

Promoting Safe Commuting Practices to Reduce Traffic Congestion: A Traffic Educational Program for Schools in Thung Khru District

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Sponsored by: The Can Do Team

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Abstract

Our project assessed the traffic congestion in Thung Khru, Bangkok, Thailand. Through interviews and observations, we determined school traffic to be the problem. Because of constraints on engineering and traffic enforcement solutions, we explored possible educational solutions. We then developed and tested a traffic educational program that promotes safe and mindful traffic behaviors for 5th grade students at Na Luang School. After successfully testing the program, we recommended the program be expanded to all school age groups.

Executive Summary

Introduction and Background

Traffic congestion plagues urban areas throughout the world affecting millions of commuters of all income levels (Downs, 2005). Traffic jams are major problems in many cities around the world, especially developing regions such as Bangkok (Jain, Sharma, & Subramanian, 2012). At peak times, the average speed in Bangkok is 7 mph (Boniface, 2014). The problem is exemplified in the Thung Khru district (as shown in Figure 1), a 30.7 km^2 suburban area of Bangkok, which attracts residents with its numerous academic institutes, places of worship and communities. Due to Thung Khru's location between a major industrial region to the west and downtown Bangkok to the northeast, the district's population increased by 50% from 2004 to 2010; the increase of population along with the lack of public transit in the district has increased the number of vehicles on the roads (National Statistical Office, 2015).

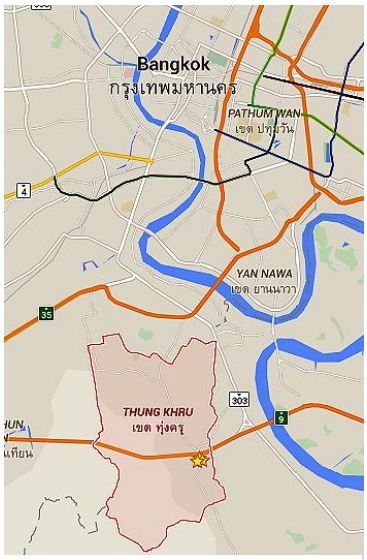

Figure 1- Location of Thung Khru district

The impacts of traffic congestion are felt in three main sectors: economy, quality of life, and road safety. From the economic standpoint, traffic jams can result in massive delays, increased fuel waste and monetary loss (Jain et al., 2012). In terms of quality of life, the constant idling of the vehicles contributes to high levels of air pollution due to the burning of fuel at an increased rate, negatively impacting the health of residents in the local community (Sanders, 2012). In terms of safety, traffic related injuries have become a major concern (Forjuoh, 2003). As the volume of traffic increases, the number of risky maneuvers by both pedestrians and drivers also increases, affecting road safety negatively (Duivenvoorden, 2010). Due to the chaotic traffic environment, a heavy reliance on personal vehicles causes high amounts of traffic congestion, especially around schools.

The causes and consequences of traffic congestion can be addressed in three ways: engineering, enforcement and educational measures. These measures can be used to address the multiple factors that contribute to traffic congestion including urbanization, increased reliance on personal vehicles and lack of infrastructure for alternative modes of travel. In terms of urbanization, the decentralization to city outskirts is currently the primary contributor to urban growth, further increasing the demand for transportation to industrial and economic opportunities (Short, 2010). In addition, the lack of infrastructure for alternative modes of travel, such as public transport, walking, or biking, creates a negative perception of the alternative modes of travel use, resulting in an increased reliance on personal vehicles.

The Can Do Team, a volunteer organization seeking to improve the quality of life in the Thung Khru district of Bangkok, is involved in many projects in the community, such as educational programs; recently, the Can Do Team has begun tackling the traffic congestion problem through projects focusing on alternative modes of travel, such as creating dedicated bike paths to mass transit stations. Due to lack of resources, engineering and enforcement are not feasible approaches for us or our sponsor. An educational approach, on the other hand, can target different audiences of the traffic community, and has a far-reaching potential to impact individual travel behaviors. Children are also a good target audience because they have not yet

developed their own pedestrian and driving behaviors (Fujii & Taniguchi, 2006). Thus, the best approach is to educate students on safe and mindful traffic behaviors, utilizing them as a channel to promote alternative modes of transportation to their parents and communities in order to reduce the number of personal vehicles on the road.

Goals, Objectives, and Methods

We developed and proposed a traffic educational program to the Can Do Team that promotes safe and mindful traffic manners in order to encourage alternative modes of travel.

In order to achieve our goal, we accomplished four main objectives. First, using observations and interviews of experts in the field, we determined contributing factors to the traffic congestion around the Na Luang School. Secondly, using interviews of experts, school administration and teachers as well as focus groups of parents, we identified possible educational solutions to address the factors contributing to traffic congestion. Thirdly, we analyzed the data collected and designed a traffic educational program for the Na Luang School to alleviate traffic congestion. Lastly, we tested a two hour lesson with a group of 49 5th grade students at the Na Luang School and adjusted our educational program as necessary.

Findings

Our findings explain the reason for taking an educational approach to alleviate traffic congestion and the elements of the traffic educational program.

Primary Contributors of Traffic Congestion:

From our initial visits to Thung Khru, we observed that Pracha Uthit Road is the main route of travel in Thung Khru and experiences traffic congestion during the day. We calculated and determined that the **traffic volume on Pracha Uthit Road exceeds the maximum road capacity during rush hours**, as exhibited in Figure 2. We also observed that the road is most congested during the time when students arrive at Wat Thung Khru School located on Pracha Uthit Road. However, the road was congested at other times during the day. Given that the area we observed on Pracha Uthit Road is located next to a temple, market, school, and two entrances to the expressway, we concluded that there were multiple factors contributing to traffic congestion on Pracha Uthit Road. We then narrowed down our scope and further investigated the effect of school traffic on traffic congestion. Therefore, we observed Na Luang School in Thung Khru and our observations suggested that **school rush hour contributes to traffic congestion in the morning**.

Figure 2- Pracha Uthit Road during rush hour

Furthermore, our observations and interviews helped us determine that **driver behavior affects the traffic flow in school areas**. Our observations at Wat Thung Khru School and Na

Luang School proved that behaviors such as idling, illegal parking, right turns, and U-turns in school areas add to the traffic congestion.

Approaches of Managing Traffic Congestion:

The three E's of traffic management are engineering, enforcement, and educational measures. However, we found that even if our sponsor had the resources, engineering and enforcement are unfeasible approaches in the Thung Khru district. During our interviews at the Thung Khru Police Department, the head police officer acknowledged that driver behaviors disobeying traffic policies contribute to traffic congestion. However, he pointed out that there are not enough police officers in the district to strengthen traffic enforcement. Therefore, a **lack of resources contributes to the Thung Khru Police Department's inability to enforce traffic policy**. In addition, the head of the Police Department said that inefficient road infrastructure cannot support all of the vehicles on the road, especially during rush hour. We also observed that there is a **lack of space to expand the infrastructure in the Thung Khru district**, displayed in Figure 3. Pracha Uthit Road has two lanes traveling in each direction and is constantly overcrowded by vehicles, highlighting the necessity for expansion in road infrastructure. However, the sidewalks are overcrowded with street vendors and parked motorbikes. Additionally, the alleys branching off of Pracha Uthit Road provide access to residential areas, but are narrower than the main route; the alleys are packed with parked cars, surrounded tightly by houses, and in many cases, allow traffic to travel only one way. Thus a **traffic educational program promoting alternative modes of travel would be the most effective approach to alleviate traffic congestion**.

Figure 3 - Pracha Uthit Road sidewalk viewpoint

Content Development of Program:

In addition to driver behavior, parents' concerns with their children's safety influence their mode of travel as well as where they drop off and pick up their children at school. As a result, parents overlook the benefits of alternative modes of travel. From the observations at the schools, we saw that parents preferred to drop off their children at the school entrance or on the same side of the road as the school. From our focus groups and interviews we learned that parents prefer to drive their children to school or have them take public transportation instead of allowing their children to walk when appropriate. As a result, we determined that **educational material should focus on traffic safety as it is a primary concern of parents, especially concerning younger students, in order to promote alternative modes of travel.** After designing a traffic educational program, we tested the program at Na Luang School with a group of 5th grade students, shown in Figure 4. From the start, parents and teachers supported the idea of a traffic educational program and thought that the program would be effective if it was a

continuous program for all age groups, ensuring that the children constantly heard key messages of safe and mindful travel behaviors.

In terms of suggested alternative modes of travel, we found that **distance is a primary factor when parents choose a mode of travel for their children.** Further, **Thung Khru parents are receptive to the possibility of their children walking to school,** however, **they do not think biking is an acceptable alternative mode of travel at this time.** Based on these findings, we created pamphlets providing detailed information of viable alternative modes of travel to the Na Luang School.

Lastly, we determined that **the traffic awareness program must address the entire school community in order to be effective.** The parents and teachers from Na Luang School suggested that older students can be a useful channel to influence younger students to adopt good behaviors taught by the traffic educational program. Additionally, the parents from the focus groups agreed that the students can be a useful channel to influence the parents as well. Initially, the students can relay the information to parents by discussing what they learned from the program; the children can then give their parents a pamphlet that promotes alternative modes of travel and methods to avoid traffic congestion when commuting to and from school. If the program is taught continuously to all age groups of the school, students may retain the good pedestrian and driving behaviors associated with commuting, and may influence their parents to adopt better travel behaviors.

Figure 4 - Test with 5th grade students at Na Luang School

Adjustments to the Program after Testing the Lesson:

After testing the lesson at Na Luang School, the pre-lesson and post-lesson surveys indicated that **students had prior knowledge of traffic safety**. Two of the questions in the survey showed that students knew the information. Another set of questions indicated that the **students gained knowledge from the lesson**. The answers to the questions showed significant improvement after the lesson. Another set of questions showed no change. For the two questions that showed no change, we concluded that this was due to misunderstanding of the question and our time limitations of the lesson. Because we had a time restriction, we were not able to discuss everything we had planned but **student engagement throughout the lesson suggests that the duration of the lesson can be increased.**

Recommendations

Based on our findings and literature review we generated a set of recommendations to our sponsor, the Can Do Team. Our proposed recommendations focus on establishing a traffic educational program, to alleviate traffic congestion, in the Na Luang School and its eventual

expansion throughout schools in the Thung Khru district. The recommendations are grouped based on different stages of the program development: implementation, expansion, and future evaluation.

Implementation of the Traffic Educational Program

1. We strongly recommend that the Can Do Team and Na Luang School administration utilize an educational approach, aimed at both children and parents, to alleviate the traffic congestion problem around Na Luang School.
2. We strongly recommend that the traffic educational program be aimed at children and focus on promoting safety and good traffic manners.
3. We strongly recommend that the traffic educational program provide information about alternative modes of travel to parents.

Expansion of Traffic Educational Program in Na Luang School

4. We strongly recommend that distinct objectives and methods of the traffic educational program lessons be tailored to different aged children in Na Luang School.
5. We strongly recommend that the Can Do Team collaborate with the school administration of Na Luang School to make the traffic educational program continuous.

Future Evaluation and Improvement of Traffic Educational Program

6. We strongly recommend that the Can Do Team utilize an expert in the traffic field to implement an evaluation program to assess the impact of the traffic educational program.
7. We strongly recommend that the Can Do Team collaborate with the teachers of Na Luang School to recruit older students to help convey key messages of the traffic educational program.
8. We strongly recommend that the Can Do Team publicize the traffic educational program and make it easily accessible through social media.
9. We strongly recommend that the Can Do Team implement the traffic educational program at other schools in the Thung Khru district.

Conclusion

Traffic problems are, in fact, the people (Rujopakarn, 2003). Defining the root cause of traffic congestion is difficult; it stems from multiple factors, some being unique to a given location. Further, traffic congestion affects society on three levels: economically, quality of life and road safety. As a result, finding a single overarching solution that will eliminate traffic congestion is impossible.

Ideally a three-pronged approach of engineering, enforcement and educational measures would most effectively tackle the traffic congestion problem; however, engineering and enforcement require significant resources. A traffic educational program is an important element of a broader strategy. We have initiated a traffic educational program that can directly influence travel behavior change. The younger generation will likely develop good traffic manners before they even touch a steering wheel. The older generation will likely hear the persistent message for change from the traffic educational program. A few people changing their mode of travel would make little difference, but thousands doing so can have a major cumulative effect on traffic congestion (Punpuing & Ross, 2001). With the traffic educational program, we envision a movement towards a safer and alleviated traffic environment.

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1.0 Introduction

Traffic congestion has become an "inescapable condition" of urban centers throughout the world, affecting society as a whole, causing economic inefficiency and negatively impacting quality of life (Downs, 2005). In 2014, Forbes reported that traffic congestion costs Americans nearly $124 billion per year (Guerrini, 2014). Residents of hundreds of US cities have come to regard traffic congestion as their most serious environmental problem (Downs, 2005). Traffic jams are major problems in many cities around the world, especially in developing regions such as Bangkok (Jain, Sharma, & Subramanian, 2012).

