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San Jose's Walk n' Roll Program: An Evaluation of School Pedestrian Education Programs

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by
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INTRODUCTION

The City of San Jose has been recognized as among the safest cities in the United States, but an area that the city seeks to improve in is reducing the number of traffic accidents involving pedestrians and bicyclists. As stated by the city, "San Jose's injury crash rate is about half the national average" (Vision Zero San Jose, 2015, p. 6), but, on average, 40 people are killed annually and 150 are seriously injured on San Jose's streets. To address this, San Jose is using data, education, and technology to make a shift towards creating streets and roads that benefit not just cars, but everyone who uses streets and roads (Vision Zero San Jose, 2015, p. 6). A key component to increasing pedestrian safety is developing safe and healthy habits at an early age, which is why education and encouragement programs are critical for this goal. This study evaluates San Jose's Walk n' Roll program and analyzes whether it has an influence on the number of students who walk or ride a bicycle to school. The effectiveness of this program will be based upon the number of students who choose to walk or ride a bicycle to school instead of riding in a car, and seeing whether there is a measurable difference after the Walk n' Roll training.

BACKGROUND

For several decades, San Jose has been active in efforts to reduce traffic accidents and traffic related fatalities. From 1996 to 2000, Santa Clara County reported that traffic related accidents accounted for 50 percent of deaths in youths from 0 - 19 years old (Pedestrian and Bicycle Information Center, 2009, p. 1). In November 2002, San Jose's Department of Transportation began an education program named "Street Smarts" to educate drivers, bicyclists, and pedestrians on safe traffic practices. To educate children and school communities about safe practices, this program introduced the Streets Smarts Back-to-School Traffic Committee, which partnered with school districts and the American Automobile Association (AAA). Through these partnerships, Street Smarts was able to provide traffic safety materials to schools and hold educational events, such as bicycle rodeos, to teach students safe active transportation practices.

Despite San Jose having fewer traffic related injuries and fatalities than the national average, city leaders adopted Vision Zero, stating that any loss of life to traffic related accidents was unacceptable. Using an estimate from the National Highway Traffic Safety Administration, the City of San Jose states that loss of one life to a traffic accident costs society $1.4 million (City of San Jose, 2017, p. 10). San Jose has approved the investment of over $80 million in its Five-Year Transportation Capital Improvement Program (CIP) to make transportation safer for drivers, pedestrians, and cyclists. The money goes toward adding more bicycle lanes, improved lighting systems, and educational programs such as Walk n' Roll (City of San Jose, 2015, p. 19).

Safe Routes to School

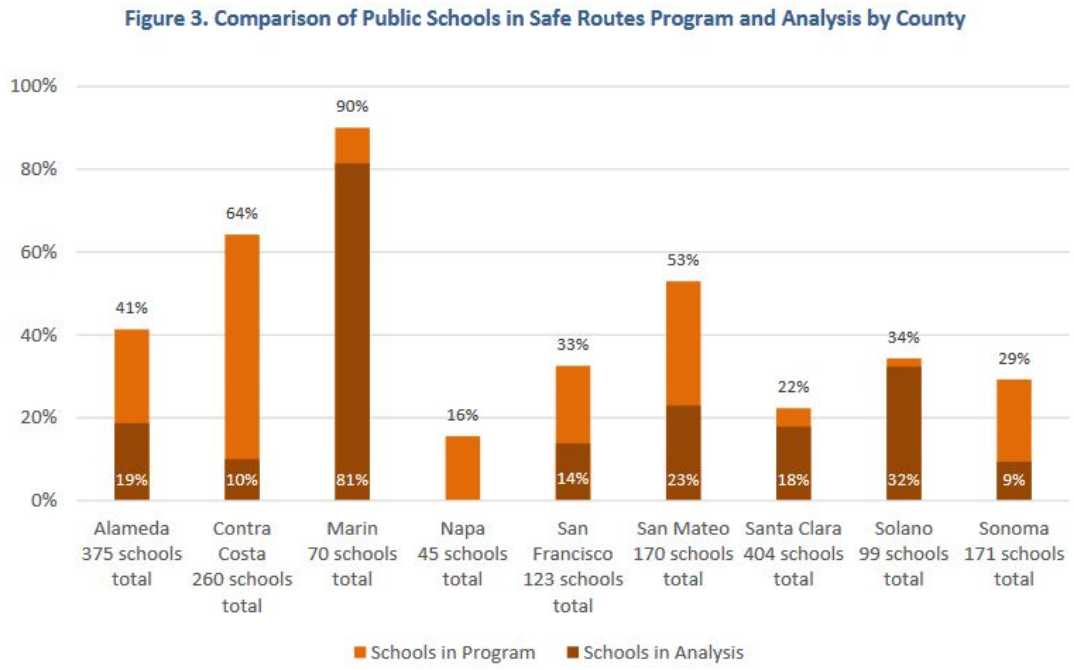
Walk n' Roll is part of a larger nationwide initiative known as Safe Routes to School. Safe Routes began as a movement in Odense, Denmark in the 1970s to reduce the number of traffic-related fatalities (Safe Routes to School Guide, n. d.). Due to the success of program, other European countries began developing their own Safe Routes programs during the 1980s. The Bronx in New York was the first city in the United States to adopt a Safe Routes to School program, and several cities in the United States began adopting their own Safe Routes to School model. Programs in the United States not only focused on traffic safety, but also aimed to decrease childhood obesity. The successes of these programs led to interest from the federal government, and Congress established the Federal-Aid Safe Routes to School Program in 2005, dedicating almost $1 billion in funding for Safe Routes to School programs across the United States. As stated by the Safe Routes to School National Partnership, has three primary goals:

1. To enable and encourage children, including those with disabilities, to walk and bicycle to school;
2. To make bicycling and walking to school a safer and more appealing transportation alternative, thereby encouraging a healthy and active lifestyle from an early age; and
3. To facilitate the planning, development, and implementation of projects and activities that will improve safety and reduce traffic, fuel consumption, air

pollution in the vicinity of schools (Safe Routes to School: National Partnership, n. d.).

In the San Francisco Bay Area, Safe Routes to School programs also aim to reduce greenhouse gas emissions and car pollution. According to the Bay Area's Metropolitan Transportation Commission's (MTC) "Climate Initiatives Program Evaluation: Regional Safe Routes to School Program" (2015) projects are funded to reduce greenhouse gases and encourage healthier lifestyles for Bay Area residents (MTC, 2016, ES-1). For Santa Clara County, $4.04 million went towards 2011-2014 funding for Safe Routes to School Programs. From 2013-2014, 90 Bay Area schools were in a Safe Routes to School Program, which resulted in an increase of 4% of students walking to school, and an 11% reduction in trips by vehicle to schools (MTC, 2016, ES-1).

Figure 1: Safe Routes Programs by County, 2016



Source: Metropolitan Transportation Commission, 2016a.

