

2010-03-04

# Designing Safe Playgrounds for the Klong Toey Community

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# DESIGNING SAFE PLAYGROUNDS FOR THE KLONG TOEY COMMUNITY

*AN INTERACTIVE QUALIFYING PROJECT/SCIENCE & SOCIAL PROJECT REPORT*

*WORCESTER POLYTECHNIC INSTITUTE*

*CHULALONGKORN UNIVERSITY*

*SPONSORED BY:*

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## Abstract

Children who grow up in slums face a variety of challenges such as eviction, drug abuse, and limited education and employment opportunities that hinder their mental, physical, creative, and social development. The Duang Prateep Foundation, our project sponsor, works to alleviate the immediate suffering of the children in the Klong Toey slum in Bangkok. The goal of our project was to design safe playground equipment that addresses these developmental needs. Our equipment designs accomplished this goal, while providing additional benefits to the surrounding communities.

## Acknowledgements

We would like to extend our heartfelt thanks to the many individuals who contributed to this project. Over the past four months, our success depended upon the help and support of those people, and so we would like to take the time to thank them.

First, we would like to thank our contacts with the sponsor, Director and Founder Prateep Ungsongtham Hata and Dr. Nom Mano, for arranging and supervising our project. Thanks should also go to the Duang Prateep Foundation and the many employees who helped us along the way. We would like to thank the group of firefighters who volunteered to construct the playground equipment, especially Khun Dumrong for putting in extraordinary effort, taking the time to assist us, and being a great friend.

We owe our thanks also to Khun Vichian and other members of the Klong Toey community, especially those in the Lock 23-24 communities. Their experience, knowledge, and input were crucial and a great help at all times.

Finally, we owe our thanks to our Worcester Polytechnic Institute and Chulalongkorn University Advisors: Professor Brigitte Servatius, Professor Tom Robertson, and Professor Supawan Tantayanon for their guidance for the entire project. Their comments and feedback ensured our continuing success throughout our project. We would also like to acknowledge the input and contributions of Professor Rick Vaz, Professor Chrysanthé Demetry, and Professor Dominic Golding, who supplied us with a vast amount of resources, information, and ideas for the project.

## Executive Summary

As the rate of worldwide urbanization increases, the percent of the population living in urban slums increases likewise. Worldwide, over one billion people live in slums; 16% of Bangkok’s population lives in slums. Extensive research has shown that poverty and slum life have many adverse effects on children in particular, including developmental and health problems. One of the largest slums in Bangkok, Klong Toey, is not immune from these troubles. More than 80,000 residents live in this slum; some families have lived there for generations because of inadequate opportunities or resources to relocate. This shows that children born into this “cycle of poverty” have fewer opportunities to break away from their current living situations.

Non-profit organizations such as the Duang Prateep Foundation (DPF) are working to alleviate the immediate suffering of Klong Toey residents and impoverished children especially. Studies show that play has profound developmental benefits for children, and the DPF believes that playgrounds, in particular, can provide an alternative to unsafe street play and detrimental activities such as drug use and trafficking. The construction of the playgrounds will supply a group of youth volunteers working at the DPF with a source of income and purpose. These volunteers work primarily as firefighters, but also assist the DPF in the construction and repair of playground equipment. From this job, they gain valuable skills and experience that will assist them in finding future employment.

## Methodology

The goal of our project was to involve the Klong Toey community, especially a group of ‘at risk’ youth volunteers working with the DPF, in the design, renovation, and construction of safe, durable, low-cost, and engaging playground equipment that promotes the mental, physical, creative, and social development of 3 to 7-year-old children. To achieve this goal, we identified four objectives:

- 1. Assess the needs, preferences, and concerns of key stakeholders, especially children and youth volunteers, within the community through interviews and focus groups.*
- 2. Create and compare design options for playground layouts and equipment based on child play preferences, material availability and cost, available space, developmental benefits for volunteers and children, and community feedback.*
- 3. Construct and evaluate playground equipment for safety and durability while working with the youth volunteers to develop their trade skills.*

4. *Provide the DPF and playground managers with organized, easy to read, and descriptive safety and maintenance plans for playground equipment and the general playground area.*

We considered children, parents, teachers, youth volunteers, the Klong Toey community members, and our sponsor, the DPF, as our key stakeholders. We solicited the opinions and concerns from each group of stakeholders and tried to accommodate them in our final design options. We took the following course of action to accomplish the above objectives:

1. Assess the needs and desires of the stakeholders through focus groups and interviews
2. Conduct safety inspections of the DPF School and Lock 23-24 Playground
3. Research inexpensive, locally available materials
4. Brainstorm and sketch equipment design ideas
5. Construct new equipment and test for safety and functionality
6. Create the layout for the Lock 23-24 Playground using a scale model
7. Create maintenance plans to ensure playground safety

## Findings

Based on our interviews and focus groups, we formulated the following findings related to the design and safety of playground equipment and layouts.