Traffic congestion in Bangkok is chaotic, caused by several factors such as: underdeveloped public transit systems, cars exceeding roadway capacity, and obstacles in the road causing bottlenecks (Rosen, 2013). The problem is exemplified in the Thung Khru district, a mere 30.7 km^2 suburban area of Bangkok, which attracts residents with its numerous academic institutes, places of worship and communities. Due to Thung Khru's location between a major industrial region to the west and downtown Bangkok to the northeast, the district's population increased by 50% from 2004 to 2010; the increase of population along with the lack of public transit in the district has increased the number of vehicles on the roads (National Statistical Office, 2015). As a result, school rush hour causes main traffic routes around schools to be flooded with personal vehicles traveling to and from the school, as well as in and out of the district, causing a significant traffic congestion problem.

The traffic congestion problem in Thung Khru is complex, with several contributing factors. To tackle those factors, we identified the three E's of traffic management that encompass engineering, enforcement and educational measures working together to reduce traffic congestion (Avila, 2005). Each "E" targets a specific focus; engineering measures target infrastructure; enforcement measures promote people to obey traffic policies; educational measures directly influence people's behaviors in the traffic environment.

Of the three, engineering and enforcement measures require significant resources to implement. Educational measures aim to influence travel behavior change without demanding many resources (Bamberg, Fujii, Friman, & Gärling, 2009). While educational programs can target workplaces, schools or residential areas, only the school is a feasible setting to educate the impact of individual travel behaviors on traffic congestion because students have not yet developed their own travel behaviors (Fujii & Taniguchi, 2006).

The Can Do Team, a volunteer organization seeking to improve the quality of life in the Thung Khru district of Bangkok, is involved in many projects in the community, such as educational programs; recently, the Can Do Team has begun tackling the traffic congestion problem through projects focusing on alternative modes of travel, such as creating dedicated bike paths to mass transit stations. Given the Can Do Team's previous work with educational programs, our goal was to design a traffic educational program promoting safe and mindful traffic behaviors in order to encourage alternative modes of travel. We tested a program lesson on 5th grade students at Na Luang School, analyzed the success of the lesson, and recommended implementation and expansion strategies for the educational program.

2.0 Literature Review

Traffic congestion has almost surpassed bad weather as a malady that is universally discussed (Downs, 2005). In this section, we examine three impacts and three primary contributors of traffic congestion, methods of reducing traffic congestion and investigate the use of traffic educational programs. We used these topics of research to help us gain insight on how to develop a traffic educational program that will promote safe and mindful traffic manners in order to encourage alternative modes of travel.

2.1 Impacts of Traffic Congestion

Traffic congestion is directly experienced everyday by millions of commuters of all income levels across the world (Downs, 2005). The impacts of traffic congestion are felt on three main sectors: the economy, quality of life, and road safety.

From the economic standpoint, massive delays and fuel waste expenses of traffic jams strain cities economically worldwide (Jain et al., 2012). With people in developed countries of Europe and the US currently wasting on average 111 hours annually in gridlock, the impact of traffic congestion is significant (Economic & environmental impact of traffic congestion in Europe & the US, n.d.). To society as a whole, traffic congestion is undesirable because it misallocates scarce resources and causes economic inefficiencies (Downs, 2005).

In terms of quality of life, a growing vehicle fleet contributes to high levels of air pollution in the large cities of developing countries (Atash, 2007). Residents of hundreds of US cities have come to regard traffic congestion as their most serious environmental threat (Downs, 2005). Stopping and starting in traffic jams burns more fuel than traveling at a consistent speed on the open highway; this increase in fuel consumption contributes to the amount of emissions released by vehicles, creating excess air pollution (Sanders, 2012).

In terms of safety, traffic related injuries have become a major public health concern worldwide (Forjuoh, 2003). As the volume of traffic increases, the number of risky maneuvers by both pedestrian and driver also increases, affecting road safety negatively (Duivenvoorden, 2010).

2.2 Primary Contributors to Traffic Congestion

Traffic congestion doesn't just happen; several key factors must be present and act concurrently to create traffic congestion. Primary factors that contribute to congestion of cities, such as Bangkok, include: urbanization, increased reliance on personal vehicles, and insufficient infrastructure for alternative modes of travel (Rodrigue, n.d.). Each cause tends to reinforce the impact of the others which thereby increases traffic congestion (Downs, 1992).

2.2.1 Urbanization

Rapid population growth, a characteristic of urbanization, is a primary cause for the immediate creation of traffic congestion (Downs, 1992). Urbanization can be defined as the process of rural locations converting to urbanized and densely populated areas through the introduction of industrialization and economic development (Peng, Chen, & Cheng, 2000). It is important to note that the decentralization to city outskirts is currently the primary contributor to urban growth, further increasing the demand for transportation to industrial and economic opportunities (Short, 2010). Urbanization of cities, such as Bangkok, creates a rapid growth in population of more suburban areas on the city outskirts, such as the Thung Khru district, leaving the outer districts vulnerable to dramatic increases in traffic congestion (Downs, 1992).

Increased urbanization has become a global trend as developing countries experience rapid modernization, such as Bangkok (Short, 2010). Between 2004 and 2010, Bangkok's total

registered population grew at a below average rate of 13%s (World Bank, 2015). However, the low growth percentage was not the case for all of Bangkok's fifty districts; Thung Khru experienced a 50% population increase during the same time span, thus resulting in a traffic congestion problem (National Statistical Office, 2015).

2.2.2 Usage of Personal Vehicles

Many cities in developing nations experience an increase in private car ownership; a combination of the people of the nation's collective economic growth and the suburbanization and relocation to city outskirts create the opportunity and the need for higher car ownership (Short, 2010). Traffic congestion is heavily influenced by the number of vehicles using roadways; therefore, vehicle ownership and usage is a significant contributor to the severity of traffic congestion in any area (Short, 2010).

In Bangkok's case, the conditions over the past decade have encouraged a dramatic rise in car ownership. Public transit can increase the development potential of real estate near high-capacity transit lines and stations, thereby increasing property values (Reconnecting America, n.d.). Studies from the University of California Berkeley determined that the introduction of the BTS Skytrain in 1999 was a significant factor in relocation of the many residents out of downtown and into the outer districts of Bangkok (Sirikolkarn, 2008). Access to the BTS caused a rise of downtown property values, making it more economical for residents to move to areas, like Thung Khru, which lack a sophisticated public transit system and encourage commuting via personal vehicles (Sirikolkarn, 2008).

As the need for personal vehicles grew in the outer regions of Bangkok, so did the need to revive the stagnant automobile manufacturing industry (Detroit of the East, 2013). In 2011, the government instituted an incentives program to promote the domestic automobile sales; by October 2012, the number of registered vehicles in Bangkok was 7.3 million, a 7.8% increase from 2011 (Jitsomboon, 2012). Most Thai people prefer using automobiles because they are both a convenient mode of transportation and a social status symbol (Techawongtham, 2012). The sudden and overwhelming amount of personal vehicles introduced to Bangkok streets has made the city more prone to traffic congestion, especially with the lack of measures put in place to manage the influx of vehicles and people (Sirikolkarn, 2008).

2.2.3 Lack of Infrastructure for Alternative Transport Use

Individual cities cannot afford to cater only to private cars and motorcycles as eventually, transport demand will surpass road capacity (Singh, 2005). In comparison to other cities, Bangkok has low public transport use and very low non-motorized modes of travel use (Poboon, 1997). Only in the 1990s was serious attention paid to developing rapid mass transit for commuters in Bangkok (Punpuing & Ross, 2001). There is a need to encourage public transport instead of personal vehicles; people should also be encouraged to use non-motorized transport (Singh, 2005). Figure 2.1 displays a study of primary modes of transportation to the Na Luang School in the Thung Khru district done by Professor Viroat, a civil engineering professor at King Mongkut's University of Technology Thonburi.

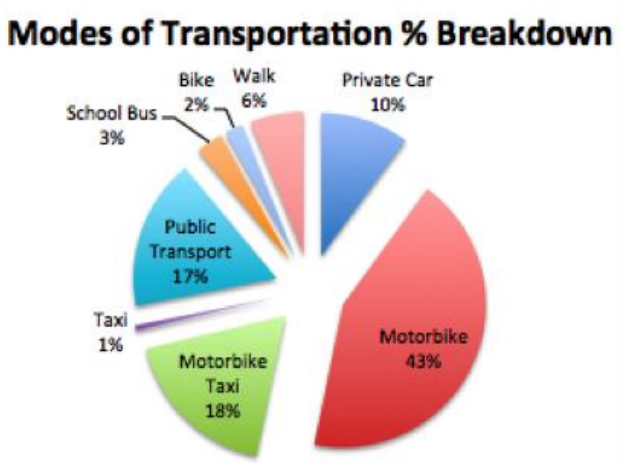

Figure 2.1 – Mode of transportation to Na Luang School in Thung Khru

As seen in Figure 2.1, the choice of non-motorized travel is only 8%. Furthermore, 55% choose some sort of personal vehicle, motorcycle or car, as a mode of transportation. Some people may not always drive out of necessity, but also by choice; the public support for alternative modes is weak (Handy, Weston, & Mokhtarian, 2005). With no bike lanes and almost nowhere to walk or cycle, non-motorized modes of travel are unattractive in the traffic environment (Kenworthy, 1995). Additionally, public transport systems have not been able to keep pace with the rapid and substantial increases in demand over the past decade (Singh, 2005)

2.3 The Three Approaches to Managing Traffic: Engineering, Enforcement, and Education

Methods of reducing traffic congestion must take into consideration what factors contribute to the triangle of traffic management: enforcement, engineering and education (3 E's). Each approach shares the common goal to influence travel behavior changes that will alleviate traffic congestion (Bamberg et al., 2009).

Engineering measures create infrastructure, such as an expressway, designed to effect the flow of traffic (Bamberg et al., 2009). Enforcement measures directly influence behavioral change by punishing poor travel behaviors, such as a large fine for illegal parking (Bamberg et al., 2009). Educational measures are designed to motivate people to voluntarily change their travel behaviors (Richter, Friman & Garling, 2009). While each of the three E's of traffic management seek to influence travel behavior changes, the problem with engineering measures is that they require extensive labor and monetary resources. Even enforcement measures require significant labor and monetary resources between traffic officers to enforce traffic policies, and traffic signs displaying traffic policies. Educational measures do not require many resources, and are designed to alleviate traffic congestion by motivating people to change their behavior to more sustainable travel methods (Richter et al., 2009). Better information and persuasive marketing can help shift both attitudes and behavior (Jones & Sloman, 2003).

To solve or alleviate Bangkok's traffic problems, solutions cannot totally rely on enforcement measures, projects or even a good transport master plan; traffic problems, in fact, are the "people" (Rujopakarn, 2003). In terms of resources required and outcome, an educational approach is most feasible, necessary and can effectively change travel behavior. Classes that instruct the public about the relationship between individual travel behaviors and a number of social problems, such as traffic congestion and air pollution, can help educate people about socially desirable behavior in the society (Fujii, 2003). For this reason, since 2004, transport and

education departments have funded a school travel program for all elementary and junior high schools in England (Department of Transport, London, 2004).

Educational measures can provide people with information that will motivate them to change their travel behavior. For example, a community based program for motorcycle rider education was provided for motorcyclists in three randomly selected sub-districts in Northern Thailand to influence changes of risk-taking behaviors; following the education program, the injury rates for 1995 and 1996 were significantly lower in the intervention population than in the control population (Swaddiwudhipong, Boonmak, Nguntra, & Mahasakpan, 1998).

2.4 Traffic Educational Programs

The goal of educational programs is to provide the audience with information in a way that will influence behavioral change. Drawing from studies surrounding traffic educational programs was crucial in helping us guide the development of our project. Firstly, the programs gave us insight into methods for influencing behavior change in the traffic environment. Secondly, the programs helped highlight behaviors and target audiences.

2.4.1 Methods for Influencing Behavioral Change in Traffic Environment

Behavioral change is achieved through an exchange of value; people change not only because they are well informed or forced into action, but also because they get something they value in return (Smith, 2006). Two key steps when influencing behavioral change are first, ensuring that the traffic environment has measures in place that make recommended behaviors both possible and beneficial to adopt, and second, ensuring that the messages which motivate change are heard by the audience, continuously to ensure retention, through channels that capture the audience (Smith, 2006).

Travel feedback programs (TFPs) are designed to change travel behavior through travel campaigns and education. A travel behavior study found that personalized communication through direct education is more effective in changing travel behavior than non-personalized mass communications through widespread campaigns (Gärling & Steg, 2007).

There are three main techniques to changing travel behavior: directly motivating travel behavior change, requesting the target audience to come up with a plan for changing travel behavior, and providing individualized travel behavior information (Fujii & Taniguchi, 2006). For example, one method of changing travel behavior implemented in Sapporo, Japan provided participants with a booklet written to motivate change in their travel behaviors by describing why an individual's travel behavior is important; participants were also provided with a booklet describing how they could change their travel behavior (Taniguchi, Hara, Takano, Kagaya, & Fujii, 2003). Another method required participants to devise a behavioral plan for changing their travel behavior; a social psychological study on how behavioral intentions are actually implemented indicated that requesting the target audience think about a behavioral plan has a strong effect on actual behavioral change (Gollwitzer & Brandstätter, 1997; Fujii & Taniguchi, 2005).