The MTC found that Alameda, Marin, and Santa Clara Counties had lower walking and biking percentage changes since beginning the programs, despite these counties having longer histories of being in Safe Routes programs. The MTC states that this could be due to the fact that these counties have populations that are "amenable to switching to walking and biking" and began the shift away from cars earlier, so the incremental change was less (MTC, 2016, p. 15). Despite this, all counties enrolled in the program have shown a shift towards active transportation rather than driving.

MTC data also shows that the distance that a family lives from a school is an indicator of how likely students are to switch from family vehicle to active transportation. The farther a family lives from school, the less likely it is that a student is willing to

switch from family vehicle to active transportation (MTC, 2016, p. 16). For the entire region, the total number of miles that students walked is 199,489 miles more and bicycled 148,777 miles more since starting the program (MTC, 2016, p. 17). It was found that in a sample of schools accounting for 65,185 enrolled students, a total of 403,812 pounds, or 4.8%, in greenhouse gas emissions was reduced (MTC, 2016, p. 19). The MTC states that if this number was applied to all 1.9 million enrolled students in all nine Bay Area counties, it would lead to a reduction of 5.3 million pounds in greenhouse gas emissions.

Walk n' Roll

The Walk n' Roll program was created in 2012 to encourage students to walk or ride their bicycles rather than take family vehicles to school. The city reached out to schools and provided information to schools and surrounding communities on the benefits of active transportation to school (Vision Zero San Jose, 2015, p. 10). At the regional level, the Metropolitan Transportation Commission funds San Jose's Walk n' Roll program through the Climate Initiative's program (Vision Zero San Jose, 2015). The goals of the Walk n' Roll program are:

- Instill healthy and active lifestyle behaviors by encouraging daily physical activity in a fun and social environment.
- Improve community safety by increasing the visibility and number of students walking and biking to school.
- Reduce traffic congestion around school zones while reducing air pollution and greenhouse gases.
- Increase their sense of community (City of San Jose, 2017).

The City of San Jose states that it will achieve these goals through the implementation of the 5 "E's, which are essential to all national Safe Routes to School programs:

- **Education** Through bike rodeos, assemblies and other activities, the City will provide pedestrian and bicycle safety tips, information on the benefits of an active and healthy lifestyle, and highlight the positive impact students can have on their environment through biking and walking.
- **Encouragement** The City will help school staff and parents organize fun activities to encourage students to walk and bike. These activities include Walking School Buses, Bike Trains, and special events such as International Walk to School Day, Bike to School Day, and monthly Walk/Bike to School Day events.
- **Engineering & Evaluation** The City will use a community-based approach to identify improvements that would enhance suggested walking routes to each school. The City will use existing grant funds and City funds to address high priority needs.
- **Enforcement** To increase the safety of all involved, the City will reinforce safe driving behavior in school zones through the collaborative efforts of the San José Police Department's Operation Safe Passage and the Department of Transportation's Parking and Traffic Compliance Team (Vision Zero San Jose, 2017).

In addition to these 5 E's, San Jose's Walk n' Roll program also has a sixth E which stands for equity. San Jose hopes to make active modes of transportation accessible to students of all socioeconomic backgrounds. Traditionally, students in lower income neighborhoods have had a difficult time getting to school using active transport due to factors such as safety and lack of community engagement.

San Jose's Walk n' Roll program was initially funded by the Valley Transit Authority's (VTA) VERBS program at the time. VERBS stands for "Vehicle Emissions Reductions Based at Schools" and has four goals:

(1) facilitate the planning, development, and implementation of a project and/or activity that will reduce traffic, fuel consumption and air pollution in the vicinity of schools; and

(2) reduce traffic related injuries and fatalities to school children; and

(3) enable and encourage children, including those with disabilities, to walk and bicycle to school; and

(4) make bicycling and walking to school a safer and more appealing transportation alternative, thereby encouraging a healthy and active lifestyle from an early age. (VTA, n.d., p. 1)

VERBS is part of the MTC's Bay Area Safe Routes to School Program, and the MTC grants $5 million to cities, counties, and local transit agencies to help fund bike lanes, traffic calming projects, and education programs for students (MTC, n.d.). VERBS receives approximately $5 million in funding from the Federal Highway Administration's Congestion Mitigation and Air Quality (CMAQ) funds, and the VTA is able to fund projects ranging from $500,000 to $1,000,000 through these funds. The Walk n' Roll

program will go from receiving VERBS funding to VTA money through Measure B funds. Measure B is a half-cent sales tax increase that was approved in 2016 by Santa Clara County voters which is expected to generate $6.3 billion over the course of 30 years and is intended for transit improvements (VTA, 2018.).

Walk n' Roll initially worked with 25 schools in its first cycle, and now works with 67 schools. The program uses the help of volunteer groups that help facilitate the program at the school sites. The volunteer groups consist of parents, community members, and the principals. The program meets with the schools monthly to record updates and any concerns that schools may have. Due to the increasing number of schools that participate in Walk n' Roll, the program works closest with new schools to help with implementation, as opposed to schools that have been longer with the program.

Education

The Walk n' Roll program uses assemblies and bike rodeos to educate students on how to walk to school safely and how to safely ride their bicycles. Safety assemblies are usually held at the beginning of the school year, and teach students what precautions they should take when crossing streets, and the benefits of walking to school. During these assemblies, the Walk n' Roll program is introduced to students, and schools designate one day out of the week as a walk-to-school day. On these days, students are encouraged to walk to school with their parents and friends, rather than taking a family vehicle to school. The first Wednesday of October is also recognized as International Walk to School Day and is used to encourage all students to walk to school that day. Bike rodeos

are used to teach students how to safely ride their bicycles and to pay attention to their surroundings. During a bike rodeo, students go through different courses that teach them different aspects of bicycle safety, such as how to check their bicycles to make sure they are safe, appropriate riding speeds, and the traffic signs bicyclists should be aware of.

Encouragement

There are various incentives and methods that schools use to encourage students to walk to school, and the type of incentives given are dependent on the schools. Some schools within the program may assign a certain day of the week as walk-to-school day, and reward students with stickers or pencils for walking to school. Principals and teachers may participate in walk-to-school days to model safe walking and to encourage their students to walk to school, as well. The number of days that students walk to school may be recorded, as well, via tally or barcode, and a school might recognize students with certificates (see Figure 2) to acknowledge their efforts.

Figure 2. Example of Walk n' Roll Certificate. Taken from: City of San Jose. (2016). *Walk n' Roll Toolkit* [Sample certificate]. Retrieved from: http://www.getstreetsmarts.org/downloads/walknroll/WalknRollToolkit_English.pdf

Engineering and Evaluation

Walking audits are intended to get community feedback and community input to improve the safety of a school's surrounding area. Parents, principals, Walk n' Roll staff, and Department of Transportation engineers walk around the neighborhood to see what capital improvements are needed. Feedback from the community is recorded and the Department of Transportation takes the feedback into consideration when developing the annual capital improvement budget for infrastructure improvements (see Figure 3).