1. **Communities such as Locks 1, 2, and 3 are not interested in building playgrounds, but other communities, including Lock 23-24, show a need and desire for playgrounds.**

Through talking with the community leaders and DPF members, we discovered that several communities in Klong Toey were interested in making profits by charging customers for parking in their open space. However, six communities expressed a desire to use their space for an updated or new playground. We found children playing in the streets in communities that lack playgrounds and an abundance of children in existing playgrounds, which demonstrates the need for playgrounds.

2. **Children in Klong Toey enjoy climbers, swings, play houses, loose tires, and seesaws the most, but will play on other common equipment available in local playgrounds.**

Based on the children's drawings and answers in the focus groups, we established that males generally enjoyed equipment that involved climbing and adventurous activities, while females generally enjoyed swings, seesaws, and playhouses present on the DPF Playground. During our observations on the DPF School playground, we noticed that there was a very large amount of children, considering the size of

the playground. Because of this, the children used every piece of equipment, regardless of favoritism. Similarly, at the Lock 23-24 playground opening, children played on every piece of equipment.

**3. While DPF youth volunteers do not have specific career goals, they will benefit from developing trade skills and gaining more experience by constructing and installing the playground equipment.**

We learned from interviews that, previously, the volunteers had very limited to no training or background in mechanics. In the year or so that they worked with Khun Dumrong and the DPF, they developed basic skills related to measuring, cutting materials to size, using hand tools, welding, drilling, and sanding. We also discovered from the interviews that the youth volunteers did not have specific goals for the future. They were grateful for the trade skills they had and additional job opportunities.

**4. Available materials such as tires, tow straps, and metal pipes were effectively constructed equipment capable of providing developmental benefits for children and youth volunteers.**

We discovered that used tires are a readily available material that many companies are willing to donate. The DPF could acquire tow straps without cost from the Port Authority and metal pipes for a low cost. Based on knowledge gained from past research and the team's informed assessments, we categorized each design as capable of providing development for children in at least one area. Thus, every design developed children either socially, mentally, physically, creatively, or a combination thereof. Every proposed design for playground equipment was also capable of providing trade skill experience and development for the youth volunteers.

**5. Some existing playground equipment in the DPF School and Lock 23-24 playgrounds were unsafe, but it was possible to incorporate safety recommendations into designs for new equipment.**

Based on our safety inspections, we found that all of the existing equipment either purchased or built by the DPF was in need of repairs or improvements. Many of these desired repairs (72%) were simple fixes such as repainting equipment or burying footings, but a few major safety concerns also existed. The most notable major safety concerns were broken fasteners on the strap climbers and broken floorboards for the slides. We were able to incorporate our observations of common and recurring problems so that our new equipment designs were safer.

**6. The new layout for the Lock 23-24 Playground addressed the needs and preferences of the community by using a safer layout that incorporated a greater variety of equipment.**

The Lock 23-24 Community Playground lacked a safe, efficient layout. We created a layout incorporating newly built equipment and utilizing buffer zones to ensure there was enough space between equipment

for the children to play safely. Due to limited space, not all of the possible equipment could be included in the layout. Thus, we excluded equipment that was less popular or needed significant repairs.

**7. The DPF and Lock 23-24 Community did not have a method for maintaining their playgrounds but expressed interest in a plan to facilitate general upkeep and safety repairs.**

Based on interviews with community leaders and members of the DPF, the team found a desire for a maintenance plan for community and school playgrounds. Broken and unsafe equipment were left alone onsite because the community volunteers did not know how to make repairs. Though the general community knows how to use the playground technology, they do not usually have the knowledge to maintain and repair it. The community leader of Lock 23-24 responded enthusiastically and positively when we asked if a maintenance plan would help address problems such as the broken equipment.

We would like to acknowledge that our project was not without flaws and challenges. We had limited time, resources, and background knowledge to complete this project. Our designs were limited by the skills of the DPF youth volunteers and available tools and materials. We have not been trained on playground safety or working with children. Our methods were also limited from our lack of experience running interviews and focus groups. Note that children are not the most reliable source of information, and have limitations of their own. As a non-profit organization, the DPF could not afford all of the equipment or resources desired. Throughout the project, we attempted to continuously collect unbiased and thorough results and information. However, readers should be aware of the limitations and flaws of this project when reading our recommendations in order to judge their credibility.

## **Conclusions and Recommendations**

Through our observations and research, we developed the following three conclusions:

1. Playgrounds and the construction of playground equipment benefit the sub-communities, children, and DPF's youth volunteers of Klong Toey.
2. All of the existing equipment we inspected had safety concerns, but it was possible to incorporate safety recommendations into new equipment designs and layouts.
3. The DPF and communities of Klong Toey did not have maintenance plans, but showed a need and interest in keeping their playgrounds safe, maintained, and up-to-date.

Based on these conclusions, we formed a set of recommendations for the Duang Prateep Foundation and sub-communities within Klong Toey with the purpose of designing and maintaining future playground equipment and keeping playgrounds safe and up-to-date.