Since 1993, a traffic safety education program has been organized by the Ministry of Education offering training and educational materials for schoolchildren at the primary and secondary levels; the development phase has been completed, however, response to the budget request for the implementation phase has not been promising (Suriyawongpaisal & Kanchanasut, 2003). A common feature among most of the programs is a lack of independent systematic evaluation; in addition to education, a level of enforcement should be involved to ensure that the key messages are retained and followed by the target audience (Suriyawongpaisal & Kanchanasut, 2003).

2.4.2 Target Audience and Content for Traffic Educational Programs

Traffic educational programs can be implemented in three basic settings: schools, workplaces and residential areas. While programs for each setting share the objective of solving transportation problems, such as traffic congestion and air pollution, in the area, only the school is a feasible setting to educate the impact of travel behaviors on traffic congestion because students have not yet developed their own travel behaviors (Fujii & Taniguchi, 2006). There have been educational programs targeting traffic safety developed in Thailand already, but hardly any educational programs targeting travel behaviors and traffic congestion.

This suggests the importance of a traffic educational program aimed at students promoting travel behaviors; given different levels of maturity and cognitive development, different age groups should have different objectives relating directly to the impact they have in the traffic environment, as shown in Figure 2.2 (Nishiuchi, n.d.).

Age Group	Objective
Elementary school students	1. Increasing their awareness in relation to how their behaviors can affect traffic 2. Ensuring that they can travel safely on the roads as pedestrians & cyclists
Junior high school students	1. Enable them to think about not only their own behaviors, but also those of others, and their effect on traffic 2. Ensure they have the skills and knowledge to travel safely as pedestrians & cyclists
High school students	1. Teach them the skills and knowledge required to be able to travel along roads safely as motorcyclists & cyclists 2. Cultivate sound members of society who demonstrate a sense of responsibility of their behaviors in the traffic environment

Figure 2.2 – Target age groups and objectives for traffic educational program

In order to achieve these objectives, the content of the educational program for each age group should take into consideration the role each age group plays in the traffic environment. For example, elementary school students should begin with basic traffic manners including: things they must not do on the road as a pedestrian or cyclist, the necessity of traffic rules, and obeying police officers. For junior high school students, the content should be a little more sophisticated, such as awareness of themselves as members of the traffic community, and a more general overview of behaviors that affect traffic congestion. The content for high school students should treat them as members of society, continuing to focus on awareness of themselves as members of the traffic community, as well as introducing the responsibility of drivers and the role drivers play in traffic congestion (Nishiuchi, n.d.).

2.5 Summary

Traffic congestion is an inescapable condition for urban centers, impacting people economically, affecting the quality of life and road safety in the area (Downs, 2005). The factors contributing to traffic congestion are urbanization leading to a heavy usage of personal vehicles, which stems from travel behavior. While there are three main approaches to traffic management,

engineering and enforcement require many resources that the Can Do Team does not have, making them unfeasible approaches. The educational approach is not only the most feasible approach, but also a necessary approach because not many traffic educational programs targeting travel behavior exist when traffic problems are, in fact, the people (Rujopakarn, 2003).

3.0 Methodology

The goal of our project was to develop and propose a traffic educational program to the Can Do Team that promotes safe and mindful traffic behaviors to the Na Luang School community in order to encourage alternative modes of travel and ultimately reduce personal vehicle usage. In order to achieve this goal, we accomplished four objectives: (1) Determined primary factors contributing to traffic congestion during rush hour at the main route of travel in the Thung Khru district and the Na Luang School; (2) Identified possible educational solutions to address the factors contributing to traffic congestion at the Na Luang School; (3) Designed a traffic educational program to alleviate traffic congestion at the Na Luang School; (4) Tested the lesson plan at the Na Luang School and recommended ways to continue and expand the traffic educational program as necessary.

3.1 Determined Primary Factors Contributing to Traffic Congestion

To identify factors contributing to traffic congestion in the Thung Khru district, we first observed Pracha Uthit Road, the district's main arterial roadway. Pracha Uthit Road is the only route in the Thung Khru district that leads to the expressways, causing an influx of residential commuters. Additionally, Pracha Uthit Road experiences a high volume of traffic because of a temple, market and school located within 100 meters of each other as shown in Figure 3.1 (left). From these observations, we identified factors contributing to traffic congestion and identified schools as the area of focus. We observed traffic congestion to be worse during school rush hour at Wat Thung Khru School.

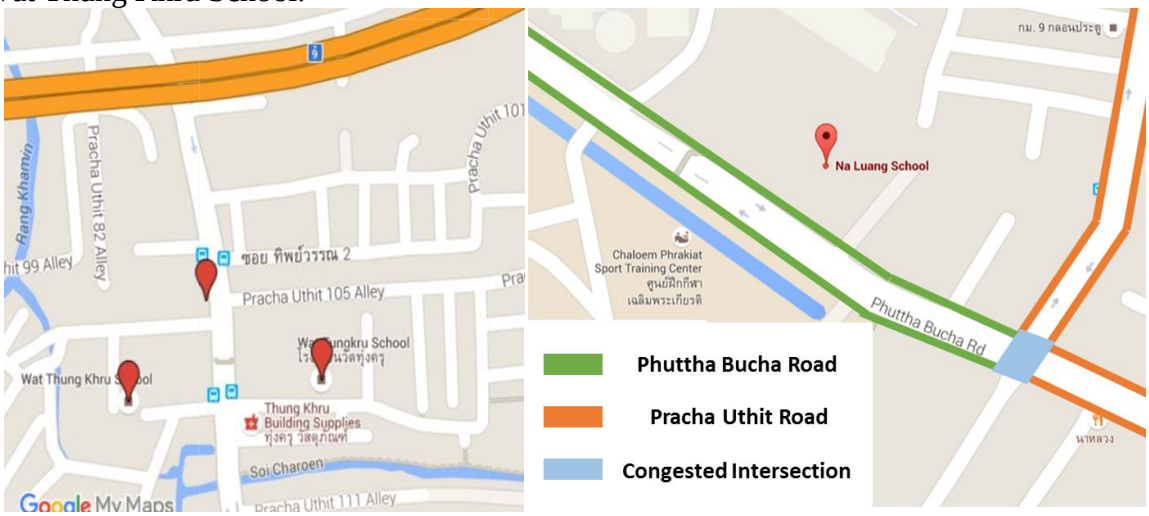

Figure 3.1 – Diagram of Pracha Uthit Road (left) and Na Luang School (right)

Source: (Google, n.d.)

However, we realized Wat Thung Khru School was not a good test study due to the school's proximity to a market, temple, and expressway. To better understand primary factors contributing to traffic congestion in school areas we observed Na Luang School. For both areas, we observed traffic during a weekday for 30 minute intervals during rush hour and off hours.

Observing in 30 minute intervals provided the team with data from various times for future comparison. These observations were done on the overpasses located near Wat Thung Khru School and Na Luang School. Using information collection techniques such as note-taking, video recordings, and photography, we identified modes of travel most commonly used and common behaviors associated with each mode of travel that contributes to traffic congestion.

To better understand the Thung Khru community's concerns surrounding school related traffic congestion, we conducted focus groups and formal interviews. The focus groups were with Na Luang School PTA (Parent Teacher Association) and the Pracha Uthit Soi 43 Community parents to identify what their concerns were and what they saw as factors contributing to the traffic congestion in Thung Khru. The formal interviews were conducted with the Thung Khru police officer Wattana Prayongpun and Professor Viroat Srisurapanon. These interviews helped us identify factors contributing to traffic congestion in Thung Khru from the community's viewpoint. An annotated list of participants in focus groups and interviews is shown in Appendix A and translated interview questions are shown in Appendix B.

3.2 Identified Possible Educational Solutions to Address Contributing Factors to Traffic Congestion

After determining school traffic as a main contributor to traffic congestion, we investigated possible educational solutions addressing specific causes of school traffic contributing to traffic congestion. To accomplish this objective, we gathered input from experts in the traffic field, as well as members of the school community.

In order to gain insight into possible educational solutions, we interviewed Professor Viroat, who has conducted research pertaining to traffic and solutions in depth. Additionally, we conducted interviews with the Thung Khru police to identify what educational solutions should focus on addressing. Lastly, we took into consideration the school community's opinions and conducted focus groups with Na Luang School PTA and the Pracha Uthit Soi 43 community parents in order to explore their opinions about education as a possible solution.

3.3 Design a Traffic Educational Program

To achieve the objective of designing a traffic educational program, we accomplished the following four steps. First, we analyzed the data gathered from observations, interviews, and literature review, to determine crucial information to be used for content of the traffic educational program. From our observations in Thung Khru, we determined problematic travel behaviors to address. We conducted focus groups with Na Luang School PTA and Pracha Uthit Soi 43 Community to identify their concerns with traffic congestion and the use of alternative modes of travel. Based on our literature review, we gathered objectives for different age groups to be taught in the program. All of this information was used to determine the content of the program. Next, we interviewed teachers at Na Luang School to gather information on effective practices to convey the information and to see what would engage our audience, students in 4th to 6th grade. Then we designed the traffic educational program. And lastly, we asked teachers at Na Luang School and the Can Do Team to critique the content of the program. The feedback we received was used to make improvements to the program before testing a lesson at Na Luang School.

3.4 Tested the Lesson and Adjusted the Curriculum as Necessary

The lesson plan we designed was tested during a 2-hour life skills class period at Na Luang School with a group of 49 5th grade students. This testing of the program was necessary to evaluate the effectiveness of the lesson plan, which was accomplished in two steps. First, we

gave the students a survey before and after the lesson. We used these surveys to identify the knowledge gained about the topics presented in the lesson. After, we discussed the lesson with the teacher to identify the strengths, weaknesses, and any suggestions for future implementation. We then recommended adjustments to the lesson plan based on Input from the teacher and the results from the surveys.

4.0 Results

Observations and interviews helped us determine the primary causes of traffic congestion and a viable area of focus to develop our recommendations. Through interviews with experts and focus groups with parents, we developed a traffic educational program that we tested at Na Luang School. Our findings in the following four categories helped us develop the reason for taking an educational approach to alleviate traffic congestion and the development of a traffic educational program: (1) Primary contributors of traffic congestion; (2) Approaches to managing traffic congestion; (3) Development of lesson plan content; (4) Adjustments made after lesson plan.

4.1 Primary Contributors of Traffic Congestion

Finding #1 Traffic volume on Pracha Uthit Road exceeds the maximum capacity during rush hours

From our observations of Pracha Uthit Road, we calculated the traffic volume for each direction of the road using the statistic known as passenger car units (PCU) through the process described in Appendix G. During our interview with Professor Viroat, we discovered that traffic congestion occurs when a road's traffic volume capacity is exceeded; for Pracha Uthit Road, he noted that under ideal circumstances (no presence of merging, turning, or stopping) the road can handle 1000 PCU per direction during a 30 minute time interval.

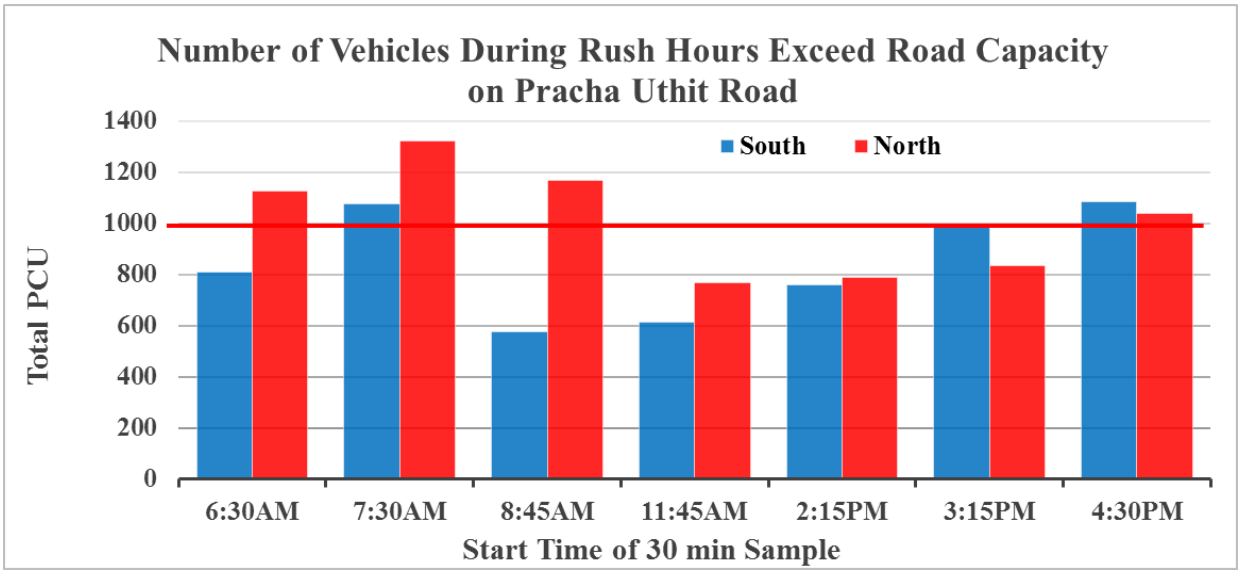

Figure 4.1 – PCU on Pracha Uthit Road

We compared our traffic volume calculations against the maximum capacity (shown in Figure 4.1) and determined that during four sample periods the road's maximum capacity was exceeded: 6:30AM, 7:30AM, 8:45AM, and 4:30PM. It is important to note that our findings on

Pracha Uthit Road were based on one day of observations; however, we do not believe this is a significant limitation as our determination of peak congestion periods align with those suggested by traffic signs along Pracha Uthit Road, shown in Figure 4.2.