Walk Audit

Route	Location	Observation/Concerns	Notes/Comments
3	Ave right in front of the school	Kids coming from Creek Trail cross midblock across Ave	The two crossings are very far away for kids, even though they should cross at the interections, they do not because of the fact that they are far away.
3	Ave right in front of the school	Many parents make illegal U-turns in front of the school	This is very concerning as there are many kids who cross midblock
3	Ave right in front of the school	People do not respect the 25mph speed limit while children are present.	We did not notice any 25 mph speed limit signs on Ave heading toward Ave
3	On Ave between and	School signs blocked by trees on Leigh heading towards (near Creek Trail)	
3	and Ave	No school signs at this intersection	We are not aware of how far from the school signs are permitted
2	Ave	Lifted sidewalk	
5	All along Creek Trail inside the school boundary (from Elementary to Ave)	Homeless/transient people set up camps just off the trail.	
5	All along Creek Trail inside the school boundary (from Elementary to Ave)	People smoking and doing drugs along the trail, students walking to school are exposed to this	

Figure 3. Walk Audit sample. Taken from: City of San Jose. (2018). *Walk Audit* [Informational chart]. From City of San Jose Walk n' Roll Program

After walking around the surrounding neighborhood, the Department of Transportation works with the community to develop different routes that students can use to get to school, depending on where the students live. These routes are provided to parents who volunteer to lead groups of students in "walking school buses." "Walking school buses" consist of volunteer parents who walk with a group of students to school.

Enforcement

San Jose's Department of Transportation's Parking and Traffic Compliance Team and the Police Department address Walk n' Roll's enforcement component. Before and after school, officers and members of the Parking and Traffic Compliance Team make sure that drivers are obeying traffic signs, traffic laws, and street markings.

METHODOLOGY

This study used Sylvia & Sylvia's Outcome Evaluation model to research the design of San Jose's Walk n' Roll program and its impact in regard increasing the number of students who choose active modes of transportation. The Walk n' Roll Program is a voluntary program that the city offers to schools that are willing to participate. The importance of program evaluation is stated by Ron and Kathleen Sylvia in their book, *Program Planning and Evaluation for the Public Manager*, "Another important reason for collecting and synthesizing local data is that it can form the basis for local resource allocations" (Sylvia & Sylvia, 2012, p. 117). The emphasis of the program is to encourage students to walk and ride their bicycles to school rather than ride in their families' cars. Another goal of the program is to educate students on safe pedestrian practices. Overall, the program aims to educate students on the benefits of walking and bicycling to school, and to have students continue engaging in active modes of transportation. This is measured and recorded by mode shift, which will be mentioned in the findings portions of the paper.

Table 1: Walk n' Roll Outcome Evaluation

Program	Theoretical Goals	Program Goals	Proximate Indicators	Program Measures	Program Outcomes	Outcome valence
Walk n' Roll	T1: To increase walking and bicycling to school, encourage healthier lifestyles, and have students continue those healthy habits	G1: Increase the number of students who walk or bicycle to school (T1) G2: Reach mode shift of at least 20% (T1)	I1: Number of students walking and bicycling to school (G1) I2: Mode shift percentage (G2)	M1: Comparing number of students who walk to school before the program and after program is presented (I1) M2: Comparing the mode shift from year to year (I2)	O1: Primary outcomes/ Students walk and bicycle to school more than ride in cars (M1) O2: Secondary outcomes/ Schools maintain a mode shift of 20% (M2)	±

LITERATURE REVIEW

Tingvall & Haworth (1999) wrote that according to the Vision Zero system, "It can never be ethically acceptable that people are killed or seriously injured when moving within the road transport system" (p. 2). While traditional traffic safety systems assume that road safety is the sole responsibility of those using the road, Vision Zero believes that in serious accidents, responsibility is shared between those who use the roads and those who design the roads. In cases in which road users may break, ignore, or be unaware of the laws of the road, the designers must anticipate this and adjust the roads to reduce the chances of serious injury (Tingvall & Haworth, 1999, p. 3). Tingvall & Haworth propose several strategies which would reduce mobility in certain areas and improve driver accountability in regards to traffic safety. The strategies consist of changing traffic infrastructure, changing how vehicle safety systems operate, and changing how the community uses roadways (Tingvall & Haworth, 1999, p. 6-8). The authors conclude that if society wishes to continue being mobile, it must also increase its safety measures, as less accidents can only be achieved through reduced mobility or safer systems (Tingvall & Haworth, 1999, p. 8).

It was found that after Vision Zero's implementation in Sweden, traffic deaths in the country were cut in half, even while the number of road users increased (Walljasper, 2015, p. 18). These results were attributed to road designs that lowered driving speeds, narrower roads, and barriers that separated cars, pedestrians, and bicyclists. Factors such as when vehicles would most likely interact with pedestrians and bicyclists were accounted for as well, and in such areas vehicles would have to reduce their speeds. Prior

to Vision Zero, it was believed that widening roads would make them safer, but it was found that narrowing roads led to safer driving due to the fact that drivers would have to slow down (Mendoza et al., 2017, p. 108). Vision Zero recognizes that human error may occur, and collisions between vehicles and pedestrians or bicyclists might still happen, but that those hit at a lower speed have a more likely chance of surviving.

Prior to implementation of Vision Zero in the United States, Kelley (2010) described the various reasons as to why road safety programs in the United States were not successful. Kelley states that 40,000 people die per year due to automobile related accidents (Kelley, 2010, p. 170). With the implementation of Vision Zero in several cities, there have been reports of noticeable reductions in serious vehicle-related accidents. Researchers state that after the implementation of Vision Zero, the number of pedestrian fatalities dropped by 27 percent in 2014, which was considered a historic low (Walljasper, 2015, p. 18). New York implemented several of the strategies that were outlined by Vision Zero, and it had police officers focusing on traffic safety. This resulted in the number of speeding tickets increasing by 36 percent (Walljasper, 2015, p. 19).

The City of San Jose implemented Vision Zero in May 2015 and has the same goals of reducing traffic deaths to zero. According to data put out by the city and federal government, San Jose has historically had fewer injuries per crash than the national average (City of San Jose, 2015, p. 7). Richards writes that San Jose has the second lowest traffic fatality rate of big cities in the United States, and that the city's annual crash rate of 3.18 also makes it the second lowest of comparable sized cities (Richards, 2015). However, he also states that in 2015 there were 142 traffic-related deaths in San

Jose. Additionally, the City of San Jose has also presented data that shows that 50% of San Jose's traffic-related incidents come from a small part of the city that makes up 3% of San Jose's streets (City of San Jose, 2015, p. 20). Unlike other cities, San Jose has not set a date to reach zero deaths. The reason for this, according to Jim Ortbal (2016), San Jose's Director of Transportation, is for practical reasons. He writes that the city must first lay the foundation for the program, and federal and state policies may conflict with what Vision Zero aims to achieve (Ortbal, 2016, p. 3). $80 million has been invested into the city's five-year capital improvement plan for Vision Zero strategy implementation: narrowing roads, making crosswalks more visible, and other improvements targeted in areas that experience disproportionate numbers of traffic injuries and fatalities (City of San Jose, 2015, p. 19).