**1. We recommend 13 equipment designs to install in new or existing playgrounds.**

Based on our findings about the needs of the communities and youth volunteers, child play preferences, and available materials, we recommend that the DPF incorporate any of our 13 designs for equipment into their future playgrounds. Appendix E contains descriptions and sketches of the designs. Other improvements for future playgrounds can include roofs to provide shade and better ground cover.

**2. We recommend safety improvements and repairs.**

Since every piece of equipment inspected had a safety concern, we created a list of safety recommendations based on playground safety guidelines described by the CPSC. Detailed safety recommendations organized by individual pieces of equipment and playgrounds are in Appendix H and Appendix I. Implementing our recommendations will help make the playground as safe as possible, while also enhancing equipment durability.

**3. We recommend the regular use of a maintenance plan.**

Our results showed that communities and the DPF did not have a concrete or specific way to check on the safety or maintenance of the playgrounds. This resulted in the playground equipment breaking frequently, leading to unsafe conditions. Based on this finding, we recommend that the DPF implements and utilizes a maintenance plan tailored specifically to each playground. The maintenance plans will help the DPF and playground managers to organize, schedule, and follow through with general upkeep and necessary safety repairs.

**4. We recommend staying in touch with various companies and organizations.**

We recommend that the DPF stay in contact with the following companies and organizations for future assistance and support in building new playgrounds. These contacts are sources for tire donations, playground design ideas, and safety guidelines.

- NV-Yangyont – Tire donator
- Michelin – Play Equipment donator
- Marcus Veerman, GoPlay! Organization – Equipment ideas, Official safety inspections
- Ramithibodi Hospital and CPSC websites – Safety Guidelines and References

To improve the quality of their current and future playgrounds, we suggest the DPF follow our suggestions for equipment ideas, safety, and maintenance. These recommendations will help the DPF accomplish their goal of building 30 playgrounds in the Klong Toey slum, thereby developing the local children and youth volunteers and improving the overall quality of life in these communities.

# Team Contributions

## **Viriya Boonmuang**

Viriya served as the primary editor of the Executive Summary, as well as the secondary editor for the remaining sections. She also spent a vast amount of time working alongside Thitiya as a translator and interpreter for the rest of the group. She worked with Thitiya in conducting focus groups and interviews, and performed crucial fieldwork and research. She also served as a note taker during official meetings. She worked with Thitiya in designing the layout and equipment sketches contained within the Recommendations chapter. She contributed to the Methodology, Analysis, and Recommendations chapters.

## **Elizabeth Casey**

Elizabeth was the primary editor for the Background and Analysis chapters. She also served as secondary editor for the Introduction, Methodology, Appendices, Executive Summary, and Recommendations chapters. Elizabeth was the primary author for sections of the Introduction, Background, Methodology, and Analysis chapters, and contributed for every other section. She was the primary note taker during advisor and sponsor meetings.

## **Michael Ciampa**

Michael was the primary author of the Executive Summary and sections of the Introduction, Background, Methodology, and Analysis chapters. He also contributed to the remaining chapters. He often served as group leader during formal presentations. In addition to this, he also was the primary editor of the Methodology and Analysis sections and the secondary editor for the Introduction, Background, Appendices and Recommendations sections.

## **Cailah DeRoo**

Cailah was most often the organizer and leader during group discussions and meetings. She was the primary editor of the Introduction and Appendices as well as the secondary editor for the Background, Analysis, and Methodology sections. These edits included formatting and cross-referencing the entire paper. Cailah was the primary author of the Recommendations chapter, as well as sections of the Introduction, Background, Methodology, and Analysis chapters. She also contributed her writing to every other section of the paper.

## **Thitiya Pattaragosol**

Thitiya served as the primary editor of the Executive Summary, as well as the secondary editor for the remaining chapters. She also spent a vast amount of time working alongside Viriya as a translator and interpreter for the rest of the group. She worked with Viriya in conducting focus groups and interviews, and performed crucial fieldwork and research. She served as a note taker during official meetings. She worked with Viriya in designing the layout and equipment sketches contained within the Recommendations chapter. She contributed to the Methodology, Analysis, and Recommendations chapters.

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# Introduction

Research shows that the worldwide rate of urbanization has dramatically increased in recent years, especially in developing countries (Bolay, J. (2006). ; Igel, B. (1994); United Nations, Department of Economic and Social Affairs, Population Division. (2006); Human Settlements Programme, 2003). As of 2005, nearly half the world's population lives in urban areas, and the United Nations expects this rate to continue to grow in future years. The proliferation of urban slums is closely tied to urbanization. Worldwide, over one billion people live in slums. In the next ten years, the estimated population living in urban slums will increase by 140% (United Nations, Department of Economic and Social Affairs, Population Division. (2006).