Figure 4.2 – Traffic sign with peak hour times on Pracha Uthit Road

Finding #2 School rush hour contributes to traffic congestion in the morning

Based on our interview with Professor Viroat, we realized: (1) the majority of Thung Khru parents prefer to drive their children to school using personal vehicles, such as cars and motorcycles, and (2) using personal vehicles for school commuting contributes to traffic congestion. Our observations at Pracha Uthit Road supported Professor Viroat's claims. We noticed that during the morning drop-off (7:30AM to 8:00AM) and afternoon pickup (3:00PM to 5:00PM) periods, the lane that accesses Wat Thung Khru School (South Bound Lane) experienced the most traffic as shown in Figure 4.1. However, we understood that we could not attribute the increase in traffic congestion solely to school traffic as there are other factors that can increase the volume of traffic on Pracha Uthit Road, such as commuting to the temple, the market, the expressway to Bangkok, or back to residential areas.

To better investigate how school rush hour contributes to traffic congestion, we shifted our focus to observing Na Luang School because while it is in close proximity to Pracha Uthit Road, it is not surrounded by other points of destination such as a market or temple**,** making it easier to observe the direct effects of school rush hour on traffic congestion. At Na Luang School, we observed that the lane that accesses the school experienced the highest volume of traffic during the 7:30AM to 8:00AM drop-off period, as shown in Figure 4.3.

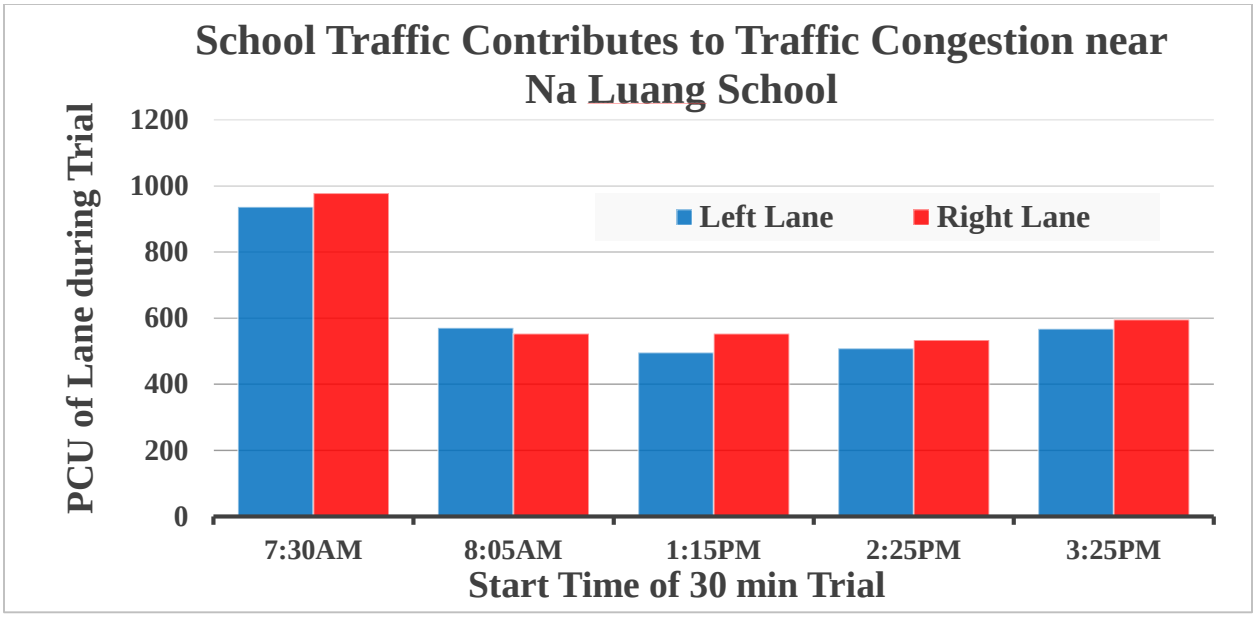

Figure 4.3 – PCU at Na Luang School

Additionally, we witnessed a drastic reduction in traffic congestion once Na Luang School was in session. The image in Figure 4.4 shows the road shortly before school starts at approximately 7:45AM while the image in Figure 4.5 shows the road after school starts at approximately 8:10AM. The difference of the number of vehicles on the road at each time can be seen; the traffic flow clearly increases when school is in session.

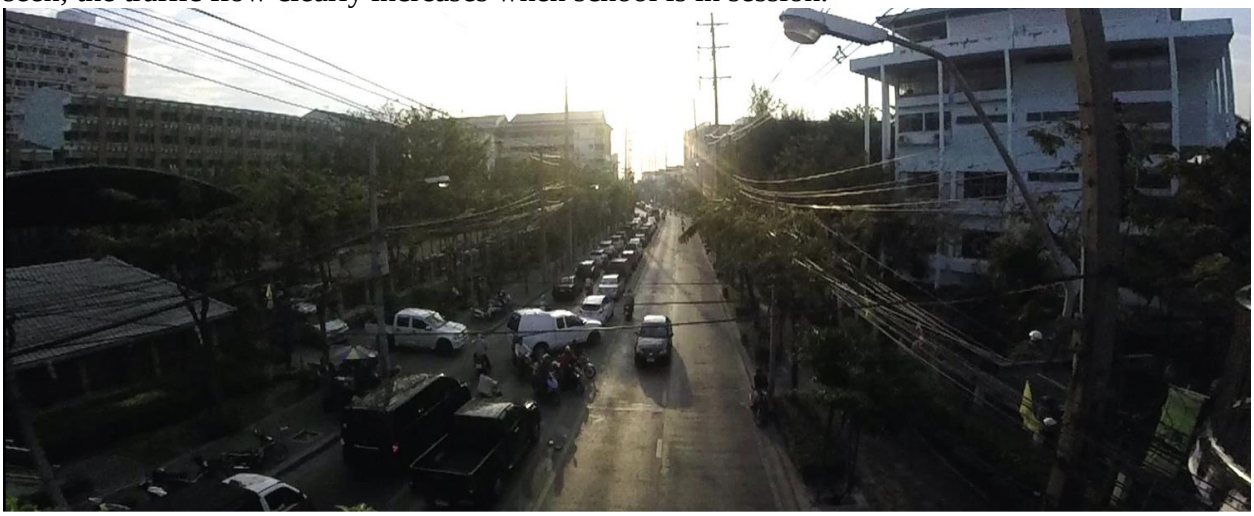

Figure 4.4 – Traffic before the start of the school day at approximately 7:45AM

Figure 4.5 – Traffic after the start of the school day at approximately 8:10AM

Finding #3 Driver behavior affects the traffic flow in school areas

Our observations highlighted that driver behaviors are a contributing factor to traffic congestion around schools. We identified many similarities in behaviors between Wat Thung Khru School and Na Luang School. Some of the behaviors include idling, illegal parking, right turns, and U-turns in school areas. The behaviors and actions we observed had a domino effect on traffic flow; all it took was one driver to interrupt the traffic flow and cause traffic congestion.

Illegal parking and idling vehicles

The reoccurring events of illegal parking and idling in lanes have an effect on the flow of traffic. Illegal parking and idling had been discussed and brought up as a problem during the interviews and focus groups. We observed that vehicles park in areas designated as “no parking” areas and idle in lanes. The illegal parking and idling events add to the traffic congestion as vehicles are forced to merge to one lane, essentially creating a one lane road until the parked vehicle continues to travel as shown in Figure 4.6. We observed these behaviors at Wat Thung Khru School and Na Luang School.

Figure 4.6 – Blue vehicle (songthaew) idling at a bus stop

U-Turns and right turns in school areas

We noted that parents prefer to drop off or pick up the students on the school side of the road resulting in a high number of U-turns and right turns at the school. As shown in Figure 4.7, right turns cause traffic congestion by stopping vehicles on the opposite side as well as the vehicles in the lane behind the turning vehicle.

Figure 4.7 – Vehicles making right turns on Pracha Uthit Road

At Na Luang School, we observed that right turns into the school blocked thru traffic from Phuttha Bucha Road to Pracha Uthit Road. Represented in Figure 4.8, we noticed that motorcycles contributed most to right turn traffic as they were more aggressive with turning in front of oncoming vehicles and outnumbered the amount of turning cars 10:1. Consequently, motorcycles blocked thru traffic for over nine minutes while cars contributed less than four minutes of blockage time during a 30 minute interval.

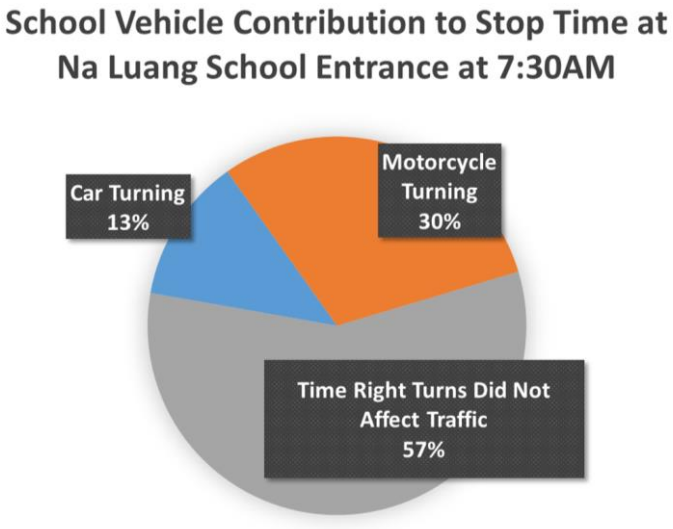

Figure 4.8 – Stop time at school entrance at 7:30AM observation interval

4.2 Approaches to Managing Traffic Congestion

Finding #4 Lack of resources contributes to the Thung Khru Police Department's inability to enforce traffic policy

From our interview with Officer Wattana, we found that the Thung Khru Police Department believes a primary factor contributing to traffic congestion is behavior, specifically drivers' disobedience of traffic policies. However, he noted that there are not enough traffic officers in the district to effectively enforce the area, stating that he needs 20 officers while they currently only have six. While most of the traffic officers are stationed on Pracha Uthit Road, the priority is directing traffic at the traffic light intersection rather than enforcing traffic policies.

Furthermore, during observations at Wat Thung Khru School, we noticed volunteer police officers directing traffic. Officer Wattana stated that the volunteer officers help direct the flow of traffic by giving signals, but do not have authority to penalize drivers. Additionally, there is a lack of volunteer officers, highlighting the overall lack of manpower in Thung Khru Police Department.

Finding #5 Thung Khru lacks the space to expand road infrastructure

Based on our interview with Officer Wattana, the Thung Khru Police Department acknowledges that the road infrastructure of Pracha Uthit Road is insufficient for the amount of traffic volume currently experienced. Upon further investigation, we learned from Officer Wattana that there are budgetary restrictions to improving transportation infrastructure. Additionally, we learned from focus groups with Na Luang School PTA that developing bike lanes on Pracha Uthit and Phuttha Bucha Road is unfeasible due to sidewalks already being congested (as shown in Figure 4.9). During our observations of Pracha Uthit Road, we discovered that the sidewalks were overcrowded with street vendors and parked motorbikes, highlighting the lack of space on the road. Additionally, the telephone poles and storefronts leave no space to expand the road infrastructure.

Figure 4.9 – Crowded road and sidewalks on Pracha Uthit Road

The alleys branching off of Pracha Uthit Road provide access to residential areas, but are narrower than the main route. Additionally, the alleys are packed with parked cars, surrounded tightly by houses, and in many cases, allow traffic to travel only one way.

Finding #6 A traffic educational program promoting alternative modes of travel would be the most effective approach to alleviate traffic congestion

Officer Wattana highlighted that the best approach to alleviate traffic congestion is to educate the people on traffic policies. Furthermore, our interviews with teachers and focus groups with parents revealed that a traffic educational program would benefit the community because students can take what they learn from it and bring the information back home to share with their parents. Additionally, parents stated that they would be more open to changing if they could trust the suggested travel behaviors, highlighting the necessity to educate the community, providing them with the information that will influence change in their travel behaviors.

4.3 Development of Test Lesson Plan Content

Finding #7 Educational material should focus on traffic safety as it is a primary concern of parents, especially concerning younger students, in order to promote alternative modes of travel.

Based on our focus groups with the Na Luang School PTA and the Pracha Uthit Soi 43 Community, we discovered that parents are primarily concerned about the safety of their children when they are commuting to school; parents stated they would be more open to the idea of alternative modes of travel if they deemed the methods safe. Additionally, parents cited that undisciplined drivers and the threat of strangers were major reasons why they preferred to personally drive their children to school, as opposed to letting them use alternative modes of travel.

We discovered during our observations a connection between mode of travel, level of the safety concern, and the age of the students. We observed more of the younger children being dropped off by their parents' vehicle or by a motorcycle taxi directly in front of the school, eliminating any concerns about the safety of the children. On the other hand, we observed that the majority of students using public transportation and using the overpass bridge to safely cross the road were older students. We also observed that some older students use motorcycles to get to school, supporting that there is a relationship between age of the students and mode of travel.