Based on several studies reported in scholarly journals, Vision Zero has shown promising results in Sweden and other European countries. It takes an approach that holds all stakeholders in roads responsible, rather than just those who use the roads. This has led to innovations in road safety, and its adoption in the United States has been reported as having success within a short period. While the City of San Jose has far fewer serious traffic accidents and traffic fatalities than the national average, it still has invested in having Vision Zero to bring those numbers to zero.

Safe Routes to School

Using data from several studies and government sources, Osborne (2005) writes about the effects that Safe Routes programs have had in the United Kingdom, Denmark, and the

United States. Osborne writes that healthy habits developed at a younger age often carry on to adulthood, and that it is why it is important to study what influences travel mode choice (Osborne, 2005, p. 235). In an effort to reduce the number of traffic fatalities, Denmark heavily invested in making its streets more accommodating for pedestrians and bicyclists. Denmark's government also promoted bicycling programs, making the city of Odense Europe's top bicycling city (Osborne, 2005, p. 236). In contrast, the UK has a larger percentage of children who walk to school, but much lower numbers of those who ride their bicycles. The UK's Traveling to School Initiative has led to a reduction of traveling by car by 23 percent (Osborne, 2005, p. 236). The United States invested more into school bus transport and still has a high percentage of transportation by car. The percentage of children who walk or bicycle to school in the United States is far lower than those who live in Denmark and the UK. A rise in childhood obesity and the rising cost of car travel have been the impetus for Safe Routes programs to begin in the United States (Osborne, 2005, p. 237). Osborne concludes that the Danish model has shown that having Safe Routes programs leads to safer streets and developing healthy habits, and that governments should communicate with stakeholders, collect travel data, and invest in programs that encourage alternatives to driving (Osborne, 2005, p. 237).

Several authors have written studies on the effectiveness of the Safe Routes to School program. Hubsmith (2006) explains the Safe Routes to School Program and describes earlier European programs that reduced pedestrian fatalities. In the United States, 20 to 30 percent of morning traffic is due to parents driving their children to school (Hubsmith, 2006, p. 169). To show how trends have changed, data shows that in

1969, half of all students walked or biked to school, as opposed to 2003, where 15 percent of students walked or biked to school (Hubsmith, 2006, p. 169). Hubsmith states that outside of contributing to more traffic congestion, this problem has led to children being less physically active, which can then increase the rate of childhood obesity. Reasons for children walking less include parental fears of their children being struck by cars, the distance from schools, and fear of strangers (Hubsmith, 2006, p. 169-170). The article goes on to describe the 5 Es of Safe Routes to School: Evaluation, Engineering, Education, Encouragement, and Enforcement, and how each of their characteristics contributes to the success of Safe Routes programs.

The history of Safe Routes programs is also detailed, with Denmark's 1970s pedestrian and bicycle safety program being the first established national Safe Routes to School program. Prior to the Safe Routes program, Denmark had Western Europe's highest rate of traffic-related child fatalities, and after ten years of the Safe Routes program, the casualty percentage was reduced by 80 percent (Hubsmith, 2006, p. 178). After the success of Denmark's program, other countries began developing their own version of Safe Routes programs, dramatically lowering pedestrian and bicycling injuries.

In 1997, the United States started its first Safe Routes programs, which included New York City's Safe Routes to School Program, Florida's Safe Ways to School Program, and Chicago's Walk to School Day (Hubsmith, 2006, p. 181). Within California, Marin County's safety program received $50,000 in federal funding, and nine schools in the country saw increases in walking by 64 percent and bicycling by 114 percent (Hubsmith, 2006, p. 181). Federal funding toward Safe Routes programs

continually increased, and after President Bush signed the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) in 2005, $612 million was available for Safe Routes programs for the following four years. Hubsmith concludes that the United States should form partnerships with other countries with Safe Routes program "to share best practices", and that more research and evaluations should be done to understand the effectiveness of Safe Routes programs (Hubsmith, 2006, p. 188).

In Implementing Safe Routes to School: Application for the Sociological Model and Issues to Consider, Martin, Moeti, and Pullen-Seufert (2009) examine the benefits of the Safe Routes to School program, and barriers to implementing the program. The authors state that because children are required to attend school, teaching the benefits of walking and bicycling to school and having students practice alternative modes of transportation have benefits in improving health and community building. Teaching students about these benefits has the potential to encourage families and neighborhoods to increase the amount of walking and bicycling, and decrease the amount of car driving (Martin et al., 2009, p. 611).While the authors conclude that areas that are able to implement Safe Routes to School benefit from improved student health, an improved sense of community, and improved air quality, there are socioeconomic barriers that can prevent neighborhoods from adopting the program (Martin et al., 2009, p. 612). Poor neighborhoods have difficulty adopting and implementing the program due to the fact that students may live too far away from their schools to participate. Within other neighborhoods, the threat of crime may prevent students from engaging in the program as

well. However, the authors state that finding ways to bring Safe Routes to School and developing transportation methods could be a possible way to build more equity and infrastructure in these economically-challenged neighborhoods (Martin et al., 2009, p. 612).

DiMaggio, Frangos, and Li (2016) use crash records from 18 states spanning over the course of 16 years to study whether there is a relationship between the National Safe Routes to School program and a reduction in traffic accidents involving pedestrians and bicyclists. The authors state that there have not been many studies that evaluate traffic safety programs, and that there is a need for more research in this field (DiMaggio et al., 2016, p. 413). The regions that are studied vary from rural to urban environments, and the authors acknowledge that the traffic conditions are locally unique. The authors conclude that there is a relationship between the number of traffic accidents and the program, and there is a reduction of traffic-related accidents in the time period studied. They state that there is a 14% to 16% reduction in pedestrian and bicyclist injuries related to traffic accidents, and a 13% reduction in fatalities (DiMaggio et al, 2016, p. 415). Some limitations to the study include the inability to study data that is recorded during school hours as opposed to non-school hours, and that the data involving bicyclists and pedestrians were studied collectively, meaning that they were unable to differentiate between accidents involving specifically cyclists or pedestrians (DiMaggio et al., 2016, 416). Despite the limitations, the authors recommend that states should adopt the program, as it has had a benefit to all states that were in their study.

