Parental Responsibility Form

Parental Responsibility Form

We are very excited that you have registered you child(ren) to participate in the walking bus. This program will be a fun and safe way for your child)ren) to walk to school.

As a parent of a participant, it is important that you understand your responsibilities. Please read the following rules and sign below.

You must:

- *Ensure that your student is at the bus stop 5-10 minutes before the designated pick up time*
- *Communicate with the leader if your student is not going to participate in the bus that day*
- *Communicate with the leader if your student is going to arrive late that day*

If your student misses the bus:

- *At arrival- it is the responsibility of the parent to accompany their student either to the walking bus or to the school*
- *At dismissal- The student should go to a specified place to call their parents to come pick them up*

I agree that I have read and understand the rules and responsibilities for the walking bus.

Signature: _____ *Date:* _____

Appendix F: Health Form

Health Form

It is very important for the volunteers of the walking bus to be aware of any and all medical conditions that your student has so that they know the correct way to help in case of emergency. The volunteers will not distribute this information in any form

---

Medical Conditions:

Please list any medical conditions your child has that you believe the volunteer should be aware of (eg. Asthma, diabetes, epilepsy, etc.):

_____

_____

Allergies:

Please list any allergies your child has. If none, write none:

_____

_____

Appendix G: Letter to Parents

Esteemed parent,

We are very excited that you have registered your student to participate in the walking bus. This program will be a fun and safe way for your student to walk to school.

As a reminder, you have received a pamphlet with the information about the rules and regulations for this walking bus. One of the leaders will call you soon to introduce themselves and answer any questions you might have.

Your walking bus will run the following days:

Monday:	*Morning-Arrival*	*Morning-Dismissal*	*Afternoon- Arrival*	*Afternoon-Dismissal*
Tuesday:	*Morning-Arrival*	*Morning-Dismissal*	*Afternoon- Arrival*	*Afternoon-Dismissal*
Wednesday:	*Morning-Arrival*	*Morning-Dismissal*	*Afternoon- Arrival*	*Afternoon-Dismissal*
Thursday:	*Morning-Arrival*	*Morning-Dismissal*	*Afternoon- Arrival*	*Afternoon-Dismissal*
Friday:	*Morning-Arrival*	*Morning-Dismissal*	*Afternoon- Arrival*	*Afternoon-Dismissal*

The following are the leaders and their contact information for your route:

Monday:	*Name:*_____	*Telephone Number:*_____
Tuesday:	*Name:*_____	*Telephone Number:*_____
Wednesday:	*Name:*_____	*Telephone Number:*_____
Thursday:	*Name:*_____	*Telephone Number:*_____
Friday:	*Name:*_____	*Telephone Number:*_____

Your student will be picked up and dropped off at the following location and time:

Location: _____ *Time:*_____

Other reminders:

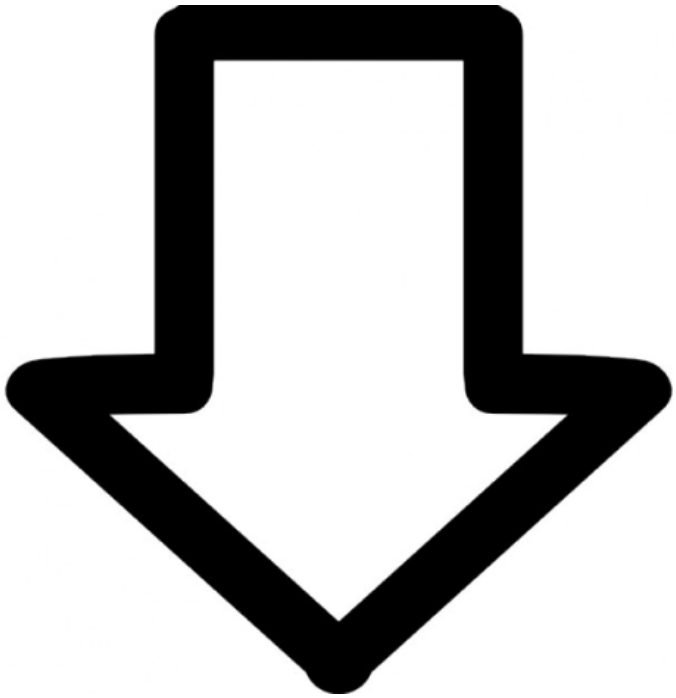
- This program will start on _____
- Please ensure that your student is at the designated bus stop 5- 10 minutes before pick up time.
- If your student cannot participate one day, please call the leader and inform them
- Please read all the rules and regulations for the bus

