Evaluation of Road Traffic Injuries and Deaths of Children around the Primary School in Thailand

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Abstract: The objectives of this study are to examine the statistics of child accidents in kindergarten and primary school students, as well as the statistics of accidents that occurred while picking up and dropping off students both at the provincial level and around rural kindergarten schools in Thailand. This study investigated road safety facilities around Anuban Schools. The results indicated that the child accidents were not caused by school safety facilities within 500-meter radius area around schools but were caused by urban density.

Keywords: Road Traffic Injuries and Deaths, Safety, Primary School, Children

1. INTRODUCTION

1.1 Aim and Objectives

The development of transportation systems in Thailand to support the expansion of cities and travel comfort has resulted in an increase in private cars and motorcycles, causing traffic problems, energy wastage, and increased levels of accidents. The World Health Organization has predicted that there will be over 3,000 road fatalities daily (from 2002 – 2020), with high-income countries having a 30% reduction in traffic fatalities. On the other hand, low to medium income countries will have an increase in road accidents. Furthermore, the WHO has also summarized five 'Behavioural Risk Factors 2001-2014' which are (1) speed, (2) drunk-driving, (3) helmets, (4) seat belts, and (5) child restraints. Moreover, the three of these factors (wearing a helmet, law that requires the use of a seat belt, restraint for a child passenger and related laws) all have direct results in the safety of children worldwide and show the seriousness given to world population (WHO, 2015).

Table 1. Thailand law enforcement of road safety

Country	Speed limits are set at a national level	Speed limits are modifiable at a local level	Maximum speed			Effectiveness of overall enforcement (respondent consensus) (scale 0-10)
			On urban roads (km/h)	On rural roads (km/h)	On motorways (km/h)	
Thailand	Yes	No	80	90	120	3

Table 2. Thailand child restraint law

Country	Restrictions on children sitting in front seat	Child restraint law based on	Enforcement	% children using child restraint
Thailand	No	No	-	-

The child safety in Thailand is no national child restraint law and lower standard. The child accident records are not being centrally kept but scattered between various organizations such as the Royal Thai Police, the Ministry of Transport, and the Transport Company Ltd. Furthermore, there is no precise inspection of the environment around the schools such as school gates, sidewalks, parents' parking spots, crosswalks, signs, and traffic signs that contribute to child accidents.

Child restraint laws

Law requires child restraints based on age/weight/height and restricts children from sitting in front seats

Law requires child restraints based on age/weight/height or child restrict law combined with restrictions on children sitting in front seats

No child restraint law/Child restraint law not based on age/weight/height and no restrictions on front seats
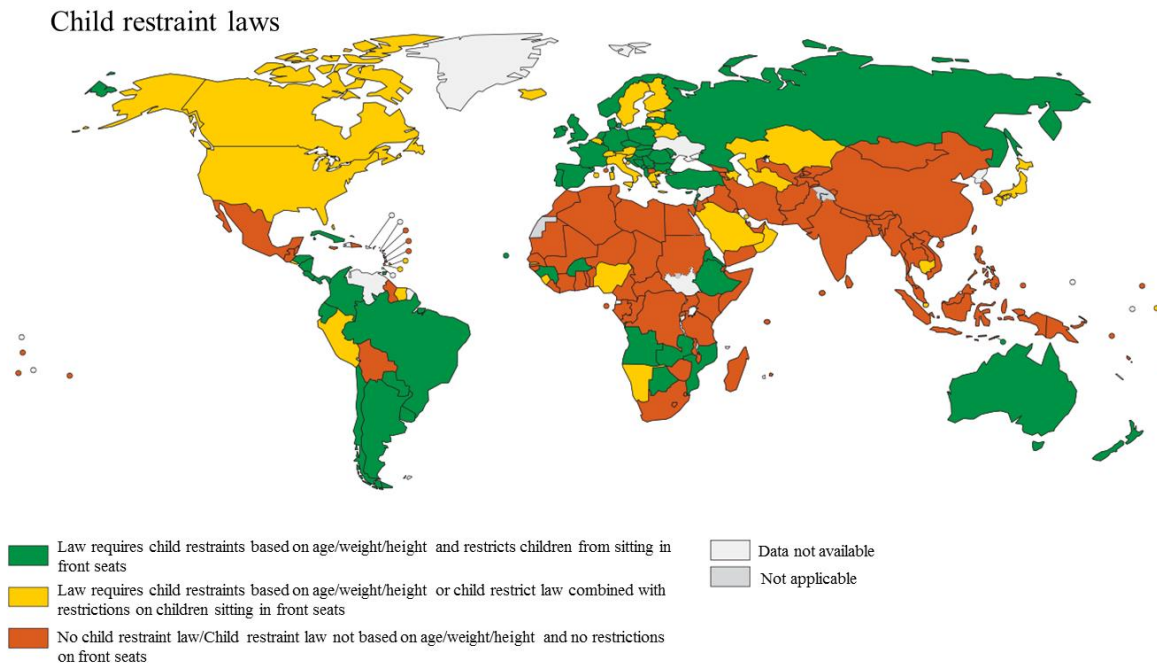
Data not available

Not applicable

Figure 1. Global child restraint laws (WHO., 2015)

The Road Safety Culture is private organizations which deal with road accident reports 24 hours and keep a detailed report. It combined with Google Maps and Google Street View. The research objectives: (1) study the statistics of accidents in kindergarten and primary school students (age 4-12 years) and the statistics while picking up and dropping off students (6.00-10.00 and 14.00-18.00) in Thailand; (2) study the environment around primary schools in terms of road safety facilities by targeting provincial kindergarten schools; and (3) study the factors responsible for road accidents with children. Furthermore, the research represents: (1) introduction (1.1) aim and objectives (1.2) traffic accident in Thailand (1.3) child safety (1.4) travel behavior and school environment (1.5) kindergarten (1.6) literature review (2) research methodology (2.1) data collection (2.2) populations and samples (2.3) software (3) results (3.1) population density and accidents in Thailand (3.2) accidents with children in Thailand (3.3) accidents while picking up and dropping off students (3.4) environment around Anuban schools in Thailand (3.5) accident factors (4) discussion and conclusion and (5) recommendations for future research.

1.2 Traffic Accident in Thailand

The Office of Transport and Traffic Policy and Planning (2015) reported that the numbers of road accidents in Thailand from 2009 to 2014 have decreased. There were 84,806 accidents in 2009 and 62,769 accidents in 2014, while the accident rate stayed the same from 2011 to 2014. The top three vehicle types involved in accidents are (1) motorcycles at 35.68%, (2) private cars at 30.68%, and (3) small trucks (pick-up trucks) at 16.96% (Royal Thai Police).
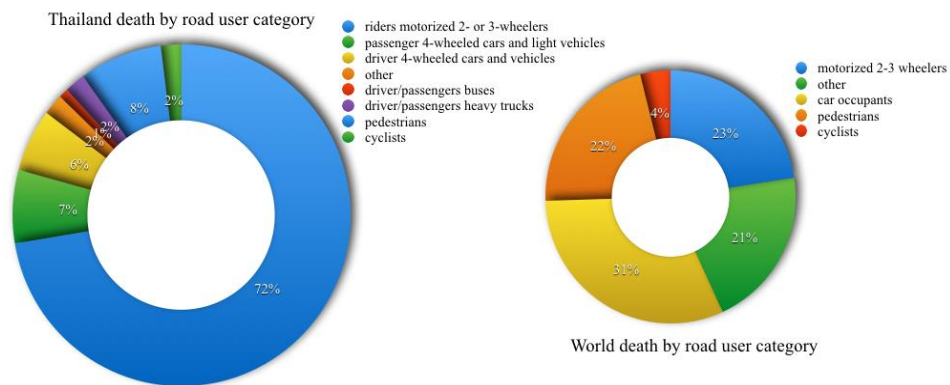
Figure 2. Traffic death in Thailand and The world (WHO, 2015)