The focus groups noted that if there is a "continuous" program designed to address these safety concerns they would be more receptive to having their children utilize alternative modes of travel, such as walking. The groups recommended the following content to be included: (1) Crossing the bridge; (2) Crossing busy intersections; and (3) Handling encounters with strangers.

Finding #8 Distance is a primary factor when parents choose a mode of travel for their child

From our interview with Professor Viroat, we realized that the residents of Thung Khru are only likely to walk to a destination if it is within 400 meters. Our focus groups expressed that sentiment; parents who lived roughly one kilometer away are uncomfortable with their children walking that distance, especially if unsupervised. The focus groups suggested that we determine

specific alternative methods for these long distance commuters as their needs are different than short distance commuters. Suggestions included: effective travel routes to school that avoided traffic congestion, and the importance of helmet use when riding motorcycles.

Finding #9 Thung Khru parents are receptive to the possibility of their children walking to school

Given that it was an appropriate distance, parents from our focus groups expressed a willingness to allow their children to walk to Na Luang School if they did not have to worry about the possible dangers of the students walking by themselves. Some parents were skeptical of the concept at first, but they offered a few suggestions that would help give themselves better peace of mind; suggestions included: having volunteers walk students to and from school (such as a teacher, parent, or older student), and teaching children safe walking manners.

Finding #10 Thung Khru parents do not think biking is an acceptable alternative mode of travel at this time

Based on our focus groups, parents reacted negatively to the concept of allowing their children to bike to and from school. Parents cited how they perceived biking to be too dangerous given the traffic and behavior of Thung Khru drivers. However, parents mentioned if there were bike lanes in the district, they may allow their children to bike to school.

Finding #11 The traffic educational program must address the entire school community in order to be effective

Parents, teachers, and police officers support the idea of a traffic educational program, especially one that is taught throughout multiple grade levels. The school runs kindergarten through 12th grade, making the school community large between several different age groups, and parents associated with each.

The parents from the focus groups also agreed that teaching the students can have an influence on the parents as well. Initially, the students can relay the information to parents by discussing what they learned from the program; the children can then give their parents a pamphlet that promotes alternative modes of travel and tips for parents to avoid traffic congestion when commuting to and from school. If the program is taught continuously to all age groups of the school, students may retain the good pedestrian and driving behaviors associated with commuting, and may influence their parents to adopt better travel behaviors.

Parents and teachers from Na Luang School suggested that older students can make the program more effective. Parents believe that older students can influence younger students if they are seen taking appropriate safety precautions like using the bridge to cross the road.

4.4 Adjustments Made after the Lesson Plan

Finding #12 Students gained knowledge from the lesson

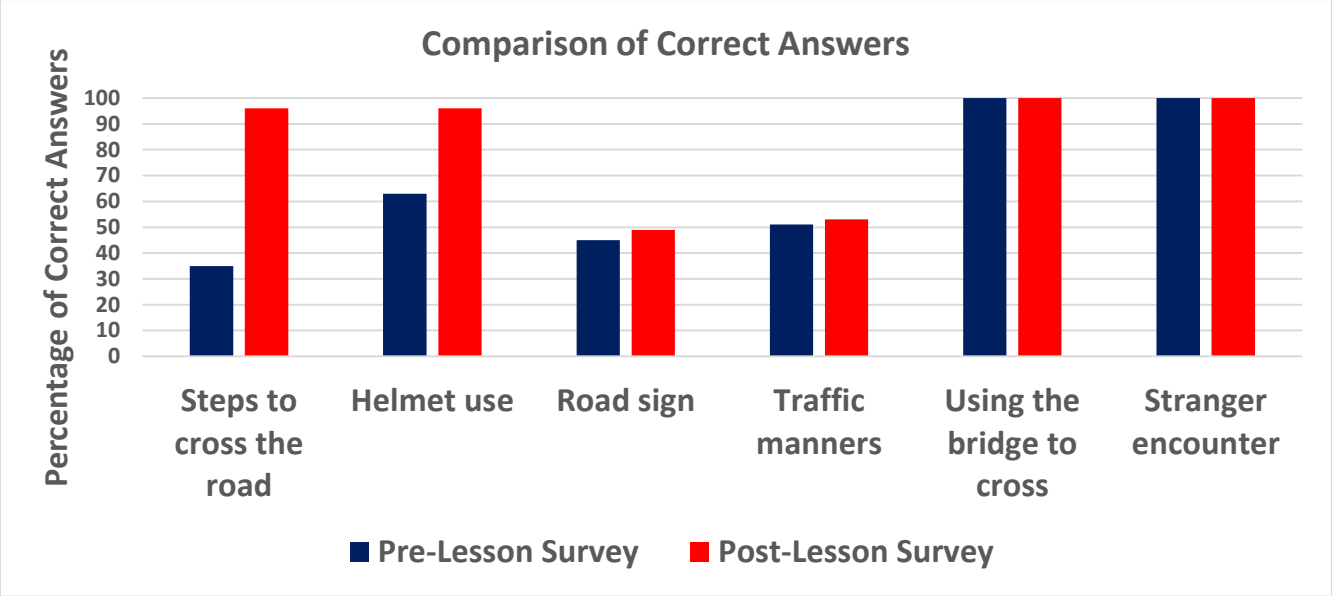

Figure 4.10 – Comparison of correct answer between pre and post lesson surveys

Based on a comparison between our pre and post lesson survey, shown in Figure 4.10, we discovered that students in our test program learned in the areas of crossing busy streets/intersections and using helmets when riding motorcycles. At the end of our lesson, nearly all of the 49 students knew how to act in scenarios pertaining to safety in these two categories whereas at most 35 percent of students knew how to cross the street and 63 percent understood the importance of wearing helmets at the beginning of the lesson. The students' ability and willingness to learn during our test program confirms the assertions made by teachers and parents that students would be receptive to learning about traffic safety. A more detailed breakdown of the pre and post lesson survey results can be found in Appendix F.

Finding #13 Students had prior knowledge of traffic safety before our test lesson

Based on our pre and post lesson survey results shown in Figure 4.10, 100 percent of students already knew to use bridge/zebra crossings and to avoid contact with strangers. This discovery suggests that there is already a conscious effort from the community, whether that be by the school or the parents, to teach children these traffic safety concepts at an early age. Therefore, we discovered that it is best to teach these topics to a younger age group as we realize the potential for younger students to learn about traffic safety.

Finding #14 Students can still learn other key concepts concerning traffic safety

At the conclusion of our test lesson, we recognized that students did not exhibit additional understanding in two topic areas as shown in Figure 4.10: traffic signs and the importance of good traffic manners. In retrospect, we attributed the lack of growth in these categories due to errors on our behalf. We realized that in an effort to shorten the lesson time, we removed content from the traffic sign activity that the students needed for our evaluation. Additionally, the traffic

manners questions were confusing to students because of question phrasing, evident by the students asking for assistance in understanding the questions.

Finding #15 Student engagement throughout the lesson suggests that the duration of the lesson can be increased

In our lesson plan, we planned to teach the class for an hour based on the assumption that we would lose the students' interest if the lesson went on any longer. During our test of the lesson, some of the activities took longer than we had planned resulting in the lesson lasting two hours. At the end we spoke to one of the teachers to gain feedback on how she thought the lesson went. She pointed out that the students enjoyed the lesson and paid attention for the duration of the lesson. They also seemed to enjoy it a lot because it was a change of pace from their usual teacher given that we were the ones teaching it.

5.0 Recommendations

This chapter presents our recommendations on establishing a traffic educational program to alleviate traffic congestion in Na Luang School and its eventual expansion throughout schools in the Thung Khru district. The team proposed final recommendations for our sponsor and authorities at Na Luang School, such as the Administration, Parent Teacher Association, and Na Luang community leaders. These recommendations are supported by our literature review and our findings presented in the previous chapters.

Na Luang School's warm reception to the traffic educational program and our sponsor's excitement of the traffic educational program illustrates the possibility of the program expanding within Na Luang School, and eventually to other schools throughout the Thung Khru district. We will discuss the limitations of our program that can be addressed by future evaluation and expansion.

5.1 Recommendations about Implementation of the Traffic Educational Program

We strongly recommend that the Can Do Team and Na Luang School Administration utilize an educational approach, aimed at both children and parents, to alleviate the traffic congestion problem around Na Luang School.

There are three main approaches to traffic management: engineering, enforcement and educational measures. The goal of an educational approach is consistent with the Can Do Team's mission statement to improve the quality of life in the Thung Khru district, by educating the community on good traffic behaviors. Additionally, finding #6 highlights that teachers and parents of Na Luang School community believe that an educational approach would be effective. Finding #3 conveys that a contributing factor to traffic congestion is the people and their disregard for traffic policies, whether it be from lack of knowledge, social norms or because there is no other choice, highlighting the necessity for education on the traffic congestion topic.

Additionally, engineering measures require both monetary and labor resources, making it an unfeasible approach for the Can Do Team to alleviate the traffic congestion problem. Finding #5 highlights that even if the Can Do Team and the Thung Khru Police Department had the necessary resources, there is no space for expansion in infrastructure, making engineering an unfeasible approach.

In terms of enforcement measures, finding #4 highlights that even if the Can Do Team was able to coordinate with the Thung Khru Police Department, the Police Department lacks the resources, such as labor and funds, to enforce traffic policies in the district.

Finding #7 highlights that an effective educational approach should promote traffic safety as well as utilize students as a channel to the parents. Our research highlights that education is most effective when there is collaboration between the students and parents.

We strongly recommend that the traffic educational program be aimed at children and focus on promoting safety and good traffic manners.

Two contributing factors to traffic congestion are school traffic and the heavy reliance of personal vehicles, such as motorcycles and cars, as a mode of travel to school. Finding #2 highlights that traffic congestion peaks during times of school pickup and drop off periods. Professor Viroat, the civil engineering professor of King Mongkut's University of Technology, conducted a study at Na Luang School investigating the modes of travel to the school. The study points out that parents do not utilize alternative modes of travel, such as biking or walking, because of their concern of safety of their children; 41.7% of them worry about security while 30.3% worry about the risk of an accident. Further, finding #7 is consistent with Professor Viroat's study; parent concern of safety of their children is a determining factor of their mode of travel to school.

Thus, the traffic educational program should promote safety in the traffic environment, in order to reduce parents' concerns surrounding safety of their children. The intent is to increase the use of alternative modes of travel, reducing the number of personal vehicles contributing to school traffic and, as a result, helping alleviate traffic congestion.

The root problem of traffic congestion is, in fact, the people. Finding #3 highlights the negative effect behaviors have on traffic flow. Promoting good traffic manners to the children may raise awareness to the effect behaviors can have on traffic, instilling good traffic manners before they develop poor behaviors in the traffic environment.

We strongly recommend that the traffic educational program provide information about alternative modes of travel to parents.

Traffic educational programs must recognize that parents choose the mode of travel to school for their children. While teaching students safe and mindful traffic manners may be an important portion of an educational program, it is crucial to provide parents with information on both why and how they should adopt suggested alternative modes of travel. Finding #1 highlights the necessity of adopting alternative modes of travel because the number of personal vehicles on the road contributes to traffic congestion. In terms of influencing behavioral change, a crucial step is getting the audience to listen to the message.

Finding #11 points out that students are useful channels to influence parents to change. First, students can bring pamphlets providing detailed information about alternative modes of travel directly to their parents. The suggested alternative modes of travel consist of methods that reduce personal vehicles in congested areas, such as a walking school bus, carpooling or picking up/dropping off at non congested areas and trusting children to walk to/from those areas. Second, students may apply what they learn to their everyday lives, pointing out poor traffic manners to their parents when they observe them.

5.2 Recommendations about Expansion of Traffic Educational Program at the Na Luang School

The recommendations below expand upon the traffic educational program we delivered. We were able to produce a detailed lesson plan for 4th-6th grade (8-10 years old) students but in order for the traffic educational program to effectively alleviate traffic congestion around Na Luang School, it should be expanded within Na Luang School to target all students. The following recommendations outline future actions to be taken by the Can Do Team because it is necessary to continue the traffic educational program to make it effective.

We strongly recommend that distinct objectives and methods of the traffic educational program lessons be tailored to different aged children in Na Luang School.

In the school setting the educational program can promote good travel behaviors before students develop poor travel behaviors that contribute to traffic congestion. Each age group should have distinct objectives, focused around their role in the traffic community, addressing both safety and highlighting the affect certain behaviors can have on traffic congestion. Based on our research and findings, we developed a table, shown in Appendix C, with our recommended objectives, methods for lessons and suggested alternative modes of travel for different age groups.

In terms of suggested alternative modes of travel, finding #8 points out that distance is a variable when choosing modes of travel. Finding #9 highlights that Thung Khru parents are receptive to the possibility of their children walking to school, if it is safe. Lastly, finding #10 points out that given the conditions of the road infrastructure, Thung Khru parents do not think biking is a safe alternative mode of travel.

However, as the Can Do Team expands the educational program in Na Luang School, it is crucial to continue to gather the inputs of teachers and students from the specific age groups beyond our recommendation. We only gathered the input of teachers and students from the 4th-6th grade age group, given that this was our target age group.

Our research on educating students highlights that different age groups are associated with different levels of maturity and cognitive development. As a result, methods that were used in our test with the 5th grade students might not engage older or younger students. For example, the traffic sign bingo activity was extremely engaging for the 5th grade students, but 10th-12th grade students may not be as interested.