In his evaluation of active transportation to school (ATS), Stewart studied several factors that are possibly related to ATS from various parts of the world, and looks at whether the findings can benefit the Safe Routes to School program. One of the strongest predictors of whether students engage in ATS is the distance that students travel to get to school. The study found that if students live within one half to one mile of their school, they are more likely to walk to school, as opposed to students who travel farther distances (Stewart, 2010, p. 132). The infrastructure and perceived crime rate of a neighborhood are indicators as to whether students engage in more ATS. Infrastructure and available resources play a role in whether students walk or ride bicycles to school, as well. Areas in which there are bicycle lanes and sidewalks are more likely to have students who engage in ATS as opposed to those areas that do not. Stewart concludes that while having a Safe Routes to School program could possibly have a benefit to students and traffic congestion, there should be more research done on these programs to assess the results (Stewart, 2010, p. 147).

Spinney and Millward (2011) studied different factors and their relationships to student travel modes in Canada. The authors used questionnaires to collect student data that details household income, household vehicles, and how far students live from school (Spinney & Millward, 2011, p. 60-61). Schools are categorized as public schools, French schools, and private schools, and accounted for what grades are taught, the size of the schools, and the age of the buildings (Spinney & Millward, 2011, p. 61). Different neighborhood characteristics, including population, income, and age, are also used as variables in the study (Spinney & Millward, 2011, p. 61). The authors used a Pearson

chi-square test to study the association of mode choice and the different student, school, and neighborhood characteristics (Spinney & Millward, 2011, p. 62). The study found that student distance from school was the biggest factor in whether students walked to school. It was also found that students from higher income and lower income neighborhoods had higher incidences of walking (Spinney & Millward, 2011, p. 68).

FINDINGS

The data used comes from San Jose's Walk n' Roll program. The program gets its data from classroom tallies conducted by teachers. Data is collected at the beginning of the day, Tuesday through Thursday, asking students how they got to school. Data is then collected at the end of the day, asking how students travel home. Weather is also recorded to study how it affects modes of travel. The tallies are collected one week in Fall semester and one week in Spring semester. When collected, Walk n' Roll lists the modes of transportation as walking, bicycling, and other. Other consists of riding scooters, skateboards, and other active modes of transportation outside of walking or biking. These numbers are represented in percentages and are added together to show the combined active transportation percentage.

In addition to collecting the aforementioned data, mode shift is also calculated and recorded by the Walk n' Roll program. Mode shift is calculated to show the change from the baseline to the current period. This is important because it shows the progress that has been made since to the first enrollment period.

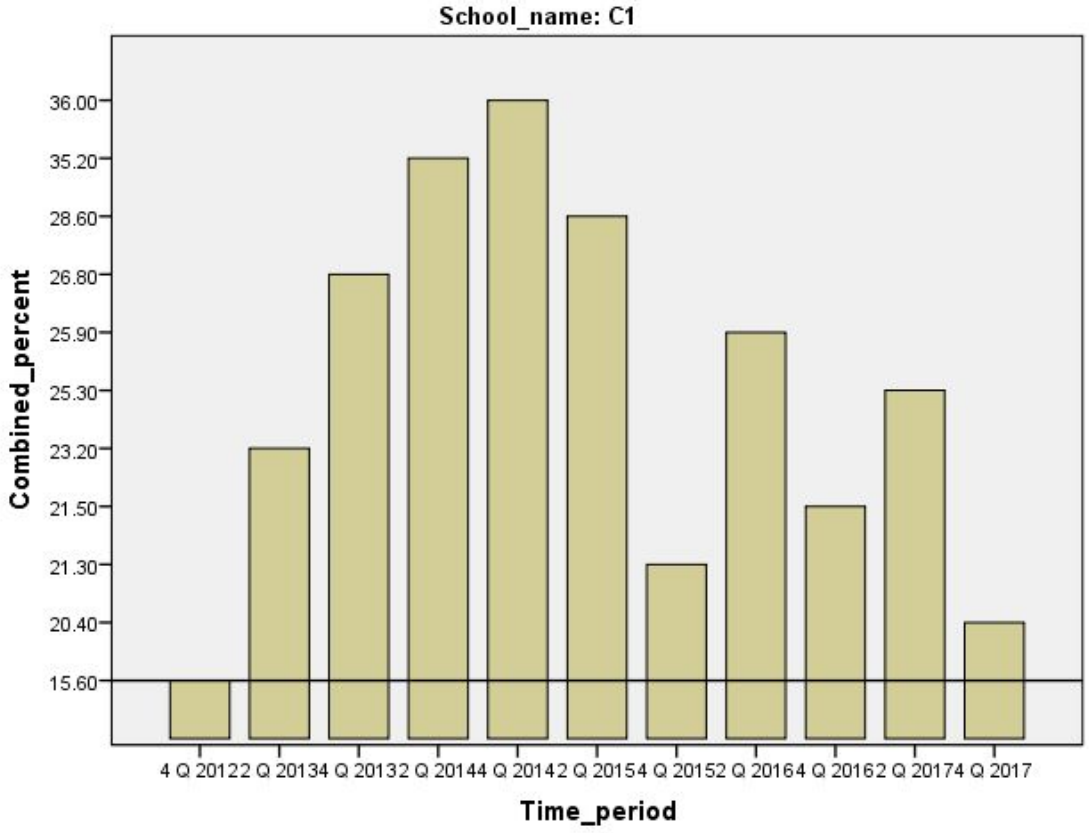
$$\frac{\text{(Current period percentage - baseline percentage)}}{\text{baseline percentage}} = \text{Mode shift}$$

The first period that a school is enrolled in the program is considered the baseline. Because the Walk n' Roll program assumes that it will be working with a school for at least three years, the first year of enrollment gathers data to see where schools are in terms of driving to school and modes of active transportation. The reasons for a school's

recorded numbers may vary. Factors include volunteer parents and students moving to other schools, or a change in school administration. When this happens the program must re-introduce itself to a new group of parents or a new principal, which may affect on how engaged the new school community is with the program.

Walk n' Roll provided data from 33 schools and the data presented has the names of the schools changed for privacy purposes. Of the 33 schools, data from four schools was analyzed. Time period represents when the data was recorded, and is split into either 2 Q, which represents Spring, or 4 Q, which represents mid-Fall. While a school is active it is marked with a "1", and if it becomes inactive, meaning it may have stopped working with the program, it is marked with a "0". This paper used samples from schools that have been active with the program for more than two years to see the long-term effectiveness of the program. As stated previously, Walk n' Roll works closest with schools for the first two to three years, and after that period they do not work as closely with schools. Mode shift is measured on an annual bases and is measured against the first period of enrollment, so only percentages from Spring periods are used.