The trend of accidents in Thailand varied according to the economy and city development. This can be divided into five periods as follows: (1) The economic recession period (1984-1986), with a steady average of accidents at around 19,000 accidents nation-wide per year, with 5 fatalities and 17 injuries per 100,000 population; (2) The economic recovery period (1987-1992), the accident rate nearly tripled when compared to the same period before; (3) The bubble economy period (1993-1996), was the worst traffic safety situation due to higher rates of registered vehicles, which doubled the number of accidents compared to the previous period; (4) The economic crisis period (1997-2000), the economic crisis of 'Tom-Yam-Kung Disease' was a positive sign in the road accidents in Thailand, with a reduction of 70,000 cases per year. On the other hand, the danger of injuries increased by 85.5 people per 100,000; and (5) The re-recovery era (2001 onwards), an economic recovery by a domestic economic stimulation policy and the first car policy resulting in an increase in new vehicles registered, causing more traffic accidents (Tanaboriboon and Satiennam, 2005).
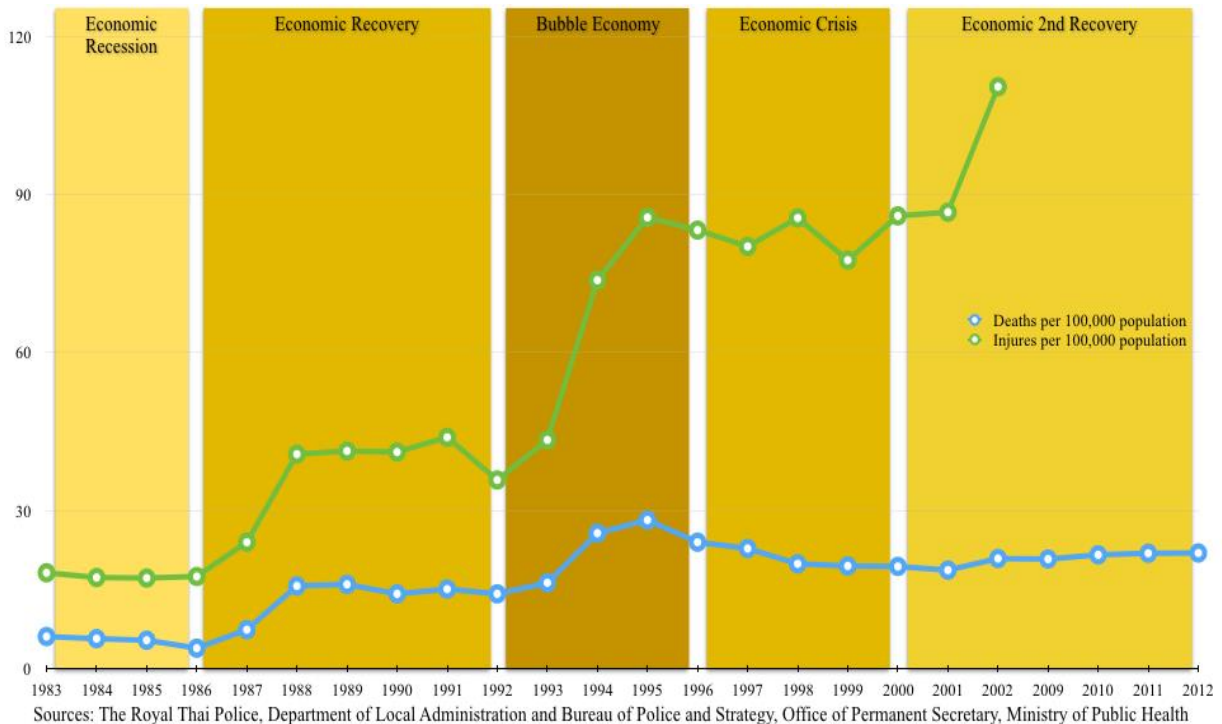

Sources: The Royal Thai Police, Department of Local Administration and Bureau of Police and Strategy, Office of Permanent Secretary, Ministry of Public Health

Figure 3. Road traffic accidents in Thailand

1.3 Children Safety

Safety means "freedom from danger and risks" is also a second-tier need in Maslow's Pyramid of Needs (Maslow *et al,* 1945). A child will develop a sense of safety and by learning from the parents, family and environment that will develop in the first period of life due to the perception of danger from a child's environment. Those with a high degree of feeling safe will be those who received warmth and are friendly towards others. In contrast, those with a low degree of feeling safe will reject love, treat others coldly, alienate from others, boycott, feel lonely, and perceive life under danger and threats ((Bowlby, 1988) and (Erikson, 1968)).

Several studies abroad focused on the parents' perception of their child in various aspects, such as walking, cycling, and using public transport from home to public areas (Carver *et al,* 2005). Additionally, several transportation engineering reports show that mixed usage of land, walking and cycling facilities and walking-friendly areas within a 20-minute radius of travel time decreased the level of worry about children's safety. Furthermore, studies also found that children and parents are traveling and using bicycles more in areas that have appropriate improvements in road safety facilities (Kerr, 2006).

Road safety in terms of walking and cycling on the road or the sidewalk depends on several factors such as traffic volume, route safety, age range of children who become more self-dependent as they grow older, road safety and driving speed, road width, and the perception of parents' on the safety of each route (Merom *et al,* 2006). A Californian study about environmental improvements for walking, sidewalks and traffic control found that children are significantly more likely to feel confident when walking to school (Boarnet *et al*, 2005).

1.4 Travel Behavior and School Environment

Most children in Thailand are required to attend kindergarten at the age of 4 and then proceed on to primary school until graduation at the age of 12 (Ministry of Education, 2003), forcing children to travel from their home to school, depending on what their family can provide. They may be accompanied by parents, guardians, relatives or travel by school buses. The environment for their daily lives can be home, school, and the route between their home and school. Accidents within the environment both inside and outside the school, danger from strangers, or getting lost all caused the parents to be worried (Carver *et al*, 2008).

There are four important variables that affect travel behavior, which are (1) Socio-economic attributes and different family cultures, both within the family and the culture in general; (2) Individual attitudes; (3) Lifestyle; and (4) Built environment ((McLaren and Hawe, 2005) and (Ghasrodashti and Ardeshiri, 2015)). These are related to the attributes that affect safety, which are obstacles and behavioral reasons in the traveling of parents and children (Panter *et al,* 2008). The main elements for this are: (1) personal and road safety; (2) social interactions between students, teachers, and parents; (3) facilities to assist active travel; (4) urban form and street design; (5) general aesthetics; and (6) weather. Moreover, the environmental improvements tend to significantly increase the confidence of the parents and children traveling to school (Boarnet *et al*, 2005). Finally, a study of environment, behavior, and the sociocultural aspect are related (Moor, 2003).

Further, the office of transport and traffic policy and planning detailed recommendations in three aspects: (1) unsystematic data management about children; (2) reduction in the severity of accidents; and (3) reduction in accidents, including the factors regarding passengers, drivers, and vehicles. One of the variables recommended is a poor intersection with no traffic lights or safety facilities. The report recommended improving risky spots,

inspecting the conditions of signs and traffic lights, installing speed limit signs, warning signs, improving road surface and sidewalks, installing street lights and blinking traffic lights, and finally adding safety measures in the front area of the school and other government places.

Furthermore, a manual on using traffic control equipment on crosswalks in city areas, school areas and academic institutions explained in detail the traffic signs, pavement markings, traffic signals, as well as other related equipment such as road lightings (Department of Highways, 2011).

1.5 Kindergarten School

Regions in Thailand are divided into Education Service Areas which are managed by The Office of the Basic Education Commission. A kindergarten (Anuban School) is a primary school for both kindergarten and primary schools. It is a large school which is responsible for basic education from primary school was selected to be a provincial school for each area. Anuban school are managed as an association in the form of Provincial Anuban Association. This study has specifically chosen only provincial Anuban schools, totaling 65 schools in 65 provinces for the following three reasons: (1) they are large provincial schools in a city area, with large traffic volume; (2) they are public compulsory education schools with an educational standard, similar numbers of students and family financial status, as well as being representatives for their province; and (3) they offer both kindergarten and primary school education in the same school.