In Bangkok alone, there are over one million people (or 16 percent of the city's population) living in slums (United Nations, Department of Economic and Social Affairs, Population Division. (2006); Human Settlements Programme, 2003). The Bangkok Metropolitan Authority identifies a slum as "an overcrowded, non-orderly and dilapidated community... which can be harmful to [the] health and lives [of its inhabitants]," (United Nations, Department of Economic and Social Affairs, Population Division. (2006); Human Settlements Programme, 2003). Over 800 slum communities exist within Bangkok; some are relatively new and small, while others, such as Klong Toey, were established over forty years ago. More than 80,000 residents live in this slum, and some families have lived there for generations because of inadequate opportunities and resources to relocate (Hata, T. (1996). Challenges such as eviction, overcrowding, drug abuse, employment, and education affect Bangkok slum dwellers and children in particular. As an example, students in Bangkok are required to attend school until the 9<sup>th</sup> grade (Office of the Permanent Secretary Ministry of Education, 2009). However, in Klong Toey, most children only attend school until they are 6 years old (P. Ungsongtham Hata, personal communication, February 5, 2009). Children drop out of school due to schooling expenses and to work to help support their families. This limited schooling results in underdevelopment and insufficient education that hinders obtaining future profitable careers (Duncan, G. J., & Brooks-Gunn, J. (Eds.). (1997); Children's Defense Fund, 2008; Young, 1996; Duncan & Brooks-Gunn, 2000; Pollitt, 1994). Children born into this 'cycle of poverty' have fewer opportunities to break away from their current living situations.

There is no single or simple solution to address the manifold, complex problems associated with urban slum dwelling other than to eliminate poverty and slum conditions altogether. This long-term goal will require enormous political and social action and the allocation of substantial resources. In the interim, non-profit organizations such as the Duang Prateep Foundation (DPF) are working to alleviate

the immediate suffering of slum communities, with a focus on developing and educating children especially.

The Duang Prateep Foundation is a community-run organization that works to improve the quality of life of the residents in Klong Toey. Our project, sponsored by the DPF, involved designing play equipment for children while integrating community youth volunteers in the construction process to develop and strengthen their trade skills. Studies (Frost, 2006; Children's Play Council, 2006; Pellegrini, A. (2005); Jarret, 2003) show that play has profound developmental benefits for children, and the DPF believes that playgrounds in particular can provide an alternative to unsafe street play and detrimental activities such as drug use and trafficking.

The goal of our project was to involve the Klong Toey community, especially a group of 'at risk' youth volunteers working with the DPF, in the design, renovation, and construction of safe, durable, low-cost, and engaging playground equipment that promotes the mental, physical, creative, and social development of 3 to 7-year-old children. To achieve this goal, we identified four objectives:

1. Assess the needs, preferences, and concerns of key stakeholders, especially children and youth volunteers, within the community through interviews and focus groups.
2. Create and compare design options for playground layouts and equipment based on child play preferences, material availability and cost, available space, developmental benefits for volunteers and children, and community feedback.
3. Construct and evaluate playground equipment for safety and durability while working with the youth volunteers to develop their trade skills.
4. Provide the DPF and playground managers with organized, easy to read, and descriptive safety and maintenance plans for playground equipment and the general playground area.

Playgrounds in particular offer many advantages to the community, especially to children and youth volunteers. Playgrounds are shared spaces where the community can come together to socialize or celebrate. We hope that these playgrounds will be fun, safe places that aid in the development of children in the Klong Toey community. Additionally, we hope that the construction of the playgrounds will supply the volunteers with a source of income and purpose, as well as valuable skills and experience that will assist them in finding future employment. These outcomes will help the community come one-step closer to overcoming the problems related to slum dwelling.

# Background

This chapter explains the ties between urbanization and poverty, the effects of slum life on the children of Klong Toey, the Duang Prateep Foundation's (DPF) local playground development project, and the research of experts on the importance of play in child development. This background information will support the reasoning for this project and why playgrounds, in particular, will help the Klong Toey slum community.

## Ties between Urbanization, Poverty, and Slums

Urbanization is a trend that currently affects countries worldwide. In developing countries especially, the percent of the population living in urban areas compared to rural areas is rapidly increasing (Bolay, J. (2006). ; Igel, B. (1994); United Nations, Department of Economic and Social Affairs, Population Division. (2006). Figure 1 shows a comparison of the urban and rural population of the world. Currently, nearly half the world's population lives in cities, and the United Nations expects this rate to continue to grow in future years (United Nations, Department of Economic and Social Affairs, Population Division. (2006)).