Additionally, finding #13 points out that during our test we discovered that the 5th grade students already had some previous knowledge of road safety behaviors, specifically crossing the road and stranger encounters. This suggests that those road safety behaviors should be taught to younger students, who may not have previous knowledge, highlighting the importance that content of the program lessons differ between age groups.

We strongly recommend that the Can Do Team collaborate with the school administration of Na Luang School to make the traffic educational program continuous.

Our research suggests that a crucial step to influencing behavioral change is ensuring retention, continuously conveying the key messages. Given that Na Luang School is kindergarten through 12th grade, the traffic educational program should be continuous, expanding to all age groups. Teaching a program lesson once to 5th grade students is unlikely to effectively influence behavioral change.

Additionally, finding #7 highlights the parents' suggestion that the traffic educational program at Na Luang School be continuous. The traffic educational program will be more effective if, as students progress through their primary and secondary education, they continue to go through program lessons that pertain to their age, instilling good and safe manners. Finding #12 points out that the 5th grade students learned from our program lesson, suggesting that the educational program material is useful. Finding #15 highlights that the program lesson was engaging and kept students attentive, highlighting that making the traffic educational program continuous throughout the entire school will likely be well received by other age groups as well.

5.3 Recommendations about Future Evaluation and Improvement of Traffic Educational Program

The recommendations below outline future actions for the Can Do Team to take for evaluation and improvement of the traffic educational program we delivered.

We strongly recommend that the Can Do Team utilize an expert in the traffic field to implement an evaluation program to assess the impact of the traffic educational program.

In order to assess the impact of the traffic educational program it is crucial that the Can Do Team administer surveys to the students of Na Luang School. Finding #7 highlights the importance of making the traffic educational program continuous; students should go through the program each year. The surveys should be administered continuously, as well, to constantly check in on the success of the program. Given Professor Viroat's past experience in his study at Na Luang School and his connection with the Can Do Team, we suggest that the Can Do Team utilize Professor Viroat's expertise to administer the surveys, organize and analyze the data. Appendix D displays a timetable for when to administer the surveys after the students go through the program lessons, as well as a copy of the suggested survey.

We strongly recommend that the Can Do Team collaborate with the teachers of Na Luang School to recruit older students to help convey key messages of the traffic educational program.

When it comes to influencing behavioral change, our research suggests that a crucial step is getting the students to accept the messages by somehow presenting the messages in a rewarding way. Finding #11 highlights that younger (elementary) students look up to older (high school) students as role models; younger students will be more inclined to follow messages conveyed by their role models. Additionally, the parents and teachers pointed out the influence older students can create. Further, finding #7 points out that many older students already exhibit good traffic manners such as using a bridge to cross the road.

The main goal behind the entire traffic educational program is to eventually influence travel behavior change both in terms of choice in mode of travel as well as traffic behaviors. As the Can Do Team expands upon the program, recruiting older students to deliver key messages can strengthen the drive for adopting the suggested travel behaviors. However, a limitation of this recommendation is that some older students/volunteers may not have any teaching experience, and given that younger students can get distracted, the older students/volunteers may not know how to control the classroom. In order to address this limitation, we have added a set of simple methods to the lesson plan, shown in Appendix E, that may help regain students' attention.

We strongly recommend that the Can Do Team publicize the traffic educational program and make it easily accessible through social media.

Parents have the most power in actually following alternative modes of travel presented by the traffic educational program. However, the current educational program only utilizes a pamphlet, taken home by students and given to their parents, to convey the information of alternative modes of travel. Finding #11 highlights that the medium used to relay information to the parents is highly important. Content aside, the medium should be appealing and easily accessible.

As the Can Do Team expands upon the traffic educational program, the pamphlet should be accompanied by the use of social media, such as the Can Do Team's Facebook page, to better publicize the alternative modes of travel and information about the educational program. Utilizing the Facebook page can greatly expand the audiences that the traffic educational program can reach.

We strongly recommend that the Can Do Team implement the traffic educational program at other schools in the Thung Khru district.

There are 16 academic institutes in the Thung Khru district, meaning there are plenty of opportunities to expand the traffic educational program to, past expansion in Na Luang School. The traffic educational program implemented in Na Luang School can be used as a model in the future for other schools to follow. The more schools that the educational program reaches, the more likely the traffic educational program alleviates traffic congestion around the Thung Khru district.

6.0 Conclusion

Traffic problems are, in fact, the people (Rujopakarn, 2003). Defining the root cause of traffic congestion is difficult; it stems from multiple factors, some being unique to a given location. Further, traffic congestion affects society on three levels: economically, quality of life and road safety. As a result, finding a single overarching solution that will eliminate traffic congestion is impossible.

Ideally a three-pronged approach of engineering, enforcement and educational measures would most effectively tackle the traffic congestion problem; however, engineering and enforcement require significant resources. A traffic educational program is an important element of a broader strategy. We have initiated a traffic educational program that can directly influence travel behavior change. The younger generation will likely develop good traffic manners before they even touch a steering wheel. The older generation will likely hear the persistent message for change from the traffic educational program. A few people changing their mode of travel would make little difference, but thousands doing so can have a major cumulative effect on traffic congestion (Punpuing & Ross, 2001). With the traffic educational program, we envision a movement towards a safer and alleviated traffic environment.

Team Concluding Remarks

During our IQP experience, there was nothing more terrifying than being two weeks deep into the term and not being able to precisely answer this question, "What is your project?" We felt like we were staring at a red light, stuck in traffic, with nowhere to go. We struggled with communicating the problem of our project, let alone answering what our project was. At the

time, we felt that our project was so daunting and impossible that we began to doubt our ability to make a change and help our sponsor.

Finally, the day came that we desperately needed. The advisors had invited faculty from a local university to give us a workshop on stakeholder analysis. At the end of the workshop, we were forced to pinpoint a target audience that we intended to help. What was an easy activity for other IQP groups turned out to be our biggest struggle; we discussing amongst ourselves "What **is** our target audience?"

Then came the true blessing.

Noticing that we were struggling, multiple advisors and workshop conductors came to help us pick a target group. They relieved a substantial amount of pressure by reassuring us that for the activity, we did not have to use what our actual target might be; someone suggested that we, "Just pick one and see where you get, it's a process."

For the sake of the exercise, our group chose the target audience of students commuting to school. We identified the problems that faced our target audience, and thought of how helping the students might be beneficial for the entire traffic community. By walking through the exercise we realized, "Wow, we surprisingly have a substantial amount of evidence that a project focusing on school traffic could help alleviate traffic congestion."

We had our epiphany, our A-Ha! Moment. The answer was right in front of our noses the entire time, but our information overload prevented us from truly connecting the dots; we were still in the engineer mindset, looking for a single overarching solution. By the end of the workshop, we knew we had something tangible and within the next few weeks we were able to create goals and objectives to tackle our newfound focus. Fortunately, we made the realization early enough that we could flesh out an effective process to collect more information, analyze it, develop concrete deliverables for our sponsors, AND test the effectiveness of our proposed solution.

As a team, we are proud of our project and the progress that we made. It took us a little while to figure out a direction in a messy traffic congestion problem, but in the end, we overcame the challenges and produced a solution that could improve the lives of many in the Thung Khru district. We finally feel like we found the green light, with somewhere to go.

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2.0 Literature Review	Jamie, John, Narathorn, Naphat	Natalie, Mariya, Boondharika
3.0 Methodology	Mariya, Natalie, Chompunud	Narathorn, Jamie, Naphat
4.0 Results	Mariya, John, Boondharika, Chompunud	Jamie, Narathorn, Naphat, Natalie
5.0 Recommendations	Jamie, Narathorn, Boondharika	Mariya, Chompunud, Natalie
6.0 Conclusion	Jamie	Narathorn, John
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Appendix A: List of participants in focus groups and interviews

Below is a list of those who were interviewed or were included in a focus group. The individuals were interviewed because of their community involvement and knowledge of traffic congestion.

Interviews:

Head of the Thung Khru District Office

The head of the Thung Khru District Office was interviewed in the first phase of the project to understand the causes of congestion, and what consequences drivers face for illegal driving behaviors.

Officer Wattana

The head of the police department in Thung Khru was interviewed in the first phase of the project to learn about policy enforcement, and reasons for traffic congestion associated with traffic enforcement. We also wanted to learn if there were possible solutions associated traffic enforcement and the limitations.

Professor Viroat Srisurapanon

Associate Professor in the Department of Civil Engineering at King Mongkut's University of Technology, Thonburi, was interviewed in the first phase of the project to learn about his research on traffic congestion in Thung Khru.

Head of Education Department at Na Luang School

The Head of the Education Department at the Na Luang School was interviewed in the second stage of our project to gain insight on behaviors associated with school traffic, details for implementation of traffic program and previous traffic programs.

Na Luang School Teachers

Four teachers at the Na Luang School were interviewed in the second stage of our project to gain insight on what ages to target for our educational lesson plan, what methods to use to educate the students, and how to measure the success of it. General knowledge about the types of students that attend the Na Luang School was also gained.

Focus Groups:

Na Luang School Parent Teacher Association

The head community leader, the vice community leader, and the four parents with students at the Na Luang School participated in a focus group during the second stage of our project to learn of the parents' concerns regarding the alternative modes of transportation, and the topics to include in the program.

Pracha Uthit Soi 43 Community

Three parents with students at the Na Luang School, one parent with a student at the Sarasas School, and one parent with a student at the Kajonroj School, participated in a focus group in the second stage of the project to provide their opinions on the educational program, suggest what to include in the traffic educational program, and any concerns with the different modes of transportation.

Appendix B: Interview Questions

Below is our set of interview questions for the list of participants given in Appendix A. More details of the interviews including Professor Viroat's interview and the focus group interviews of the Parents Teacher Association at the Thung Khru district and the Soi 43 Community can be found in the Appendices document. A digital copy of it can be found here: **https://sites.google.com/site/bkk16traffic/deliverable**.

Head of the Thung Khru District

1. Why were you helping guide traffic?
2. What are the other factors that cause the traffic congestion?
3. Is there anyone taking actions on those drivers?
4. Does it work?

Officer Wattana

1. In your opinion, where is the most congested area in Thung Khru?
2. How do you handle the illegally parked cars?
3. Why are there so many illegally parked cars on the road if the police are present?
4. What about the volunteer police? What do they do?
5. Who has the power to make a change on the road?
6. Do you think songthaews cause the congestion?
7. In your opinion, what would be the best solution to traffic congestion?

Head of Education Department at Na Luang School

1. Do you teach traffic education in the health subject?
2. Is it continuous? Does every grade get to go?
3. How long has it been?
4. Do you think there is any difference after the field trip?
5. When do school activities usually take place?
6. Does it affect the school lessons? Does it affect the school time?
7. When does the make-up class take place?
8. Where are the education standards from?
9. Did you change it to fit the school more?
10. Does the ministry of education set up a curriculum for you?
11. Do you think the traffic congestion problem is important?
12. So, do you think traffic education will be important?
13. Did you talk about this in student-parent meeting?
14. Is it hard to come in and set up an activity at the school?
15. What do you think about the people who come in to observe?
16. In your opinion, which is the best way to solve traffic problems?
17. Do you think minimizing the private cars will help?
18. Do you have kids who ride bicycles/motorbikes to school?
19. What mode of transportation do parents use to send their children to school?
20. Are songthaews safe?
21. Do you tell the students which modes of transportation are safe or not safe?
22. What about motorcycles that come with 3 people?

23. Do you think traffic problems should be solved quickly? Where do you think has the biggest problem?
24. Do you have a parents association in school? Do they have any roles to help the school?
25. Do you think it will be helpful if people come educate the kids?
26. I recognized that kids here have really good manners, what are some techniques you use to teach the students?
27. If we have an activity for about 1-2 hours on traffic education, do you think it will work? What are the limitations?
28. Is there any excellent programs that came here in the past?

Na Luang School Teachers

1. What is the general background of the students?
2. What are some common behaviors of the students?
3. Do you usually have student-parent meeting?
4. What topics are usually mentioned at the meeting?
5. What vehicles do parents usually use to send their children to school?
6. Do you think educating the students would help?
7. What ages do you think are the best at learning?
8. Is there a measurement from any previous programs in this school?
9. In your opinion, do you think traffic education would make any difference to the Thung Khru district?
10. Do you think informing parents will be a good idea?
11. Do you have a "guidance" subject?
12. Students informing their parents about what's going on with the school or teachers informing the parents, which way is better?
13. Who are those people coming for the school program?
14. From your experience, do the students come and join the activities?
15. Can you draw their attentions to join the activity by providing extra points?
16. What is the difference between the students in the past and the current students?
17. Are the students allowed to carry mobile phones?
18. Is there a parents association at the school?
19. Which would be better, creating the activity or including it in the curriculum in a subject?
20. In your opinion, what methods do you think would solve the traffic congestion?
21. Apart from the corruption, what do you think about road users that affect the traffic congestion?
22. Do you think media helps change behavior?
23. What types of media do you think it would work for educating the students?
24. Do you think trying to influence the kids now, will have a positive impact on the kids, especially after they graduate?
25. If we are going to educate the kids on traffic manners now, what topics do you think should be useful for them to know in the future?
26. What education do you give to the fourth and fifth grade students, it doesn't have to be related to traffic?