1.6 Literature review

Based on detailed literature review and past studies, the scope and framework of this study can be summarized as follows: (1) road accidents; (2) school environment; (3) children's travel behaviours; and (4) the safety of children as shown in the summary table.
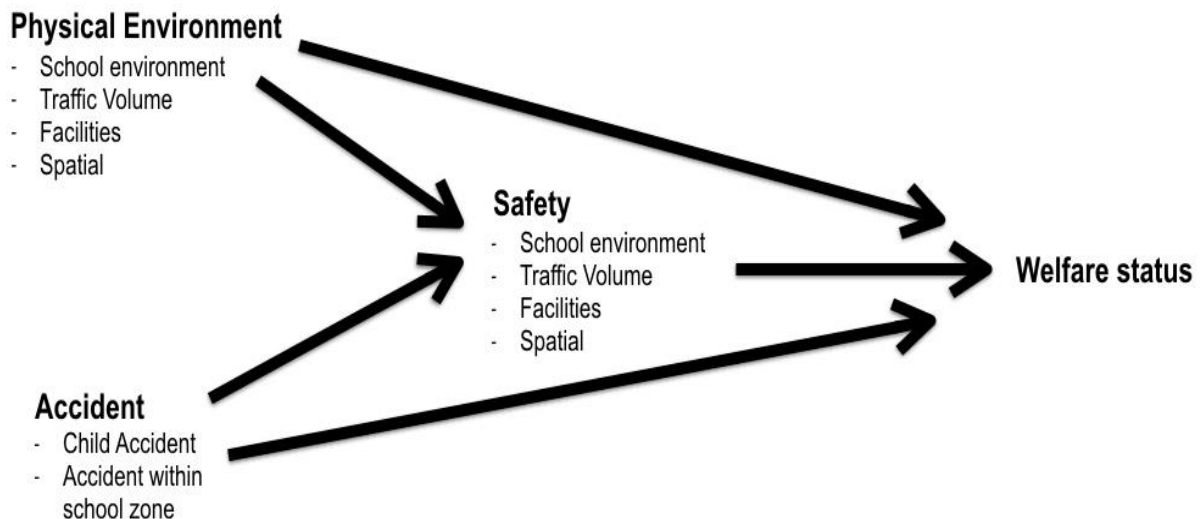

Figure 4. The relationship between variables in the study: adapted from (1) Ghasrodashti and Ardeshiri, 2015 (2) McLaren and Hawe, 2005 and (3) Nilsen, 2004.

Table 3. Summary of related research

Author	Year	Title	Physical Environment	Travel Behavior	Road accidents	Child safety
DeJoy	1992	An examination of gender differences in traffic accident risk perception	●	●	●	
Massie	1995	Traffic accident involvement rates by driver age and gender	●	●	●	●
Mayou	2000	Psychological debriefing for road traffic accident victims	●	●	●	
Moore	2004	Environment, behaviour and society: A brief look at the field and some current EBS research at the University of Sydney	●	●	●	●
McMillan	2007	The relative influence of urban form on a child's travel mode to school	●	●		●
McDonald	2011	Reliability and validity of the safe routes to school parent and student surveys		●	●	●
Hidayati	2012	The Impact of School Safety Zone and Roadside Activities on Speed Behaviour: the Indonesian Case	●	●	●	●
Kojima	2015	Smile and behavior: new evaluation method for pedestrian environment	●	●	●	

2. RESEACH METHODOLOGY

2.1 Data Collection

2.1.1 Documentary Research – This research employed a statistical model to collect child accident statistics. Based on accident databases of the Road Safety Culture (RVP) is private organizations and other government agencies for the past three years to investigate the overall statistics of accidents in the country, statistical data of accidents with children, statistical data of accidents while picking up and dropping off students, and the size of each province. Furthermore, to find the three-year average statistics of accidents, the 500-meter radius areas around the schools are investigated, which are the most likely areas for students to walk during pick up and drop off in the morning and evening. Data were sorted according to the age of the victims, from 4-12 years (not more than 15 years) and the number of accidents during pick up and drop off to rank schools according to accidents with children during those periods in each region of Thailand.

The data collection method consisted of 3 steps as follow. (1) Access the website of Road Safety Culture or RVP which is a private organization and select statistical data and spatial accident locations on a map. The results were displayed according to years and provinces where accidents occurred and radius (http://www.thairsc.com/shape). (2) Select year, province and radius to be displayed a location of an accident on the map. After that,

identify a coordinate on the map so that its location and frequency (time) of accidents could be displayed (kindergarten schools in 64 provinces within the radius of 500 meters). (3) Collect only statistics on accidents occurring with children and accidents occurring during children's pick-up and drop-off time. Population statistics, the number of registered cars and motorbikes, provincial accident statistics and statistics on accident occurring with the kids in each province were collected from the same source (http://rvpreport.rvpeservice.com). The statistics could be displayed as follows.
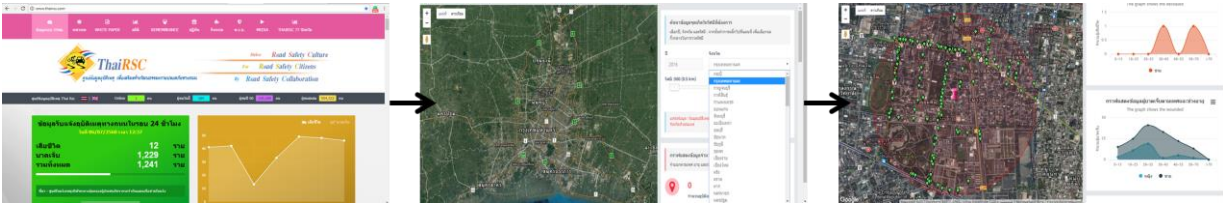
Figure 5. Data collection of child accident statistics.

2.1.2 Survey –The 500-meter radius area around the schools by considering the availability of safety facilities on roads and walkways, traffic control equipment around crosswalks, overpasses, traffic signals, signs, symbols, parking space for picking up and dropping off students, as well as the condition of walkways and their obstacles.
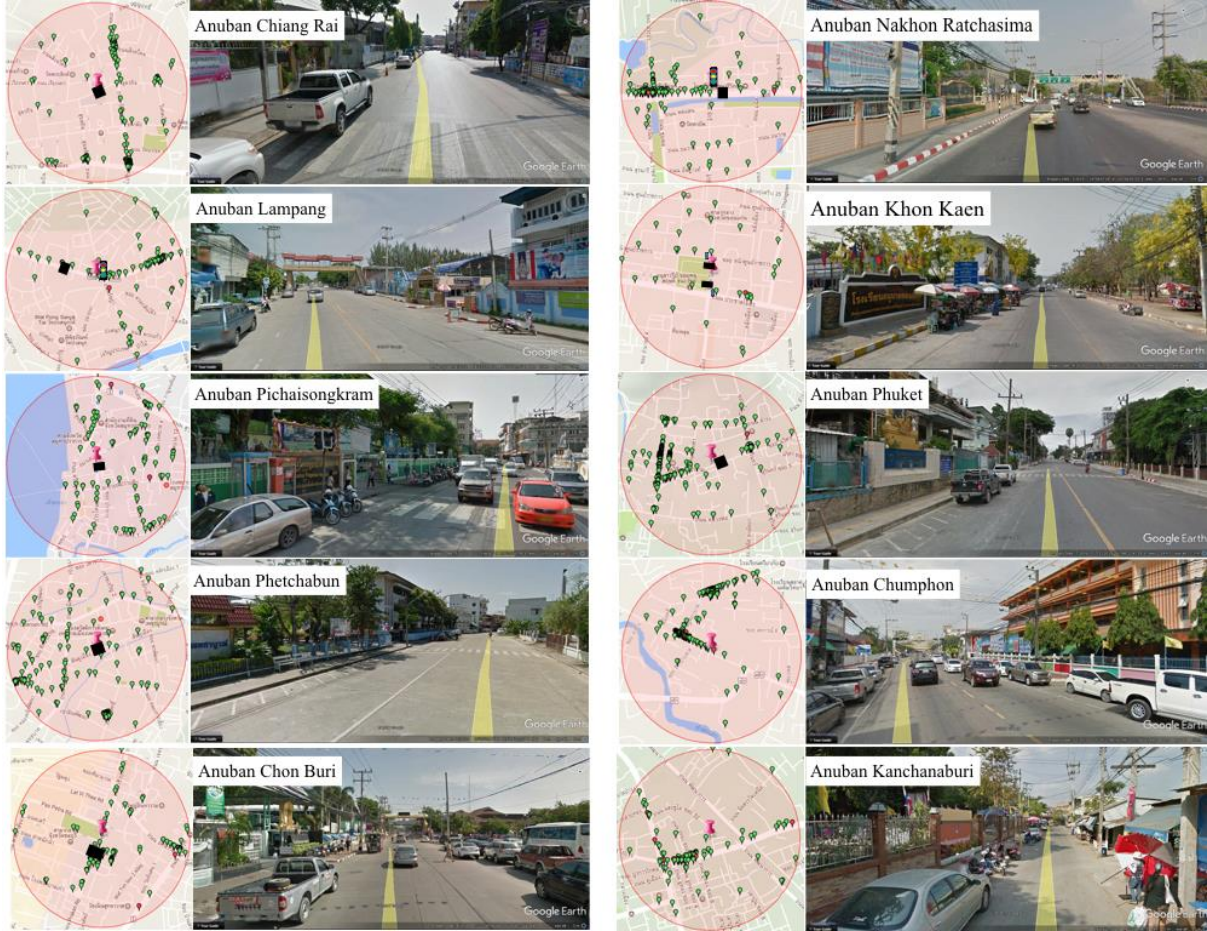