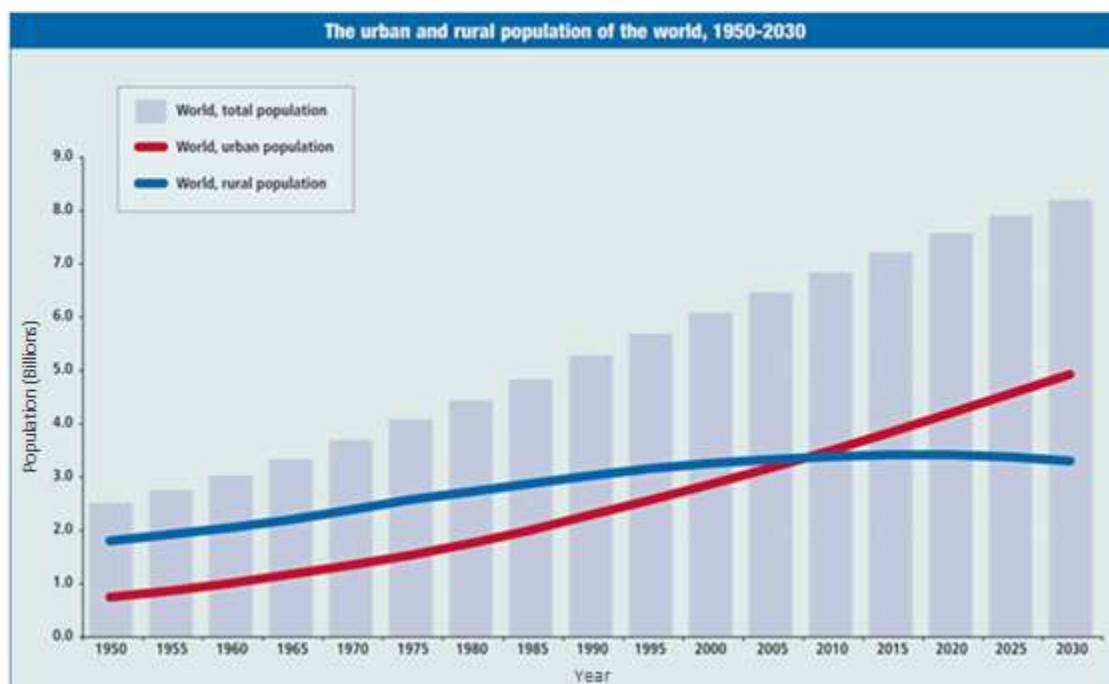


Figure 1. Comparison of the urban and rural population of the world, illustrating worldwide urbanization (Modified from United Nations, Department of Economic and Social Affairs, Population Division. (2006))



The proliferation of urban slums, and therefore poverty, are problems tied closely to urbanization. Worldwide, over one billion people live in slums, and this will increase by 140% in the next ten years (United Nations, Department of Economic and Social Affairs, Population Division. (2006). The slum population will increase as more people migrate to cities from rural areas. Urban slums are a plague in developing countries especially. Studies from the United Nations (2005) state that 43% of the urban population of developing countries live in slums, where the world average is 32%. Cities appeal to the rural poor struggling to make a living because of the abundance of job opportunities and access to necessities such as healthcare, schooling, and travel infrastructure. When poor families first move into a city, some live in slums or squatter settlements because they cannot afford other housing.

According to the United Nations (2006), Thailand experienced relatively low urbanization compared to the rest of the world. Annual population growth rates for Bangkok vary (depending on the source) from 3.6% (Bolay, J. (2006). to 0.93% (United Nations, 2006), compared to the world average of 32%.

This lower rate of urbanization may relate to a decrease in the number of slums in Bangkok in recent years. Compared to other developing cities, Bangkok has a relatively low 16% of its population living in slums. The slum population reached a peak in the 1980's, with 1020 slums in the year 1985 and a population of 2.4 million that doubled the population two years prior. By the year 2000, the number of slums in Bangkok decreased by to 866 because of successful government-built housing units and relocation projects (Bolay, J. (2006). Various NGOs have also helped members of the slums escape poverty by finding jobs, saving their money, and moving into their own houses.

## **Klong Toey Community**

Klong Toey is the largest slum in Bangkok, with over 80,000 residents. The slum sits in Southern Bangkok along the Chao Praya River on about 1.5 km<sup>2</sup> of land owned by the Port Authority of Thailand (Figure 2). Before the establishment of the Port Authority in the 1930s, the government made the land of Klong Toey available to rent at low rates to help the increasing number of poor people in Bangkok. However, upon the establishment of the Port Authority of Thailand in 1951, the government ended the land rental agreement (Tinlin, B. (1999)). Many of the original renters stayed on the land illegally because they had nowhere to go. The slum grew in population during the 1950s as rural farmers and immigrants migrated to Bangkok in search of work (Duang Prateep Foundation, 2009). Many people chose to settle in Klong Toey because the Port Authority of Thailand needed many employees to aid in building



Figure 2. A map of Bangkok with the Klong Toey slum outlined in pink (modified from BBC, 2007).

the Bangkok Port. Once the port's construction was completed, most of the workers stayed on as manual laborers.