School_name	Time_period	Active_status	Population	Walking_percent	Bicycling_percent	Other_percent	Combined_percent
C1	4 Q 2012	1.00	418.00	15.00	.50	.10	15.60
C1	2 Q 2013	1.00	434.00	21.00	2.00	.20	23.20
C1	4 Q 2013	1.00	380.00	26.00	.40	.40	26.80
C1	2 Q 2014	1.00	389.00	33.00	2.00	.20	35.20
C1	4 Q 2014	1.00	354.00	34.00	2.00	.00	36.00
C1	2 Q 2015	1.00	354.00	27.00	1.00	.60	28.60
C1	4 Q 2015	1.00	393.00	20.00	1.00	.30	21.30
C1	2 Q 2016	1.00	343.00	23.00	2.00	.90	25.90
C1	4 Q 2016	1.00	340.00	18.00	3.00	.50	21.50
C1	2 Q 2017	1.00	359.00	24.00	1.00	.30	25.30
C1	4 Q 2017	1.00	347.00	19.00	.40	1.00	20.40



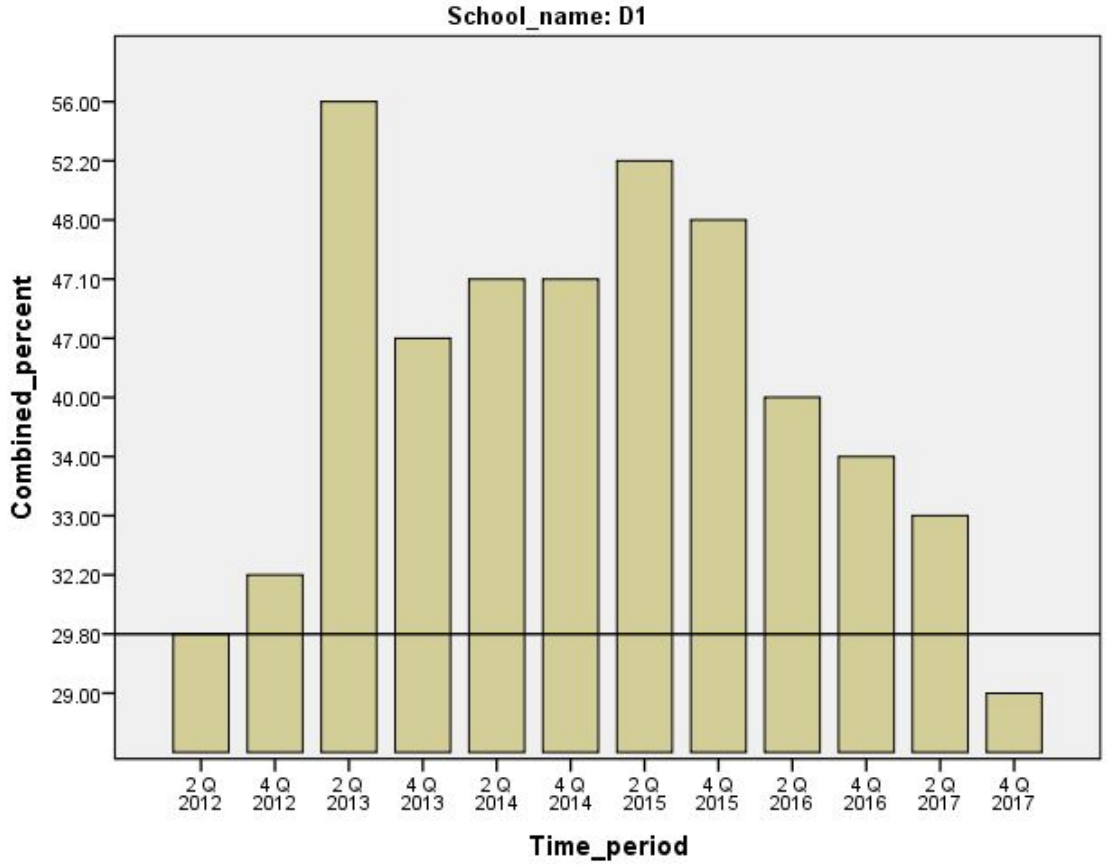
School C1 enrolled in the Walk n' Roll program in Fall 2012 with a combined active transportation percentage of 15.6% as its baseline. The combined active transportation percentage continued to increase in the following periods and reached its peak in Fall 2014 at 36%. After this, the combined active transportation percentage begins to decline, and has several periods in which the percentage increases and decreases. In its last

recorded period, the combined active transportation percentage is at 20.4%. While this percentage shows a significant drop from its highest recorded year, it is still 4.8% higher than its baseline.

School_name	Time_period	Combined_percent	Mode_shift_percent
C1	2012	15.60	.
C1	2013	23.20	48.70
C1	2014	35.20	125.60
C1	2015	28.60	83.30
C1	2016	25.90	66.00
C1	2017	25.30	62.20

School C1's mode shift percentage shows that after one year, it was able to reach and maintain at least 20% mode shift. It reached its peak of 125.6% mode shift in 2014, and has been able to keep a mode shift well above 20% in the following years.

School_name	Time_period	Active_status	Population	Walking_percent	Bicycling_percent	Other_percent	Combined_percent
D1	2 Q 2012	1.00	812.00	29.00	.20	.60	29.80
D1	4 Q 2012	1.00	818.00	32.00	.20	.00	32.20
D1	2 Q 2013	1.00	809.00	56.00	.00	.00	56.00
D1	4 Q 2013	1.00	815.00	47.00	.00	.00	47.00
D1	2 Q 2014	1.00	835.00	47.00	.00	.10	47.10
D1	4 Q 2014	1.00	805.00	47.00	.10	.00	47.10
D1	2 Q 2015	1.00	799.00	52.00	.20	.00	52.20
D1	4 Q 2015	1.00	731.00	48.00	.00	.00	48.00
D1	2 Q 2016	1.00	728.00	40.00	.00	.00	40.00
D1	4 Q 2016	1.00	678.00	34.00	.00	.00	34.00
D1	2 Q 2017	1.00	689.00	33.00	.00	.00	33.00
D1	4 Q 2017	1.00	627.00	29.00	.00	.00	29.00