Figure 6. A physical survey of Anuban schools.

Physical surveys of 65 kindergarten schools in Thailand were carried out through Google Earth Pro. The three steps of surveys included: (1) access Google Earth Pro version 7.1.1.2 606 and select Thailand; (2) search for provinces and kindergarten schools; and (3) use Google Street View to explore physical geography around the schools.

Figure 7. A physical survey of Anuban schools.

2.2 Populations and Samples

Populations in this study included 65 Anuban schools nationwide under The Office of the Basic Education Commission; 8 schools are in the northern region, 18 schools are in the central region, 14 schools are in the northeastern region, 7 schools are in the eastern region, 5 schools are in the western region, and 13 schools are in the south of Thailand.

2.3 Software

2.3.1 Map Online Services – The collection of accident statistics was done through an online map (www.thairsc.com/shape) which is updated every day (3 February 2017). This is a tool for measuring the 500-meter radius area around the schools to collect statistics of children fatalities and injuries during pick up and drop off, using the following methods: (1) look for accident sites based on year, province and radius; (2) look for provincial Anuban schools in that province and select a 500-meter radius area; (3) sort the accident data within the radius by selecting only those involving children and while picking up and dropping off students.

2.3.2 Google Earth Pro – Collect data by surveying the environment around the schools and road safety facilities using Google Earth Pro version 7.1.1.2 606 which includes images of over 90% of roads and alleys around the schools by: (1) looking for the location of each provincial Anuban school; (2) studying the area around the school, including entrances, exits, and building planning; (3) using the ruler tool to measure the width and length of the roads and walkways and identify the location of crossways; and (4) using the Street View function to survey the environment around the school for road safety facilities and identify their number and location.

2.3.3 QGIS – Collect A freeware geographical map, QGIS, is used to analyze and show collected statistics in an easy to understand infographic map.

3. RESEARCH RESULTS

3.1 Population density and accidents in Thailand

Thailand consists of 77 provinces, divided into 6 regions. Population was an average of

780,625.89 people, with registered cars and motorcycles averaging 109,038.98 and 210,049.75, respectively. The average area is 6,751.38 square kilometres and population density is 203.16 people per square kilometer. Moreover, the accident statistics for the past three years averaged at 3,802.99 cases per year. Figures 6-7 show the numbers of population, registered cars and motorcycles, as well as population density for each province in various regions of Thailand.

Chiang Mai, Chiang Rai, and Lampang are the three most populous provinces in the northern region which correspond to their being the top three provinces with the most registered vehicles. However, Chiang Rai has less area than Chiang Mai and Lampang, causing it to have the highest population density per area.
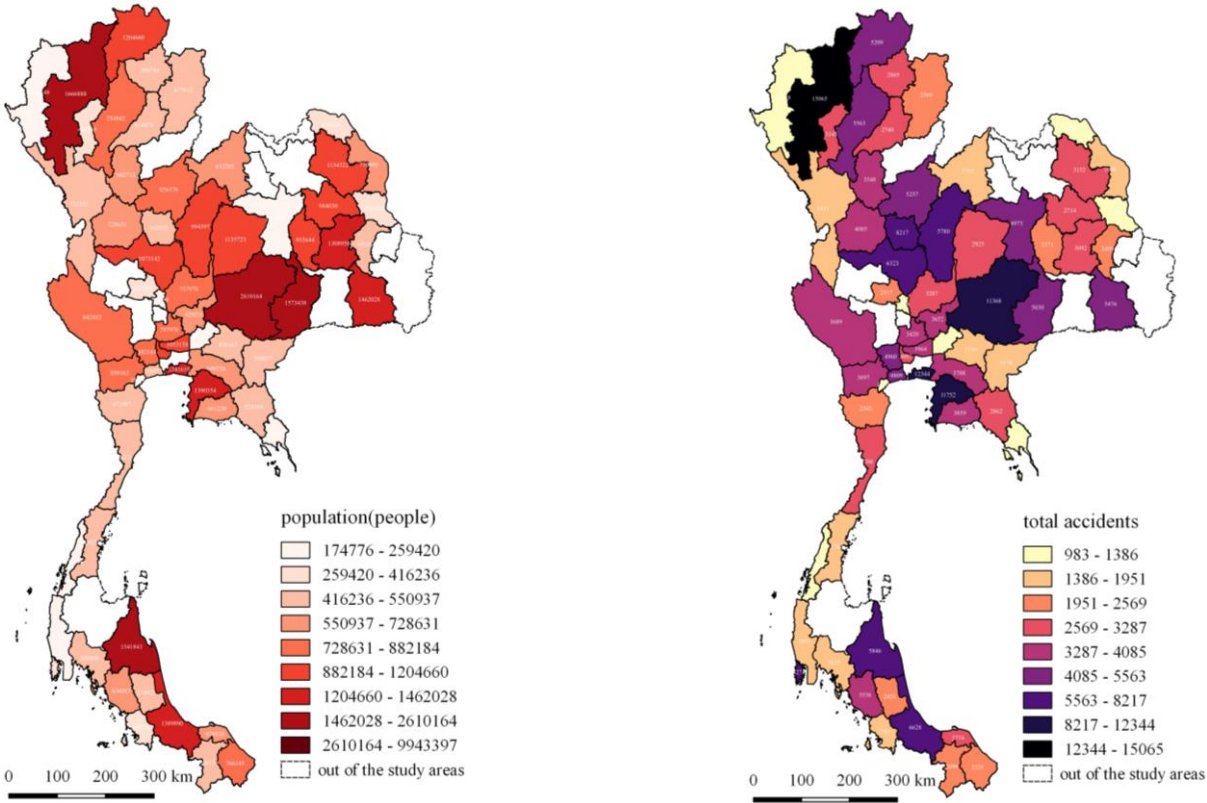

Figure 8. Thailand population and total accidents in Thailand.