Klong Toey is similar to other slums in Thailand as well as those in other third world countries. Many people overcrowd into disorganized collections of makeshift houses built from scrap lumber and other scavenged materials (see Figure 3). Some houses are in substandard condition, and heaps of trash are seen surrounding houses and along the roads. Approximately one percent of children and adults living in the slum do not have birth certificates and therefore cannot attend school, own land, or receive public welfare benefits (Duang Prateep Foundation, 2009).

Klong Toey differs from other slums because of its large, strong, well-established system of 43 sub-communities. Early on, the area lacked basic essentials such as roads, schools, and public health centers. With the help of various non-governmental organizations like the Duang Prateep Foundation, The Human Development Foundation, and Foundation for Slum Child Care, the people of Klong Toey came together to improve their quality of life. This ingrained sense of community helped the neighborhoods overcome many challenges and develop beyond the typical slum. Most houses now have basic amenities such as running water and electricity, but some sections have seen very few improvements. Klong Toey now has state schools, a volunteer firefighter organization, and other necessities like medical clinics in their community centers (Khun Dumrong, personal communication, February 2010). More information on the Duang Prateep Foundation is in Appendix A.



Figure 3. Tightly packed houses made out of scrap lumber and scavenged materials are common in Klong Toey.

Some communities within Klong Toey, such as the Lock 23-24 community, have made significant efforts to improve their living situations. Lock 23-24 lies alongside a canal on the outskirts of Klong Toey (see Figure 10 for an exact location on a map). This community worked with the PAT to build new apartment complexes (see Figure 4) for 200 families evicted from their previous homes. Khun Vichian, the Lock 23-24 community leader, stated that the PAT plans to evict everyone in her community within the next five years. Despite this, the community has made efforts to improve their surroundings. They built a playground for the children living in these complexes and the surrounding communities with help from the Duang Prateep Foundation. In building this playground, residents hope that the PAT will see their efforts and allow them to remain at Lock 23-24. They believe that the more developed and established their community is, the smaller the threat of eviction is. (Khun Vichian, personal communication, February 11, 2010)



Figure 4. Apartment complex (left) and playground (right) within the Lock 23-24 community in Klong Toey.

The Port Authority of Thailand can evict anyone from their property, including those who illegally dwell within the Klong Toey slum. Nevertheless, some families have been living in the same area for four or five generations, and they feel that they have a right to own the land (Hata, T. (1996). As stated by Tatsuya Hata (1996), a Klong Toey resident, "The civil rights of people who live in the slums regarding residence and citizenship have never been a priority with the authorities. It makes no difference how long the people have lived in their homes; they are still unable to acquire any rights." The PAT wants to get rid of the slum so that it can expand and maintain control of its land (Hata, T. (1996), but wholesale eviction of large numbers of people would be practically and politically difficult. The constant threat of eviction takes a toll on dwellers. They are less likely to put money or effort into maintaining or improving their surroundings and continually worry about whether or not they will have a place to live tomorrow. (DiNino, Garabedian, Ossa, & Smith, 2006)

Drug use and trafficking are prominent problems in the slum. In the Rom Klong Wat Sapan community in Klong Toey, "100% of respondents stated that drugs were a problem in the community," (DiNino et al., 2006). Children are frequently targeted to traffic and transport drugs, and they are at higher risk of becoming drug users because drugs are so readily available.

Parents expect their children to help support their family and get a job from the age of six or seven, if not younger. Because these children are too young and lack the skills to have an official occupation, some will beg and sell items on the streets as a means of an income that goes directly to their parents. (Khun Dumrong, personal communication, February 2010)

In Klong Toey, approximately 50% of children attend kindergarten, and about 98% of children attend local primary schools. However, fewer than 17% of children continue into secondary schools, even though it is compulsory for children in Thailand to attend school for at least 3 years in secondary school (Office of the Permanent Secretary Ministry of Education, 2009; P. Ungsongtham Hata, personal communication, February 5, 2010). One reason for the lack of continued higher-level education is that children may not be able to afford to go to public school, since the fees for uniforms, books, and supplies are beyond the meager means of many families. Approximately 80% of children around the age of six drop out of school in order to begin working to help support their family (Duang Prateep Foundation, 2009).

The combination of not attending school and working full time leaves many children with limited opportunities to play. Furthermore, poor families must spend their limited resources on fundamentals like food rather than toys. Not surprisingly, the slum has few community centers and

playgrounds compared to the population. This makes train tracks, streets, and dilapidated walkways cluttered with garbage the locations where many children spend their free time.

## Effects of Poverty and Slum Life

Both social and scientific studies have demonstrated that living in poverty has adverse impacts on children's health, physical and cognitive development, and educational achievement in both developed and developing countries (Duncan, G. J., & Brooks-Gunn, J. (Eds.). (1997); Children's Defense Fund, 2008; Young, 1996; Duncan & Brooks-Gunn, 2000; Pollitt, 1994). Slum life, in particular, also has negative effects on children, and Klong Toey certainly is not free of these challenges. These impacts range from serious health concerns to developmental problems. Children growing up in impoverished families tend to be underdeveloped both physically and mentally, compared to children in comfortable living situations. Children and young adults who have limited schooling struggle to find well paying jobs because of their lack of education and skills.