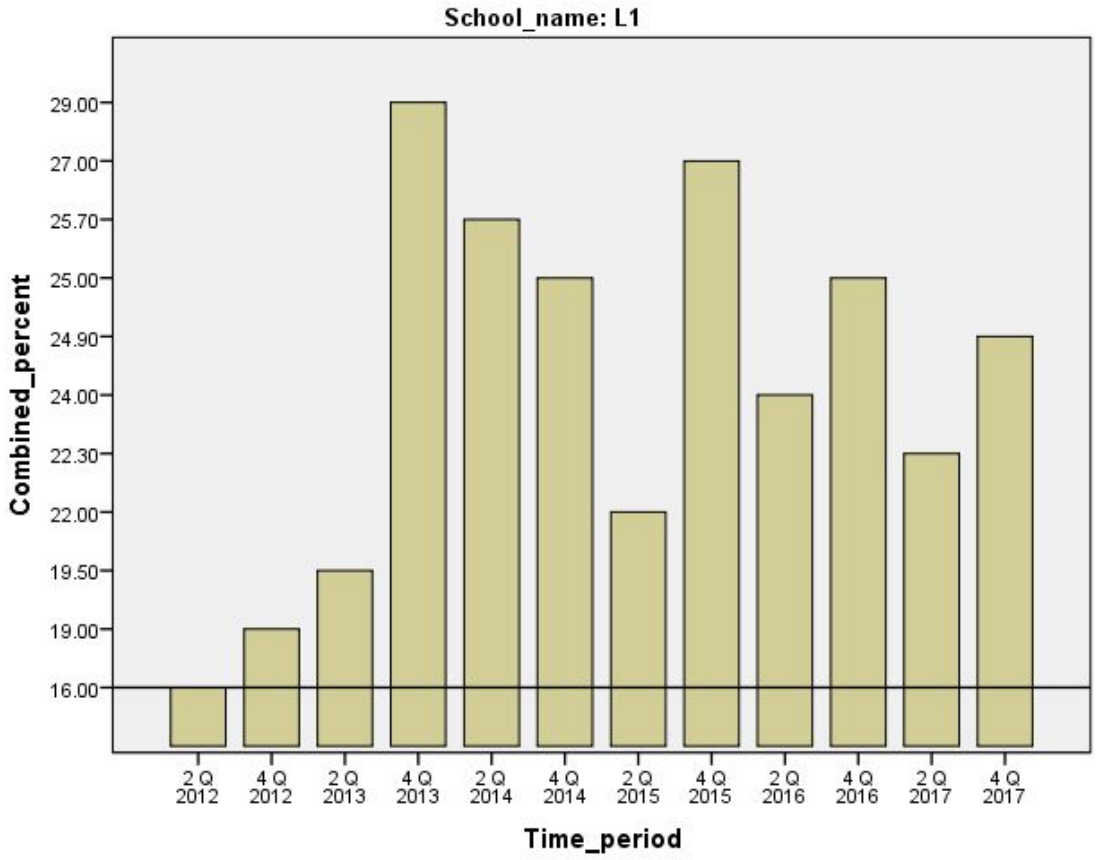
School D1 enrolled in Spring 2012 and established a baseline of 29.8% in combined active transportation percentage. It reaches its peak one year after enrollment in Spring 2013 at 56%. Combined active transportation declines to 47%, but rises back, reaching

52.2% in Spring 2015. After this, however, there is a continual decline, and in its last recorded period, the school dropped to 29% which is below its baseline. It should be noted that in addition to a decline in combined active transportation, there is a decline in student population as well, which may be a contributing factor.

School_name	Time_period	Combined_percent	Mode_shift_percent
D1	2012	29.80	.
D1	2013	56.00	87.90
D1	2014	47.10	37.90
D1	2015	52.20	75.17
D1	2016	40.00	34.20
D1	2017	33.00	10.70

After a year of enrollment, School D1 reached its highest mode shift in 87.9% and maintained at least 20% mode shift until 2017. The mode shift for the last recorded period was 10.7%, and as mentioned before, this was during a period of continual decline in combined active transportation and student population for the school.

School_name	Time_period	Active_status	Population	Walking_ percent	Bicycling _percent	Other_percent	Combined _percent
L1	2 Q 2012	1.00	871.00	13.00	2.00	1.00	16.00
L1	4 Q 2012	1.00	854.00	16.00	2.00	1.00	19.00
L1	2 Q 2013	1.00	900.00	17.00	2.00	.50	19.50
L1	4 Q 2013	1.00	975.00	26.00	2.00	1.00	29.00
L1	2 Q 2014	1.00	998.00	22.00	3.00	.70	25.70
L1	4 Q 2014	1.00	980.00	23.00	1.00	1.00	25.00
L1	2 Q 2015	1.00	1050.00	19.00	2.00	1.00	22.00
L1	4 Q 2015	1.00	1010.00	24.00	2.00	1.00	27.00
L1	2 Q 2016	1.00	1014.00	22.00	1.00	1.00	24.00
L1	4 Q 2016	1.00	1006.00	22.00	2.00	1.00	25.00
L1	2 Q 2017	1.00	615.00	21.00	.40	.90	22.30
L1	4 Q 2017	1.00	934.00	21.00	3.00	.90	24.90



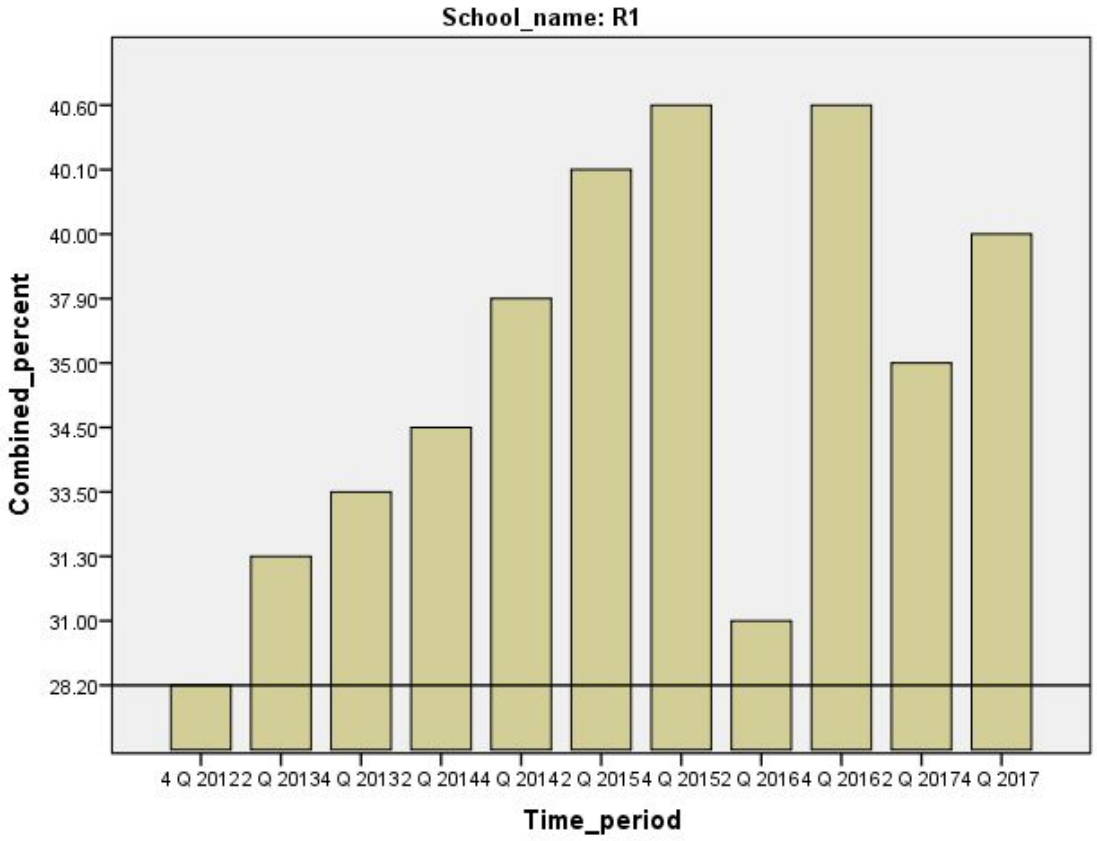
School L1 enrolled in the program in Spring 2012 and established a combined active transportation percentage baseline of 16%. The school reached its peak of 29% in Fall

2013. Following this, there are fluctuating periods of increases and decreases, but the school maintains its combined percentage over the baseline. There is also student population growth over the next several recording periods, with a precipitous drop in Spring 2017. This number is 256 students less than the next lowest recorded population. In Fall 2017, the student population rises back to a level consistent to other periods. The reason for the sudden drop is unclear, but factors that could have contributed to this include recording errors, classes going on field trips, or older students leaving for science camp.