The three most populous provinces in the central region are Samut Prakan, Nonthaburi, and Nakhon Sawan, with Nonthaburi being the most populous province and Nakhon Sawan being the province with the highest number of registered cars and motorcycles. Additionally, Nakhon Ratchasima, Khon Kaen, and Buriram are the three most populous in the northern region. Moreover, Chonburi is the most populous province in the western region. Meanwhile, the southern area, the three most populous provinces are Nakhon Si Thammarat, Songkhla, and Narathiwat. However, when considering the number of registered cars and motorcycles, Phuket is also another province with a very high number of registered vehicles while being a small province. Therefore, Phuket is the highest population density per area, leading to an increased number of accidents. As a result, the population density, numbers of registered cars and motorcycles correspond to the numbers of the population.
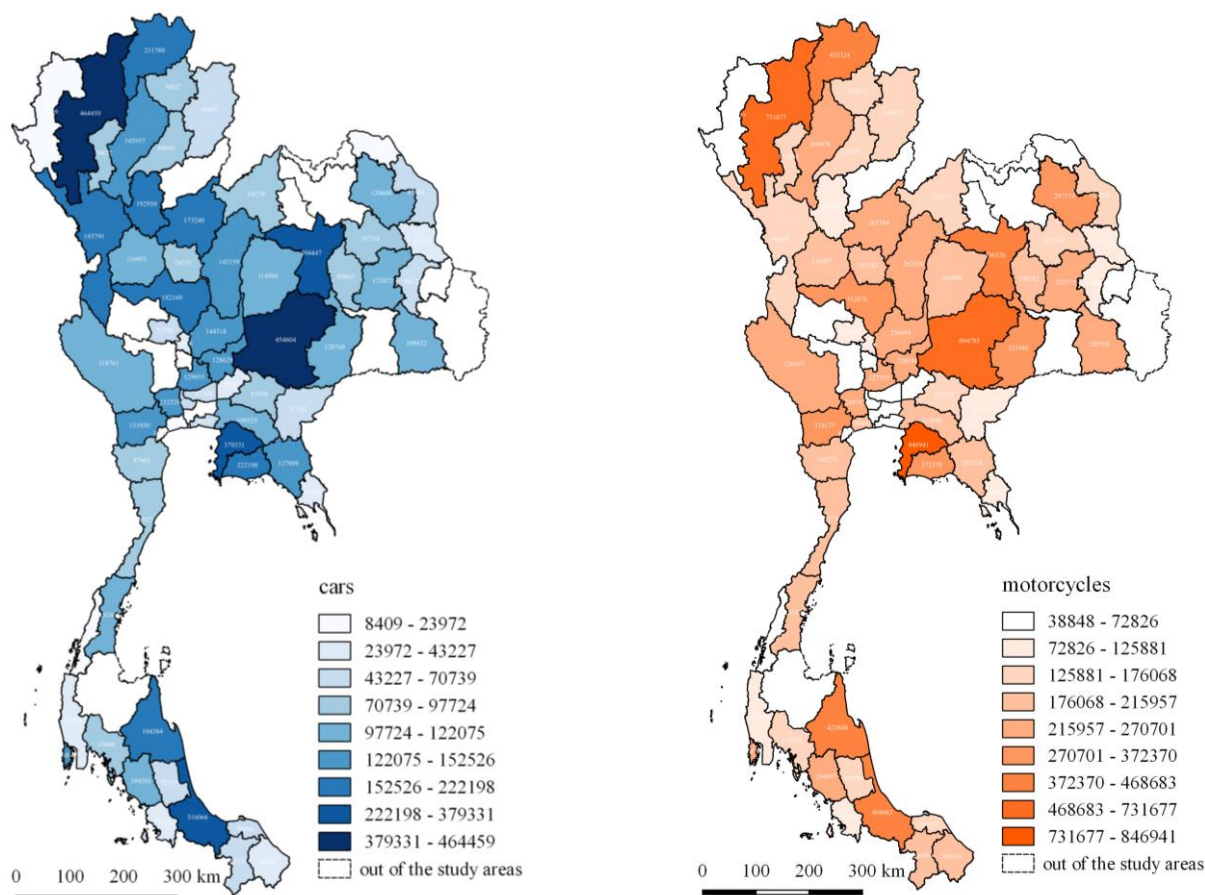
Figure 9. The numbers of vehicles and motorcycles in Thailand.

3.2 Accidents with children in Thailand

Study results on accident statistics with children are divided into two groups: accident statistics with the kids at the province level, including only those with provincial Anuban schools, with 65 provinces in total and accident statistics with children within a 500-meter radius area around the 65 schools. From the sample group, the average number of accidents for the past three years is 54.94 cases per year, which includes children deaths and injuries on an average of 10.4 cases that can be summarized by regions as follows: The top three provinces with the most three years average accidents with children in the northern region are Chiang Mai, Lampang, and Chiang Rai. Besides, the accident statistics around all three provincial Anuban schools, Anuban Chiang Rai School had the highest number of accidents, followed by Anuban Lampang School, and Anuban Chiang Mai School cause of Anuban Chiang Rai School and Anuban Lampang School are located in a high traffic volume area, greater than Anuban Chiang Mai School, which is located in the area of the Old City wall of Chiang Mai.

Therefore, Kamphaeng Phet, Nakhon Sawan, and Samut Prakan are the most accidents, while Pathum Thani and Nonthaburi have over half the number of child accidents more than those mentioned. Besides, there is no relation between the number of accidents within students in Kamphaeng Phet and the population number. One thing to note is that Kamphaeng Phet has the second highest number of registered of cars and motorcycles. Therefore, the number of vehicles had an effect on the number of accidents.
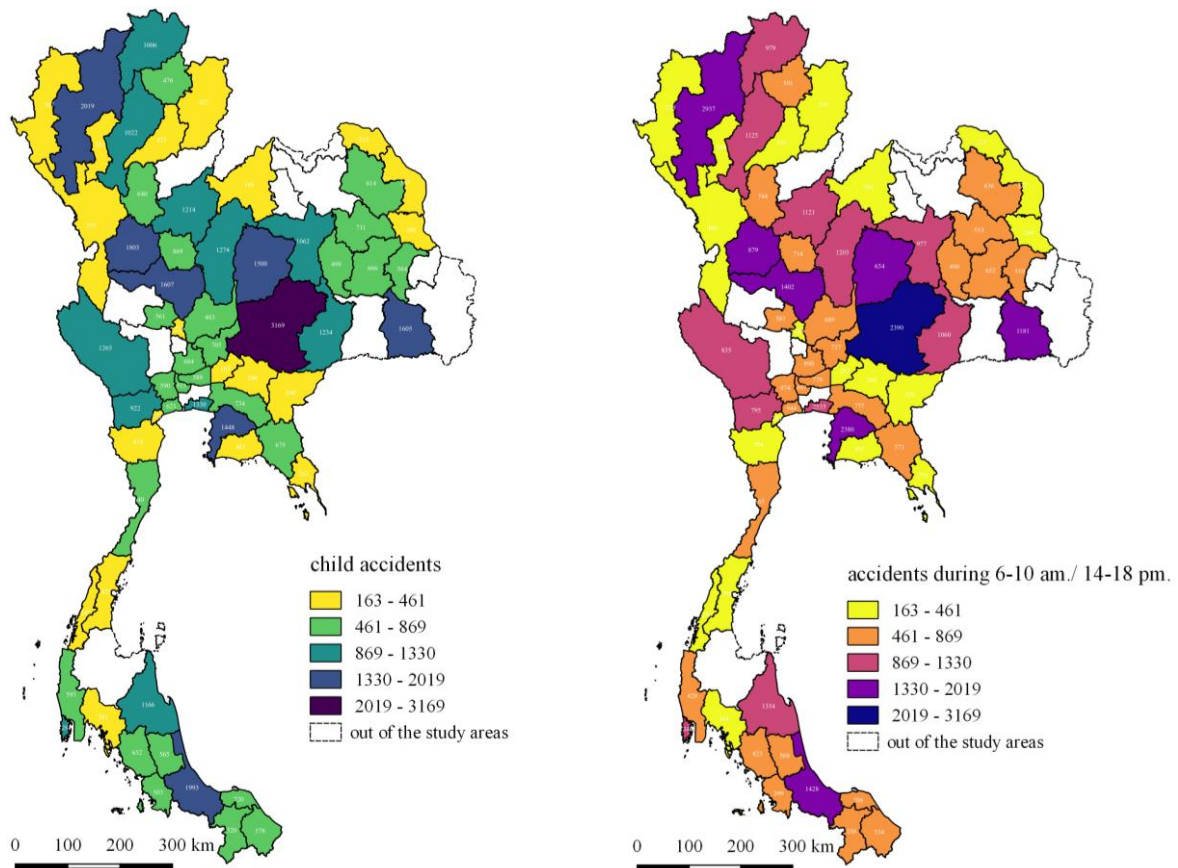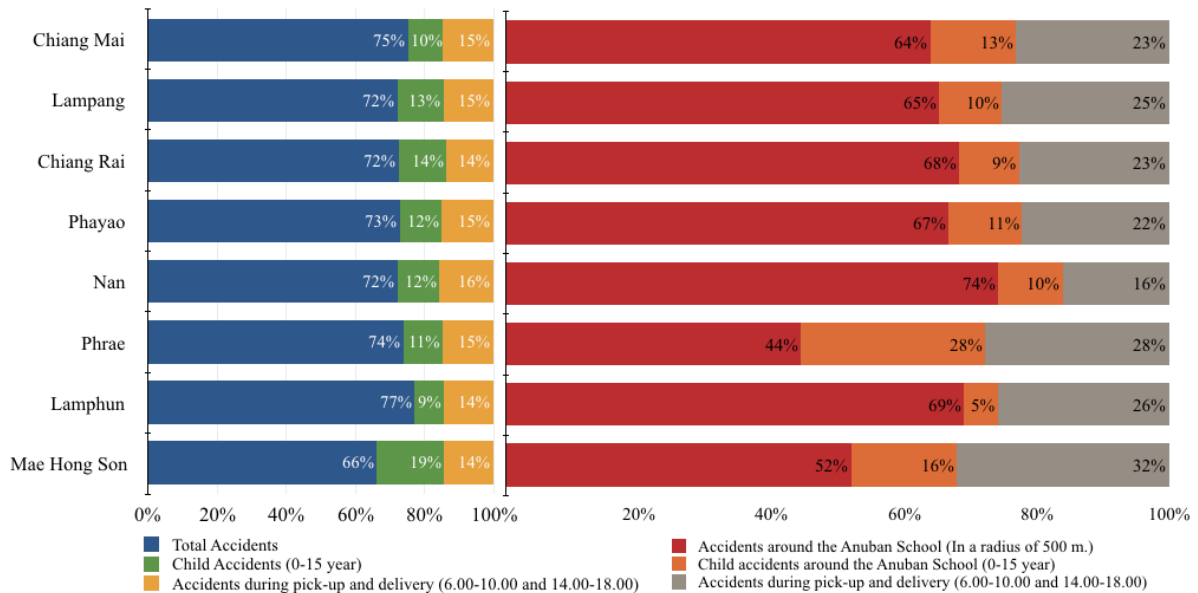
Figure 10. Child accidents in Thailand