If you have any questions about this program, please do not hesitate to call me at **********

Thank you,

Appendix H: Poster for morning meeting place

A Walking School Bus for *school name here* meets here!



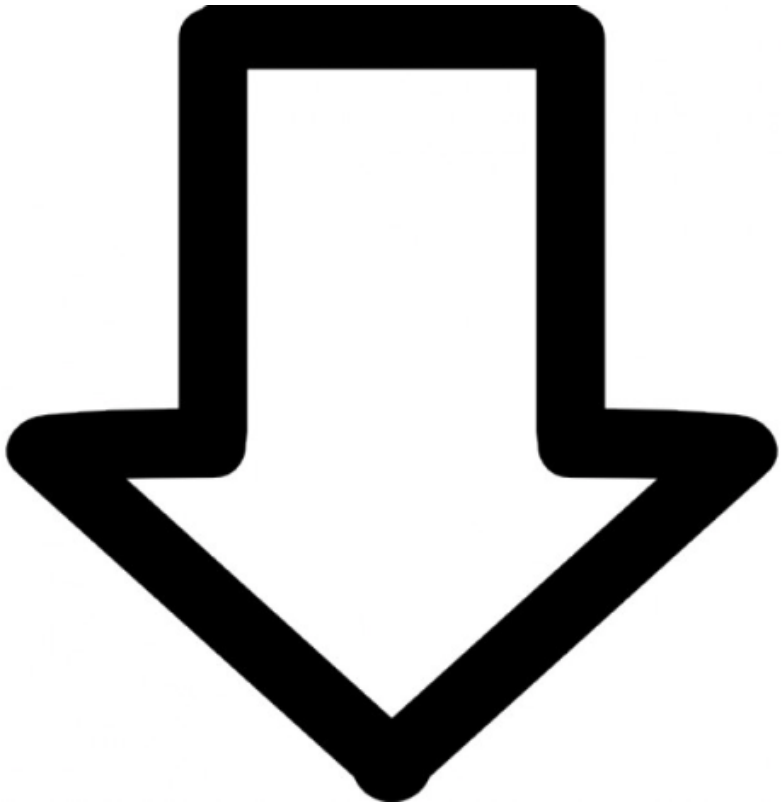
What is a Walking Bus?

A walking school bus is group of students that walk to school together accompanied by adult volunteers along a safe route.

For more information contact: *insert contact info here*

Appendix I: Poster for afternoon meeting place

Walking Bus Group # meets here



Appendix J: Example poster for advertisement outside the school

EMOV-EP & **insert school name here present:**

Walking School Bus Program!

A walking school bus is group of students that walk to school together accompanied by adult volunteers along a safe route.

*Join us at *insert location, date and time here* for an information session about the school walking bus program at your school!*

Join your neighborhood and have your kids walk to school today!

For more information contact: *insert contact person here*

Appendix K: Teacher Tally Sheet

Count of how students arrive and depart school

Name of the school : _____

Name of the teacher: _____

Grade: _____

Date on Monday: __ __/ __ __/ __ __ __ __

Number of students in the class: ___ ___

	Count of students	**Walking**	**Biking**	**School Bus**	**Family Vehicle**	**Carpool**	**Public Bus**	**Other**
	Number of students who are in the class at the time of the count	*Record the number of raised hands*	*Record the number of raised hands*	*Record the number of raised hands*	*Only with members of your own family*	*With other students*		*Motorcycle, etc.*
Tuesday-Arrival								
Tuesday-Dismissal								
Wednesday-Arrival								
Wednesday-Dismissal								
Thursday-Arrival								
Thursday-Dismissal								

Please list any possible disruptions in this count such as bad weather:

_____