School_name	Time_period	Combined_percent	Mode_shift_percent
L1	2012	16.00	.
L1	2013	19.50	21.90
L1	2014	25.70	60.60
L1	2015	22.00	37.50
L1	2016	24.00	50.00
L1	2017	22.30	39.40

School L1 reached at least 20% mode shift after its first year of enrollment and has kept its mode shift over 20% every following year. It reached its highest mode shift of 60.6% in 2014 and has kept its mode shift well over 20% every year, including the year in which it recorded a large decrease in student population.

School_name	Time_period	Active_status	Population	Walking_percent	Bicycling_percent	Other_percent	Combined_percent
R1	4 Q 2012	1.00	568.00	27.00	1.00	.20	28.20
R1	2 Q 2013	1.00	561.00	30.00	.90	.40	31.30
R1	4 Q 2013	1.00	570.00	31.00	2.00	.50	33.50
R1	2 Q 2014	1.00	600.00	33.00	1.00	.50	34.50
R1	4 Q 2014	1.00	559.00	35.00	2.00	.90	37.90
R1	2 Q 2015	1.00	560.00	39.00	.80	.30	40.10
R1	4 Q 2015	1.00	531.00	38.00	2.00	.60	40.60
R1	2 Q 2016	1.00	491.00	28.00	2.00	1.00	31.00
R1	4 Q 2016	1.00	546.00	37.00	3.00	.60	40.60
R1	2 Q 2017	1.00	566.00	30.00	3.00	2.00	35.00
R1	4 Q 2017	1.00	516.00	35.00	3.00	2.00	40.00



School R1 enrolled in the program in Fall 2012 and established a baseline of 28.2%. School R1's combined active transportation percentage continued to rise and reached its peak of 40.6% in Fall 2015. After period, there was a large drop to 31% in Spring 2016. During this period, the school also had its lowest student population, dropping from 531

students to 491 students. It is not known exactly why there is a drop, and various factors may have contributed to this. However, there is an increase in both student population and combined active transportation the following period, and the following periods have consistent active transportation percentages as the previous ones.

School_name	Time_period	Combined_percent	Mode_shift_percent
R1	2012	28.20	.
R1	2013	31.30	10.00
R1	2014	34.50	22.30
R1	2015	41.20	42.20
R1	2016	31.00	9.90
R1	2017	35.00	24.10

School R1 reached 22.3% mode shift in 2014 and reached its peak of 42.2% the following year. In 2016, its mode shift went below the 20% goal, which was also the same year there was a slight decrease in student population along with a decrease in combined active transportation. Since then, it has achieved over 20% mode shift again.

ANALYSIS

Most schools enrolled in the Walk n' Roll program did not drop below the baseline participation level, except for school D1 which showed a continual decline after its peak period. However, the school also had a continually decreasing population, which may have accounted for this. School L1 had a large population decrease from Fall 2016 to Spring 2017. Even with the decrease, however, school L1 was able to keep high participation percentages in active transportation and mode shift. This may indicate that there may be factors outside of participation with the program and population that affect whether students engage in active transportation or not.

In attempting to study the correlation between the Walk n' Roll program and reductions in traffic accidents by schools, it was found that it would not be appropriate to correlate the program and the number of traffic accidents. While San Jose's Department of Transportation provided a detailed list of traffic accidents dating from 2010, a large majority of accidents listed were not on streets near Walk n' Roll schools. Due to this, perhaps it might be more effective to study the correlation between capital improvements around schools, what effect the improvements have, and see whether there is a correlation between the program and capital improvements.

Another limitation to this study is that schools not enrolled in the program do not regularly keep track of their students' modes of travel. If this data is collected, then a comparison of all schools could be done, and it might give insight into whether Walk n' Roll influences transportation mode shift.

Data that could have contributed to this paper would be the amount of greenhouse gas emissions reduced in San Jose due to the Walk n' Roll program. This type of data would have provided a better understanding of the environmental impact that this program has on the City. While the City publishes greenhouse gas emissions inventories, the information is about the entirety of San Jose. Due to staff numbers, it might not be practical or possible for Walk n' Roll to measure greenhouse gas emissions for each school.

However, one factor that can be analyzed is the relationship between the Walk n' Roll program and the participating schools. In the first one to three years of the program the city's Walk n' Roll program works closely with schools by doing monthly check-ins, doing walking audits with the school community, and having events, such as bike rodeos and assemblies. After this period, the program uses volunteers, and school administration encourages students to engage in active transportation, and the program mainly collects data. The result is that schools reach their peaks in the first three years with the program, but there is a decline in participation afterwards. The data suggests that without the active participation of city resources with the program, participation begins to drop, but in some schools, participation may stabilize at a certain point.

Weather may also be a factor in the fluctuation in active transportation participation. California experienced a five-year drought that generated very few rainy days. (USGS, 2018) Early data collection regarding Walk n' Roll participation (2010-2016) may have been influenced by the willingness of children to use active transportation in good weather, and of parents' willingness to walk to school with

children on clear days. The drought ended in 2017 with a particularly wet year. (Stevens, 2017) It is notable that all the schools showed a drop in active transportation use during 2017, which may correlate with the increased number of stormy days. Parents may have chosen to drive their children to school more often to keep them dry.

CONCLUSION

The Walk n' Roll program's focus of increasing numbers of students walking or biking to school seems to meet its goal, but this growth is not sustained, and there is a drop off typically after the third year. After the third year, most schools keep their active transportation participation higher than the baseline, but there are cases in which schools drop below the established baseline. While there is a safety component to the Walk n' Roll program, it is focused more on education and developing safe routes for students rather than policy changes.

Going forward, future studies might want to take transportation data from schools not enrolled in the program to study travel trends. This would give additional insight as to whether there are significant changes in schools not enrolled in Safe Routes to School programs, and what other factors might affect student transportation choice. Additionally, if one of the program's stated goals is to reduce car-generated air pollution and greenhouse gas emissions, this type of data should be tracked as well. As the number of schools working with Walk n' Roll grows, it would be worth investing more resources into the program to maintain walking numbers that promote healthy habits and reduce greenhouse gas emissions to see whether the program meets its goals in this respect.

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