Ernesto Pollitt (1994), a leading expert on poverty and child development, found that in some underdeveloped countries, such as Kenya, Taiwan, and Guatemala, health problems in children were much more prevalent and correlated directly with poverty. This suggested that poverty has an effect on psychomotor development and intelligence. He also showed that substandard health among children correlated with poorer performance in cognitive and school achievement tests. Other evidence from Dr. Greg Duncan and Dr. Jeanne Brooks-Gunn (2000), researchers of child development and child poverty, demonstrated that children from poverty-stricken families tended to perform much worse in school than children from more affluent families.

Dr. Mary Young (1996), an expert in pediatrics, public health, and child development, contends that, "Children who experience extreme stress in their earliest years are at greater risk for developing a variety of cognitive, behavioral, and emotional difficulties later in life." Children in Klong Toey may be exposed to drugs, abuse, and other environmental stresses that directly affect their development. Young also states, "Children whose earliest years are blighted by hunger or disease...pay for these early deficits throughout their lives...Such children are far more likely than their more fortunate peers to do poorly in school, to drop out early, to be functionally illiterate, and to be only marginally employable." Children from underprivileged environments, such as Klong Toey, could have stunted development in cognitive and behavioral activity.

Non-profit organizations such as the sponsor of this project, the Duang Prateep Foundation (DPF), have taken various approaches to help assuage the effects of slum life on children. The DPF is a

community-run organization that works to improve the quality of life of residents of Klong Toey, with a focus on helping children especially. They built several schools in the area, funded various community development projects such as health centers and savings banks, and provided job opportunities for young adults previously addicted to drugs. For more information on the DPF and their community projects, see Appendix A.

Eight boys, ages 12 to 21, work with the DPF as volunteer fire fighters outside of their school commitments (see Figure 5). These boys have had pasts filled with drug use and illegal activities and working with the DPF has helped turn their lives around. In addition to fighting fires, the volunteers work with Khun Dumrong, a head firefighter who trained the volunteers to use various tools in order to build equipment for playgrounds throughout Klong Toey. With this experience, the volunteers hope to find better paying jobs as skilled laborers and mechanics. Kru Prateep Ungsongtham Hata, founder of the DPF, hopes to create a professional team of five to ten youth volunteer playground builders to construct playgrounds throughout Thailand in the future (Duang Prateep Foundation, 2009).



Figure 5. Several firefighter youth volunteers working for the Duang Prateep Foundation.

## Developmental Benefits from Play

Frost (2006), a prominent researcher in child development, avowed that, “On no other educational or child developmental issue is the body of evidence clearer – play is essential to the healthy development of children and to their adaptation to their culture, society, and world.” It is well known that play is a vital part of children’s early lives (Children's Play Council, 2006) and can promote “cognitive development, social development, language development, physical fitness and health, learning and coping with trauma,” (Frost, 2006). This development can include qualities such as independent thinking, problem-solving, improved self-esteem, and making friends.



Forms of play range from arts and crafts to dress up to physical activities. Play is a way for children to learn, express themselves creatively, and explore their environments. The physical nature of play correlates with better health. The National Children's Bureau (NCB) of the United Kingdom cites many governmental agencies and organizations that confirm play's benefits in children's physical and mental health (The Children's Play Information Service, 2009).

Dr. Anthony Pellegrini and Dr. Olga Jarrett have studied human development, the role of play for children, and the behavior of children at recess. Pellegrini separated recess into different types of behavior and playing including passive, rough-and-tumble, vigorous, games, object, and role-playing. Each of these different types of play develops different areas in children. For instance, when children play games like kickball, their peers force them to subordinate their behavior to the rules of the game. When they are playing together by building a stick fort, they must learn the formal and informal rules of interaction (Pellegrini, A. (2005); Jarrett, 2003). Even without a playground, the act of getting outside and playing with other children is an essential learning experience for a child.

Recess can be a source of success for children when they are able to cooperate with each other on the playground. Jarrett (2003) suggested that, "Recess may be the only opportunity for some children to engage in social interactions with other children." This can lead to success in the classroom and other areas of the child's life, including social skills and building a positive self-image. Play is incredibly important in the lives of children because it is so different from any other educational experience. Children living in the slum may have few opportunities for play and therefore do not benefit from the social experiences it offers. This shows how play can greatly develop their social life and, in turn, the educational life of a child living in the slums.

## **Incorporating Child Development into Playgrounds**

Playgrounds help with childhood development by encouraging creative play, healthy physical activity, and interaction among other children. Dr. Janet Sawyers (1994) pointed out that, "The benefits of outdoor play are maximized when developmentally appropriate equipment and materials are combined with adult supervision to support child-initiated learning." As discussed in the previous section, children benefit greatly from playtime at recess. Therefore, a playground is an effective way to address the negative developmental effects that slum life has on children. Building playgrounds can help by providing safe environments for children to gather and play, which they lack during street play. They also may help children develop intellectually, physically, creatively, and socially.