Appendix C: Recommended Objectives and Methods for Program Lesson

The table below is a breakdown of the traffic educational program lessons for four target age groups, K-3rd grade, 4th-6th grade, 7th-9th grade and 10th-12th grade. It highlights the recommended objectives for each age group, content for the lessons, teaching aids and suggested alternative modes of travel for short and long distances from school to encourage.

Note: *We developed a detailed program lesson plan for the* ***4th-6th grade*** *age group. The other age groups are filled with recommended breakdowns but the Can Do Team should gather input from age group teachers and parents modeled after our interviews with teachers and focus groups with parents in addition to develop the lesson plans more in depth.*

Age Group	**Objectives**	**Content**	**Teaching Aids**	**Suggested alternative modes of travel Short: <1 km Long: >1 km**
K-3rd grade	1. Teach them the skills and knowledge required as pedestrians 2. Increase awareness and ability to avoid danger on the roads	1. Crossing the road 2. Stranger danger 3. Paying attention while walking 4. Basic traffic signs pertaining to pedestrians	1. Interactive video activity 2. Traffic sign bingo activity 3. Poster creation contest	Short: walking school bus Long: carpooling, pick-up/drop-off at non-congested areas
4th-6th grade	1. Teach them the skills and knowledge required as pedestrians and cyclists 2. Ensure that they can travel safely on the roads	1. Crossing the road 2. Motorbike safety 3. Paying attention while walking 4. Traffic signs pertaining to pedestrians and cyclists 5. Point out pedestrian traffic behaviors that affect traffic flow	1. Interactive video activity 2. Traffic sign bingo activity 3. Poster creation contest	Short: walking school bus Long: carpooling, pick-up/drop-off at non-congested areas

7th-9th grade	1. Ensure that they have sufficient skills and knowledge to be able to travel along roads safely by bicycle 2. Enable them to think about not only their own traffic manners	1. Overview of traffic policies 2. Traffic signs pertaining to cyclists 3. Highlight unsafe traffic behaviors 4. Point out traffic behaviors that affect traffic flow	1. Interactive video activity 2. Poster creation contest 3. Traffic policy jeopardy game	Short: walking school bus Long: carpooling, pick-up/drop-off at non-congested areas, motorbikes rather than car*
10th-12th grade	1. Teach them the skills and knowledge required to be able to travel along roads safely as a motorcyclist 2. Cultivating sound members of society who demonstrate the importance of traffic manners	1. Overview of traffic policies 2. Awareness of themselves as members of the traffic community 3. The responsibility of drivers, and how their behaviors affect traffic flow	1. Traffic policy jeopardy 2. Prepare and teach a traffic educational program to younger students 3.	Short: walking school bus Long: carpooling, pick-up/drop-off at non-congested areas, motorbikes rather than car*

Note: *The suggested alternative mode of travel is motorbike over use of a car, IF there are NO other options, due to a motorbike affecting traffic congestion less than a car.*

Appendix D: Timetable & Survey for Evaluation of Change in Mode of Travel

The purpose of this survey is to evaluate whether or not the traffic educational program has influenced behavioral change, noted by a shift towards alternative modes of travel or a reduction in personal vehicle use. The recommended survey questions may require revisal in the future. We strongly recommend the Can Do Team to utilize Professor Viroat's expertise in writing effective survey questions and conducting the surveys as well as analyzing the data collected. First, shown below is a timetable of the recommended times for administering the surveys as well as to whom. Second, shown below is a sample survey.

Note: *The first two surveys are to evaluate if the students who went through the program behaviors related to safe and mindful traffic practices changed as a result. The names and information of the students, for future surveys, who went through the program will be given to the Can Do Team. The surveys after that point are used to evaluate the overall success of the traffic awareness program, given that the message may spread past the program.*

Time Period	Who to survey	What purpose
April 2016 2 months after first program lesson was implemented	Students who went through program lesson	Evaluate success of program lesson
October 2016 8 months after first program lesson was implemented	Students who went through program lesson	Evaluate success of program lesson
February 2017 a year after first program lesson was implemented	Students from all age groups	Evaluate success of traffic awareness program
every 6 months after February 2017	Students from all age groups	Evaluate success of traffic awareness program

Student Post Survey

1. Did you go through a traffic awareness program lesson?

❑ Yes
❑ No

2. What is your primary mode of transportation?

❑ Personal car
❑ Personal motorbike
❑ Motorbike taxi
❑ Taxi
❑ Songthaew (Gapore)
❑ Public transportation
❑ Biking
❑ Walking
❑ Other (fill in best description):

3. Did the traffic awareness program influence how you commute to and from school?

❑ Yes
❑ No

Appendix E: Project Deliverables – Two Hour Traffic Educational Lesson for 4th to 6th Grade Students

Below you will find the materials required for the implementation of the lesson plan designed for grades 4 to 6. An electronic copy of the materials in English and in Thai can be found on our website: https://sites.google.com/site/bkk16traffic/deliverable

Detailed Lesson Plan for 4th to 6th Grade Students

Below is a detailed lesson plan for 4th to 6th grade students in English. The lesson plan provides complete instructions on how to teach the 2 hour lesson plan. It is written with enough detail that a volunteer with the detailed lesson plan along with the lesson materials will be able to teach a class of 4th-6th grade students. An electronic copy of the lesson plan in English and in Thai can be found on our website: https://sites.google.com/site/bkk16traffic/deliverables

Traffic Awareness and Safety Lesson Plan for 4th – 6th Graders			
Time Allotment (Minutes)	**Lesson Phase**	**Details**	**Purpose of Lesson Phase**
2	**Introduction**	This lesson plan is to promote safety to the students while they are traveling to and from school. This lesson plan includes safe practices associated with walking, motorbike safety and signage knowledge.	To capture the children's attention and excitement about the topic the activities are addressing
5	**Pre-Survey** 1. Introduce the pre-survey as a way to learn the knowledge they have on traffic awareness and safety prior to the activities 2. Distribute the pre-survey to the students 3. Collect and place in a folder for further use	• 9 multiple questions • 6 questions about traffic awareness and safety • 3 questions about their transportation mode is in this survey	• To access the students' knowledge of traffic safety and awareness prior to the educational program • This will be used to compare to the post-survey to access how successful the program was and the gaps in the program
15	**Do's and Don'ts Video** 1. Brief Introduction: Explains what the video is about and why it is important 2. Play introduction clip: Explains traffic congestion 3. Play the crossing the street clips: Discuss the steps that were taken to cross the street and why using the bridge to cross is important 4. Play the distracted while walking clip: Discuss what happened when the actor got distracted and why it is important to avoid getting distracted	• Total of 5 clips	• To inform the students of the traffic problem and how they can help eliminate the problem • To suggest behaviors to avoid to stay safe when traveling to and from school

	5. Play the talking to strangers clip: Discuss what steps to take if this does occur, give examples of other situations to be aware of 6. Play the motorcycle safety clip: Discuss what the safety precautions shown in the video were and why this is important		
15	**Traffic Signs Bingo** 1. Divide the students into a group of 6 to 7 students 2. Introduction & Game Explanation: Explain why knowing traffic signs is important and then proceed to go over the signs and the practices associated with the signs using card set 1. Bingo: The goal is to cover four squares in a vertical, horizontal or diagonal row. 3. Proceed to pass out the game boards, one per group 4. For the game, use card set 2. Shuffle the cards. 5. Pull one card and say the name and behaviors associated with the card. 6. Continue step 5 until someone yells bingo Give the group of students who win bingo the prize	The traffic signs on the Bingo board are signs that pedestrians and or drivers would use Materials needed: 1. Game boards 2. 2 sets of cards: one with the sign pictures and one without the sign pictures 3. Writing utensils 4. Prizes for the winner(s) Note: The students will be marking off the tiles with a pen or pencil	• To introduce the students to the pedestrian signs to increase their safety when walking • To introduce the students to general signage. The students are more inclined to follow the signs when they are of driving age if they are introduced at a younger age
20	**Poster Creation** 1. Introduction to activity Explain that they will be making posters from the things they learned throughout the activities (show the example poster) and that the posters will be hung up around the school 2. Have the students remain in the previous bingo groups and hand out the poster	Materials needed: Posters Pens Pencils Markers	• To have the students apply the knowledge • Hanging the posters around the school will spread awareness of the problem and the information taught in the program

	paper, markers, pens and pencils 3. Walk around to monitor the Poster Creation Activity 4. Have the students briefly present their posters to the rest of the class		
5	**Post Survey** 1. Introduce the post-survey as a way to learn the knowledge they have on traffic awareness and safety after the activities 2. Distribute to the students 3. Collect and place in a folder for further use	• 7 multiple questions • All 7 questions are about traffic awareness and safety • No questions about transportation modes	• To access the students' knowledge of traffic safety and awareness after the educational program • This will be compared to the pre-survey to access how successful the program was and the gaps in the program
5	**Pamphlet Home** 1. Inform the students that the pamphlets given to them are to be given to their parents 2. Distribute the pamphlets	• Each student in program will be getting a pamphlet for their parents	• To inform the parents of the safety program given to the students • To make the parents aware of alternative modes of transportation • To make the parents aware of alternative drop off locations
2 months later and recurring	**Post Survey** This survey should be given two months after the program to test knowledge of children as well as use of other modes of transportation	• Multiple choice question survey testing knowledge and mode of transportation	• To test retention of the knowledge taught to the students • To see if program in combination with the pamphlet given to the parents had changed any of the children's mode of transportation or drop off location

Educational Video

To start the traffic educational lesson the students are shown an educational video that consists of five (5) segments. The teachers are encouraged to have a discussion with the class after watching each segment. The first video that will be shown is the introduction that discusses traffic congestion and importance of educating the students. The second video segment encourages the use of the bridge to cross the road. The third video emphasizes the importance of being aware of your surroundings while walking. The fourth video focuses on motorcycle safety. The last video increases awareness on the risks associated with talking to strangers.

The full video and each segment of the video can be found on our website:
https://sites.google.com/site/bkk16traffic/deliverables

Road Safety Bingo
Following the educational video, the students will play a bingo game centered on road safety. The materials required for the game include the following: card sets, game boards, and a PowerPoint slideshow. There are two card sets, one set shows the road signs and their definition that will be used to teach the students. The other set of cards shows the definition of the road sign that will be used to play the game. There is also a PowerPoint that can be used to play the game if preferred over the card set.

An electronic copy of all of the materials required for the bingo game can be found on our website: https://sites.google.com/site/bkk16traffic/deliverables

Pamphlet

After the completion of the lesson, a pamphlet will be distributed to the students to give to their parents. The pamphlet outlines alternative modes of travel for students to get to and from school. The pamphlet encourages the use of a walking school bus, carpool, and alternative pick up and drop off locations near the school.

Below you will find the pamphlet. An electronic copy of the pamphlet in Thai is available on our website: https://sites.google.com/site/bkk16traffic/deliverables

ผลกระทบของการจราจรหน้าโรงเรียนในชีวิตประจำวัน

ในช่วงเวลาโรงเรียนเข้าเรียน และเลิกเรียน
จะมีปริมาณรถที่มากขึ้นอย่างเห็นได้ชัด
เนื่องจากผู้ปกครองมารับ-ส่งนักเรียน
ร่วมถึงการจอดรถ หรือเลี้ยวรถเพื่อ
เข้าไปรับ-ส่งนักเรียน
จะทำให้จราจรบริเวณนั้นติดขัด

สอบถามข้อมูลเพิ่มเติม:

ร้าน Cafe' Can Do
643/14 ซอย ประชาอุทิศ 47
(ปากซอยประชาอุทิศ 47) แขวงบางมด ,
เขตทุ่งครุ , กรุงเทพมหานคร 10140
โทร: 02-0070713
097-1542131
Can Do Team

Can Do Team

WPI

อ้างอิง:

1. Road safety education [PDF]. (n.d.). http://think.direct.gov.uk/education/earlyyearsandprimary/docs/booklet_senior_managers.pdf
2. Keeping our kids safe around schools [PDF]. (n.d.). http://roadsafety.transport.nsw.gov.au/downloads/safety-around-schools.pdf

จุดเริ่มต้นที่สำคัญ

ส่งเสริมการเดินทางอย่างปลอดภัย
และมีประสิทธิภาพ

ทางเลือกต่างๆ ในการเดินทาง

ยังมีวิธีการเดินทางอีกหลากหลายวิธี
ที่ทำให้สภาพแวดล้อม และสภาพจราจรดียิ่งขึ้น

- ลดการจราจรแออัด
- ลดมลพิษทางเสียง และอากาศ
- สร้างสภาพแวดล้อมที่ปลอดภัยมากยิ่งขึ้น
- ส่งเสริมวิถีชีวิตสุขภาพที่ดียิ่งขึ้น
- ปรับปรุงการปฏิสัมพันธ์ทางสังคมทั่วชุมชน

✓ Walking School Bus
(รถโรงเรียนทางเท้า)

การเดินทางไปโรงเรียนสำหรับนักเรียน
ที่อาศัยอยู่บริเวณโรงเรียน
โดยมีผู้ใหญ่หรือผู้ปกครองเดินไปรับส่ง
เด็กหลายๆคนพร้อมกัน
จะช่วยลดจำนวนการใช้รถส่วนตัว เพิ่มวินัยกับเด็ก
และมีผู้ใหญ่ดูแลรักษาความปลอดภัย