Figure 11. Child accidents in the northern region school

Moreover, Anuban Phetchabun School, Anuban Samut Prakan School, and Anuban Samut Sakhon School have the highest numbers of accidents around the school respectively, while the top three schools with the most children deaths and injuries are Anuban Petchabun

School, Anuban Samut Sakhon School, and Anuban Saraburi School. However, Anuban Nakhon Sawan School had no accidents due to it not being located in a community area with high traffic volume like other mentioned schools. Also, top three of northeastern provinces with the most accidents with children are Nakhon Ratchasima, Sisaket, and Chaiyaphum, followed by Buriram and Khon Kaen with similar accident statistics. Moreover, Anuban Nakhon Ratchasima School, Anuban Khon Kaen School, and Anuban Sisaket School similarly have the top three highest numbers of accidents around the school area.
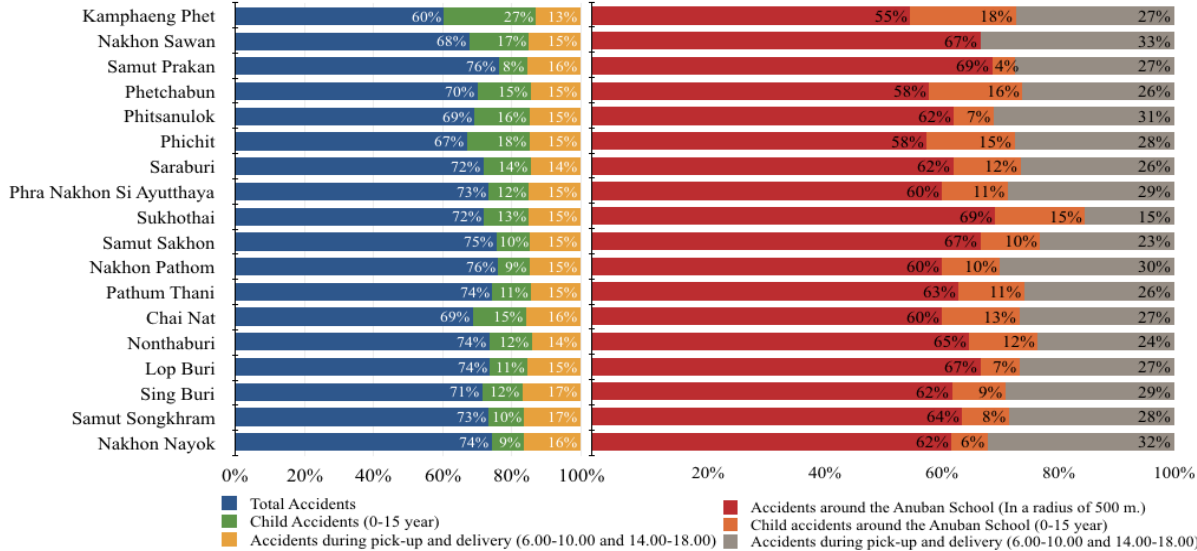

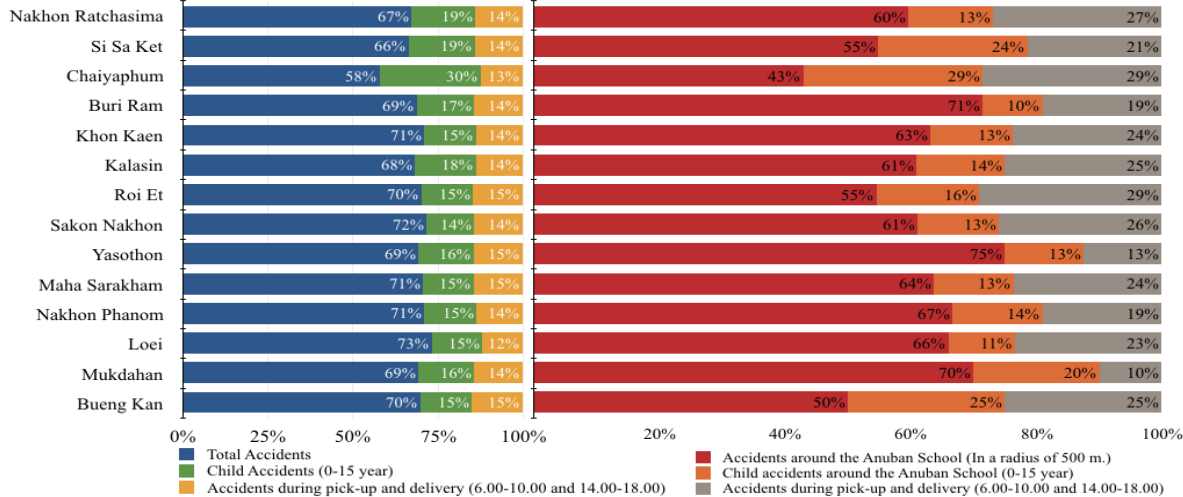Figure 12. Child accidents in the central region school

Figure 13. Child accident in the northeastern region school

Therefore, Chonburi and Kanchanaburi have the highest average numbers of accidents with children during the past three years in the eastern region and western region. Furthermore, they have child accidents exceeding 1,000 cases per year, which are higher than Khon Kaen or Phitsanulok. A notable thing is Anuban Chonburi School, Anuban Kanchanaburi, and Anuban Sa Kaeo have over 92 cases of accidents around the school area and 31 cases of child accidents cause located next to a main road with high traffic volume and

several U-turns. Finally, Songkhla, Phuket, and Nakhon Si Thammarat are the most accidents. Anuban Phuke School has a three-year average of 519 accidents, with 96 cases of children deaths and injuries. Also, this is followed by Anuban Chumphon School, with 242 cases involving 42 children cause located in the central community.
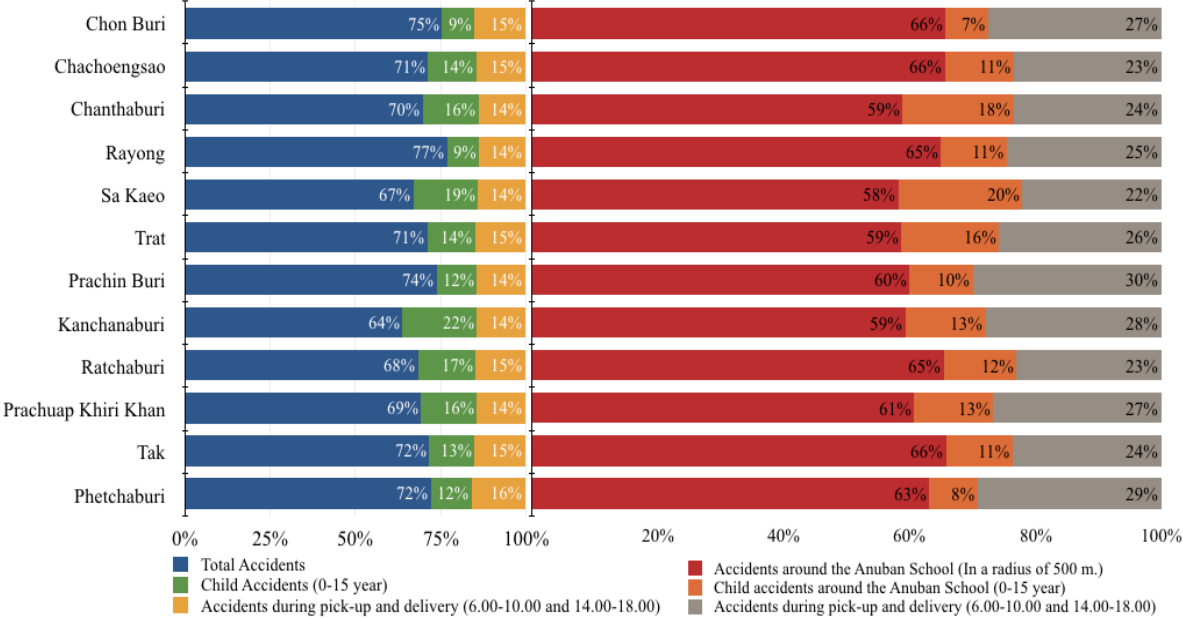
Figure 14. Child accidents in the eastern and western region school
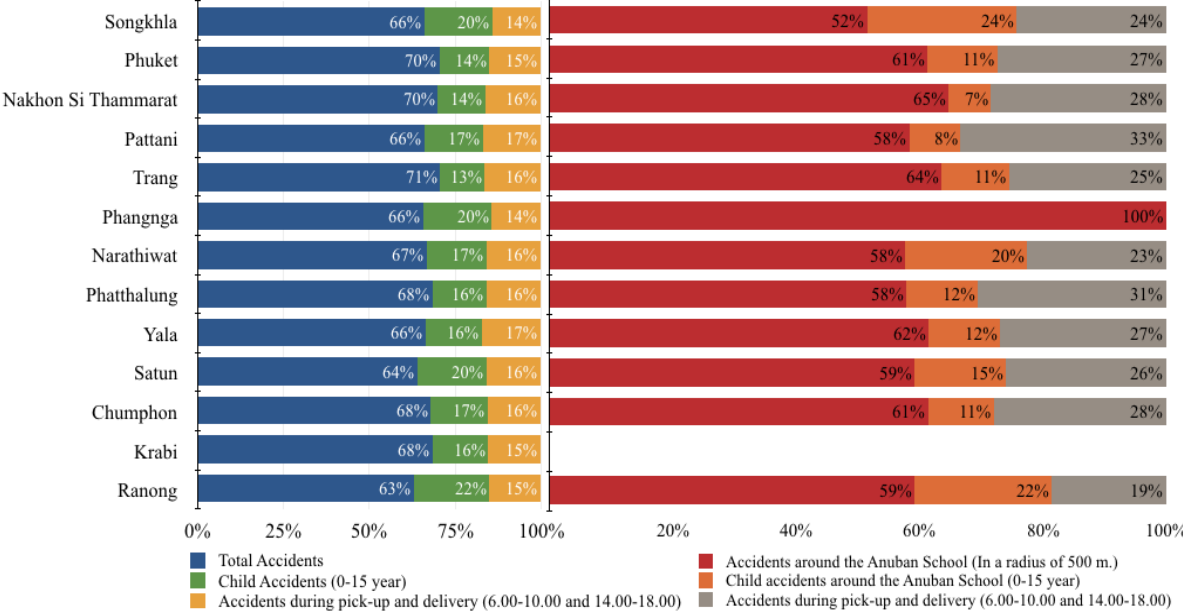

Figure 15. Child accidents in the southern region school

3.3 Accidents while picking up and dropping off students

The accidents while picking up and dropping off students averaged at 23.03 cases per year, divided into the region as follows: The most top three accidents were Anuban Chiang Rai School, Anuban Lampang School, and Anuban Chiang Mai School which matched the

number of child accidents. As a result, Anuban Phetchabun School, Anuban Wat Pichai Songkram School in Samut Prakan, and Anuban Samut Sakhon School are the top three schools in the central region. Moreover, the top three northeastern schools are Anuban Nakhon Ratchasima School, Anuban Khon Kaen School, and Anuban Sakon Nakhon School, which matched the number of accidents with children. In addition, Chonburi and Kanchanaburi have the highest number of accidents in the eastern and western regions. However, the number of accidents while picking up and dropping off students were greater than the child accidents and not related to children. Finally, the southern top three schools are Anuban Phuket School, Anuban Chumphon School, and Anuban Nakhon Ratchasima School matched the number of accidents involving students.

3.4 Environment around Anuban schools in Thailand

According to the physical environment surveys of the kindergarten schools through Google Earth Pro, there were three problems. (1) Pavements deterioration, signs and traffic lights. (2) The kindergartens were usually located near main roads or intersections prone to accidents and danger while walking. (3) Most schools lacked the traffic safety facilities. The results investigated the road safety facilities has concluded that the mainly of Anuban schools (74%) have one crosswalk or overpass and 25% have a combination of two or three crosswalks. Nevertheless, more than 25% have no crosswalks or overpasses in front of the school.
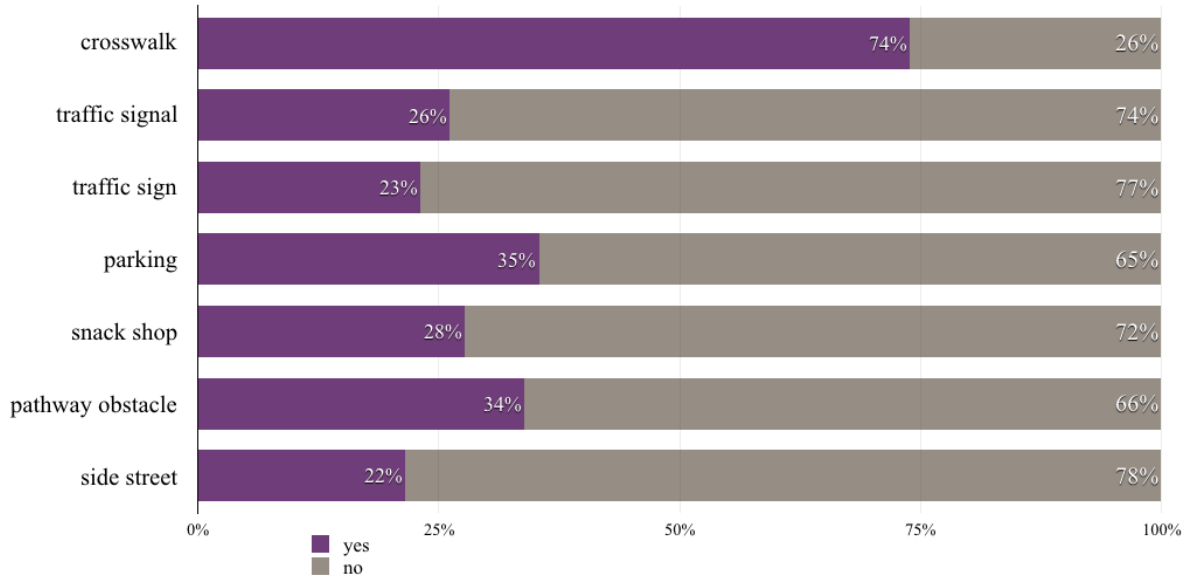