ส่งเสริมทางเลือกอื่นๆใน การเดินทางของนักเรียน และการปฏิบัติ อย่างระมัดระวังและมีประสิทธิภาพ

✓ Car pool
การใช้รถยนต์ร่วมกัน

โดยวิธีการนี้อาศัยการร่วมมือของคนในชุมชน
ที่ใช้รถยนต์ส่วนตัวเป็นประจำ
โดยให้ผู้ปกครองที่ใช้รถนั้น
รับส่งนักเรียนในระแวกนั้นเพื่อลดจำนวน
การใช้รถส่วนตัวในชุมชน

✓ Pick up and Drop off

การเลือกจุดจอดรถรับส่งนักเรียนนั้น
ควรจะหลีกเลี่ยงการรับ-ส่งนักเรียน
หน้าประตูโรงเรียน โดยจอดรถ
ให้ห่างจากบริเวณหน้าโรงเรียน
หรือจอดในสถานที่ใกล้เคียง
เพื่อลดการติดขัดในบริเวณ
ด้านหน้าโรงเรียน รวมถึง
ส่งเสริมให้นักเรียนขึ้น-ลงรถ
ด้วยความรวดเร็ว เพื่อความสะดวก
ต่อผู้ใช้ถนนผู้อื่น
การใช้สะพานลอย หรือทางม้าลายขณะข้ามถนน

ข้อเสนอแนะ:

ร่วมมือกับคนในชุมชนเพื่อหา
วิธีการในการเดินทางต่างๆ ในการ
เพิ่มความปลอดภัย และความสะดวก
ในการไป-กลับโรงเรียน

Pre-Lesson and Post-Lesson Survey:
The purpose of the pre-lesson and post-lesson surveys was to evaluate the students' knowledge before and after the program. By comparing the data from the pre-lesson survey to the post-lesson survey, we were able to identify areas for adjustment to successfully educate the students. The pre-lesson and post lesson surveys are shown below. Electronic copies of the surveys can be found in English and Thai on our website: https://sites.google.com/site/bkk16traffic/deliverables

PRE-LESSON SURVEY

Please read the following items and put a checkmark (✓) by your answer. You may choose more than one answer.

1. It's a sunny day today and you're in a hurry to school. It is rush hour and there are a lot of cars on the road. You decided to get a motorcycle taxi across the street. What should you do to get there?

( ) Aimlessly crossing the road
( ) Use the crossing bridge
( ) Use the zebra crossing

2. Oh, no! The crossing light at the zebra crossing is not working today. What are the steps you have to follow before crossing the road?

( ) Look left then look right
( ) Look right then look left
( ) No need to look because the cars will have to stop for us.

3. You finally crossed the street safely. Suddenly a stranger approached and offers you snacks/money. What should you do?

( ) Talk back to them because……
( ) Run away because…….
( ) Ignore them and walk away because…….

General Questions

4. Do you think bad traffic manners contributes to the traffic?

( ) Yes, because……..
( ) No, because……

5. Do you know this sign?

( ) Yes, it is……
( ) I don't know

6. Do you wear a helmet every time you ride motorcycles?

( ) Yes ( ) No, why?.....

7. How do you commute to school?

( ) Personal car ( ) Songthaew
( ) Bicycle ( ) Personal motorcycle
( ) Walk ( ) Motorcycle taxi
( ) Bus ( ) Bigger Songthaew

8. How do you commute back home?

( ) Personal car	( ) Songthaew
( ) Bicycle	( ) Personal motorcycle
( ) Walk	( ) Motorcycle taxi
( ) Bus	( ) Bigger songthaew

9. Who do you usually travel to school with?

( ) Alone
( ) With parents
( ) Others (please specify).....

POST-LESSON SURVEY

Please read the following items and put a checkmark (✓) by your answer. You may choose more than one answer.

1. You are in hurry getting motorcycle taxi across the street in order to get home. It is in the rush hour and there are a lot of cars on the road. What would you do to get the motorcycles taxi across the street?

( ) Aimlessly crossing
( ) Use the crossing bridge
( ) Use the zebra crossing

2. It is time to go back home. Unfortunately, there are no motorcycle taxis today and your parents are still at work. So, you have to walk home alone. Suddenly, there is a stranger approaches to offer you snacks/money. What should you do?

( ) Talk back to them because.....
( ) Run away because.....
( ) Ignore them and walk away because.....

3. In what situation you have to look right and then left before crossing the road?

( ) When using the crossing bridge
( ) When not using the crossing bridge
( ) While waiting for public transport

4. If you usually commute by motorcycles/ motorcycles taxi. What would you do before take-off?

( ) Just go without wearing the helmet
( ) Ask for a helmet

5.  Do you know this sign?

( ) Yes, it is……
( ) I don't know

6. In your opinion, what is the primary cause of traffic?

( ) Bad driving behaviors
( ) Carelessness of driver
( ) Too many cars on the road
( ) Weak law enforcement

7. Do you think bad traffic manners contributes to the traffic?

( ) Yes, because……...
( ) No, because……

Methods for Regaining Students' Attention

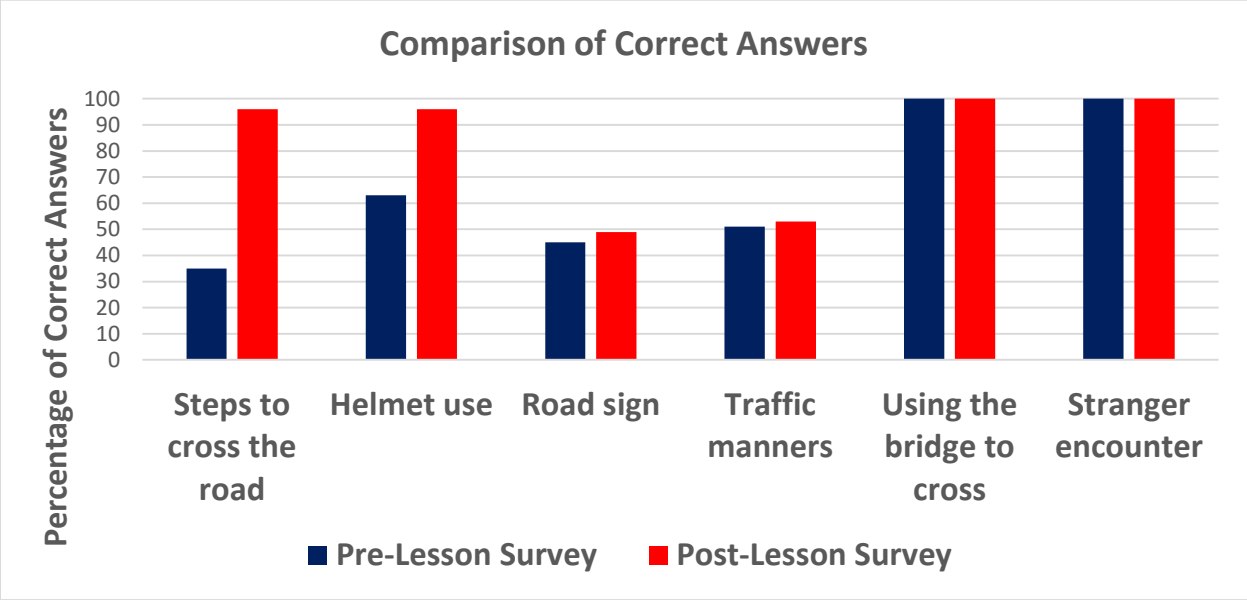
The following are a set of simple methods that can be used to regain students' attention when the classroom gets noisy with distracted students (Edutopia Community, 2014).

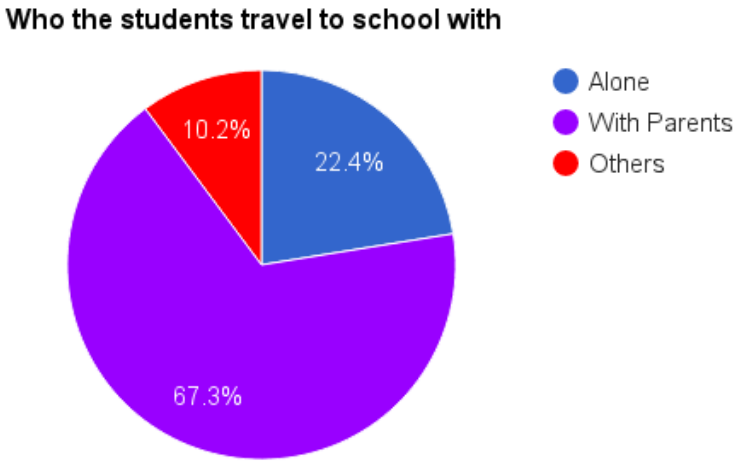
1. **If you're happy and you know it:** Sing "if you're happy and you know it clap your hands" followed by two claps; sing this a couple times until all the students are clapping their hands and have turned to face (you) the teacher
2. **Simon Says:** announce to the students "Simon says…" followed by (1) touch your shoulders (2) touch your ears (3) touch your mouth (4) touch head (5) now raise your hand! Numbers 1-4 can be said in different combinations. This method is good for regaining students' attention especially during interactive activities, where they raise their hands to answer questions.
3. **Use lights and music to signal one minute left in the activity:** play music signaling one minute left in the activity. With around 10 seconds left, go to the light switches of the classroom and flick them on and off rapidly, while counting down from 10 to 0. The students will likely focus their attention back on (you) the teacher.
4. **Indoor voices:** in the event that the classroom seems too noisy, announce to the students one of the following phrases (1) indoor voices! (2) quiet game starts...now! (3) whispers only
5. **SALAME:** before the lesson begins, introduce the acronym SALAME, which stands for Stop and Look at ME. Convey to the students that when (you) the teacher announces "SALAME!" they need to stop and look at (you) the teacher.

Appendix F: Pre-Lesson and Post-Lesson Survey Results from Testing the Lesson at Na Luang School

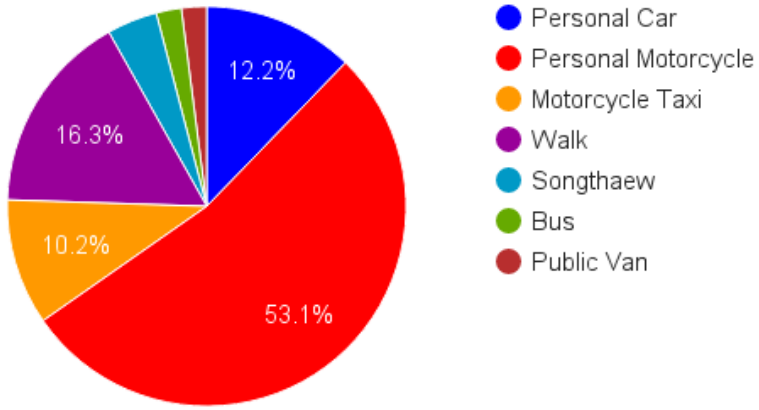
In order to assess the success of the program a pre-lesson and post-lesson survey was distributed to the students. The pre-lesson and post-lesson survey included questions about traffic awareness and safety and general safety. The pre-lesson also included questions on the student's primary mode of transportation and who, if anyone, takes them to school. The data being compared is the six questions on the pre-lesson and post-lesson survey that are about traffic awareness and safety, and general safety.

Below are the graphs of: The pre-lesson and post-lesson survey answer comparisons, who the students travel to school with , how students commute to and from school.

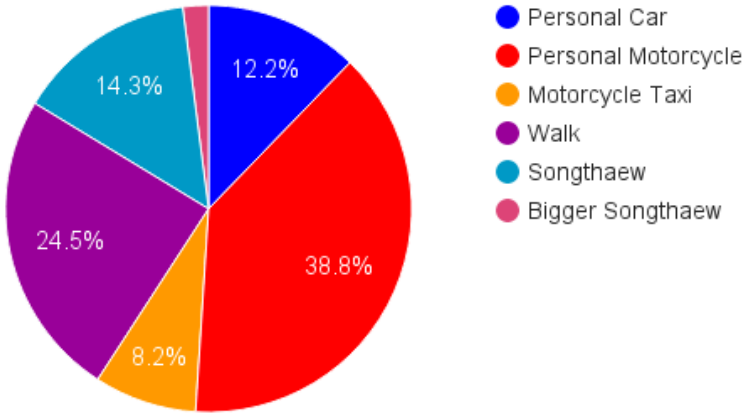




Modes of Travel to School



Modes of Travel from School



Appendix G: PCU Conversion Calculations

Passenger Car Units (PCU) are a common statistic used by civil engineers to calculate traffic flow rates and volumes. A PCU is calculated by taking the count of various types of vehicles and multiplying the count by their respective Passenger Car Equivalency ratio (listed in the table below). For example, a count of 100 motorcycles results in the total motorcycle contribution of 75 PCU.

Vehicle Type	Passenger Car Equivalency
Bicycle	**0.50**
Motorcycle or scooter (2 wheeled vehicle)	**0.75**
Passenger car, pickup van	**1.00**
Auto-rickshaw (3 wheeled vehicle)	**2.00**
Agricultural tractor, light commercial vehicle	**2.00**
Truck, bus	**3.70**
Truck-trailer	**5.00**
Hand cart	**3.00**

Source: (Sikdar, 1998)