Figure 16. Summary of road safety facilities within school zone

Otherwise, a majority of schools (74%) have no traffic signals and 77% of them have no signs indicating a school zone, and no warning or speed limit signs. Certainly, the types of roads in front of the schools, a majority of schools (78%) are located next to the main road with most roads (40.6%) measuring 12 and 16 meters in width (Mean: 14.02 m.). Furthermore, the most walkways around the school areas (50.6%) measured 1-2 meters in width (Mean: 2.63 m.), with 34% having obstacles. Even though, most school parking spaces (65%) for parents or school buses are not allocated exclusively while the rest (35%) are allocated temporarily. Likewise, vendors are blocking the pathway on pedestrian, so students have to walk on the roads. In addition, traffic signs and pedestrian are damaged and no crosswalks are

provided (Bunnarong and Upala, 2017). There are snack shops around the school areas (28.1%) as shown in the table.

Table 4. Road safety facilities within 500-meters around the Anuban school

Anuban school	crosswalk	traffic signal	traffic sign	parking	snack shop	pathway Obstacles	Anuban school	crosswalk	traffic signal	traffic sign	parking	snack shop	pathway Obstacles
Chiang Mai	●				●	●	Sakon Nakhon	●	●				
Lampang	●	●	●	●			Yasothon	●			●	●	●
Chiang Rai	●		●	●		●	Maha Sarakham						
Phayao	●				●	●	Nakhon Phanom	●					
Nan	●		●				Loei						
Phrae	●			●			Mukdahan						
Lamphun	●		●				Bueng Kan						
Mae Hong Son	●		●				Chon Buri	●			●	●	●
Kamphaeng Phet				●	●	●	Pitulatiratcharangsarit	●				●	●
Nakhon Sawan	●						Chanthaburi	●					
Pichaisongkram	●				●	●	Rayong	●	●	●			
Phetchabun	●			●			Sa Kaeo	●					
Phitsanulok	●	●	●	●			Trat	●	●				●
Phichit	●	●	●		●	●	Prachin Buri				●		
Saraburi	●		●				Kanchanaburi				●	●	●
Ayutthaya							Ratchaburi	●	●		●	●	●
Sukhothai	●			●			Prachuap Khiri Khan	●	●	●	●		
Samut Sakhon	●						Tak		●				
Nakhon Pathom	●		●				Phetchaburi			●			●
Pathum Thani	●			●	●	●	Songkhla	●			●		
Chai Nat	●						Phuket	●					●
Nonthaburi				●		●	NakhonSiThammarat	●	●				
Lop Buri							Pattani	●			●		
Sing Buri							Trang						
Samut Songkhram	●	●	●				Phangnga					●	●
Nakhon Nayok	●		●				Narathiwat						
Nakhon Ratchasima	●	●	●			●	Phatthalung	●					
Si Sa Ket	●						Yala	●					
Chaiyaphum	●			●	●	●	Satun	●				●	
Buri Ram	●			●			Chumphon	●	●	●	●	●	●
Khon Kaen	●	●		●	●	●	Krabi						
Kalasin	●	●		●	●	●	Ranong	●	●	●	●	●	●
Roi Et	●	●											

3.5 Accident factors

According, the analysis of accident statistics both at the province level and area level; (1) the overall accidents, (2) child accidents, and (3) the accidents while picking up and dropping off are significantly related to statistical significance at < .01. Furthermore, the population, the numbers of registered cars and motorcycles affecting the three numbers of accidents with statistical significance at < .01. Moreover, the total child accidents within the 500-meters radius of schools and the number of accidents while picking up and dropping off students significantly affect each other at < .01. On the other hand, only obstacles blocking walkways

slightly affect the three statistics at .05. Finally, the results concluded that accident statistics are not directly related to the environment or road safety facilities around the schools. According to the physical environment surveys and safety facilities around the kindergarten schools, it was unclear that whether safety facilities around the schools would affect child safety and accidents occurring with children during pick-up and drop-off time.

4. DISCUSSION AND CONCLUSION

This study focused on accident statistics at the province level and accidents around Anuban schools, emphasizing accidents with children during pick up and drop off. The results concluded that, at the province level, overall accident statistics, accident statistics with children, and accident statistics while picking up and dropping off students are all caused by urban density, cars and motorcycles registered. However, at the Anuban school level, accidents within the 500-meter radius around the schools depend on the location of each school, the traffic volume and the size of the community. A comparative study of accident statistics of 500-meters around the kindergarten compared to other urban accident statistics. The incidents around the school often occur with children (0-15 years and 16-25 years), while urban area accidents happen with many age ranges. It is clear that the area surrounding the school is a risk area for accidents with children.
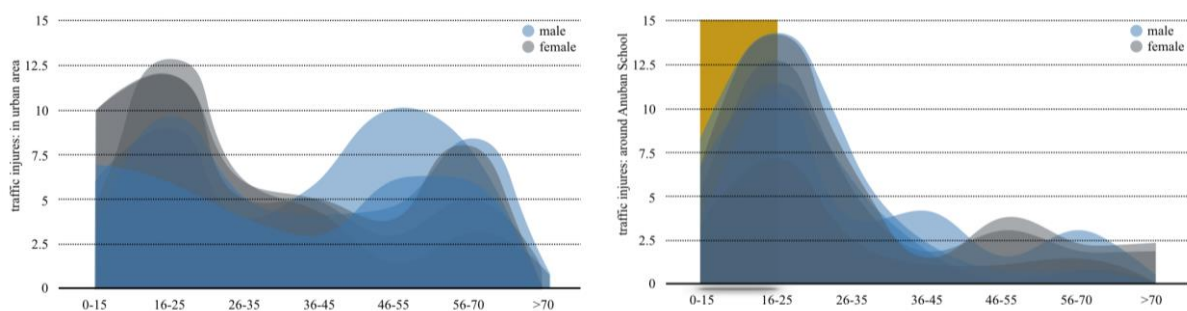

Figure 17. A Comparative graph of accidents between urban areas
and surrounding areas of kindergarten.

Furthermore, the accidents are mainly caused by road usage behaviors and school management such as assigning teachers and traffic police greatly help to improve the safety of children. Finally, the other research reported the top five factors that help with the safety of children are: (1) traffic management around the school to ensure safety and give importance to walking and bicycle use; (2) improving the internal environment of the school to provide security; (3) improving student pickup-delivery locations (4) training teachers, parents, and students about safety; and (5) organizing snack shops and walkways (Sattanon and Upara, 2017).

5. RECOMMENDATIONS FOR FUTURE RESEARCH

This study is a part of research on the environment of kindergarten schools in Thailand to improve child safety. The researcher aimed to show the number of accidents occurring around kindergarten schools, to identify whether the number of accidents was different among areas and to find how the number of accidents was different. In addition, the researcher investigated physical features of kindergarten schools. However, the researcher did not include behavioural

studies in the study. Future studies can be studies about parents' traffic behaviour, accident-prone areas during pick-up and drop-off time, parental anxiety about child safety in the school zone to provide well-rounded knowledge.

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