Playground types and designs have changed over time in response to these principles. Dr. Ann Barbour, A. (1999), a professor of early childhood education at CSU, cited the research of many experts who claimed that “Children’s playground behaviors are influenced by the amount of space per child, the delineation of space, the type and configuration of fixed equipment, the degree of challenge, novelty, and complexity, the presence/absence of enclosed areas, and the availability and kind of portable materials or ‘loose parts’”. We hoped that designing various types of playground equipment for the Klong Toey slum would encourage children to play.

Kishigami Hiroko published a report that gives ideas on how to design a pre-school center that maximizes child development. In particular, he stated that a play center should improve children’s stamina, coordination, and safety skills. Play spaces also naturally develop intuition, imagination, logic, and problem solving skills. Dr. Janet Sawyers (1994) stated that, “Adults have an important role in helping children discover their own limitations and capabilities.” This teaches the skills of sharing, trust, respect, communication, and responsibility (Hiroko, 1988; Sawyers, 1994). A playground here should be designed to benefit the children in these ways.

Hiroko stressed a few main points regarding children and playgrounds in his report. First, children should be active enough to be proud of themselves, and therefore learn self-confidence, self-respect, and self-motivation. They should learn to cooperate with one another, not compete. The playground itself should feature graduated challenges so that the children have a sense of accomplishment after pushing themselves and rising to the challenge (Hiroko, 1988; Sawyers, 1994). Such challenges could include making it all the way across the monkey bars or climbing to the top of a rope ladder. However, the challenges must not be too easy or too difficult. Sawyers (1994) stated, “Challenges beyond a child’s reach carry with them the high cost of failure... an equally serious problem occurs when young children’s skills exceed the challenges provided.” A playground that accommodates the needs of children with both high and low levels of physical competence and motor skills “will better promote the physical, social, and cognitive development of all children” (Barbour, A. (1999). Playgrounds need more than just fixed equipment; they need open spaces to run and areas to explore and interact with other children (Children's Play Council, 2006).

The Duang Prateep Foundation has already made efforts to build playgrounds in the Klong Toey community. They have a model playground built at the Duang Prateep School across from the Foundation and a completed playground at Pra-Kha-Nhong, a community within Klong Toey, both of which are in Figure 6. The DPF and youth firefighter volunteers designed and built six pieces of



equipment. The DPF also purchased equipment that the youth volunteers could not build (such as slides).



Figure 6. The model playground at the Duang Prateep School (left) and the community playground at Pra-Kha-Nhong (right).

## Playgrounds

There are multiple types of playgrounds, each containing different styles of equipment that encourage diverse types of play. Playground equipment can be fashioned out of many materials, from conventional plastic and metal to tires and other recycled resources. The equipment found on playgrounds varies widely, but swings, slides, and climbing equipment are common to most playgrounds.

Playground safety is a major concern in the United States. Though there are limited resources and guidelines for Thai playgrounds, the government recognizes that safety is an issue in Thailand. It is important for children to have a safe environment in which to play. Therefore, the equipment must be evaluated and tested for safety and be properly maintained.

## Types

Since their first use, playgrounds have evolved from running tracks and playing fields to more age-appropriate, complex, interlocking structures imbedded in shock-absorbing ground material. We considered four different types of modern playgrounds for guidelines and inspiration for our project designs: the traditional playground, the contemporary playground, the natural playground, and the adventure playground. Table 1 summarizes the materials, equipment traits, intended use, and safety of the four types of playgrounds, and Appendix B contains more details about each of the types.

According to Frost (2006), the best playgrounds include components from all playground types. Such components are open space, play equipment, sand or water, loose parts, nature, and art. When

given a choice between adventure, contemporary, and traditional playgrounds, Hayward's studies confirm that children in the U.S. prefer them in that order (Barbour, A. (1999). The aspect most appealing in the adventure playgrounds is the opportunity to explore and interact with the environment.

**Table 1. Comparison of playground types**

<b>Playground</b>	<b>Materials</b>	<b>Equipment Traits</b>	<b>Intended Use</b>	<b>Safety</b>
Traditional	Metal, Wood	Stand-alone structures, 1 entrance & exit	Physical Development (exercise)	Equipment spaced far apart for safety
Contemporary	Plastic, Metal, Wood	Linked structures, stand-alone structures, many entrances & exits	Physical, Mental, Social Development	Safer equipment than Traditional
Natural	Plants, Trees, Rocks, Dirt, Water, Snow, etc.	No man-made equipment, "loose" play items, unlimited entrances & exits	Physical, Creative, Social Development	Effected by weather
Adventure	Scrap, Recycled	Linked structures, interactive, challenging, loose/movable equipment & tools, many entrances & exits	Physical, Mental, Creative, Social Development	Play attendants present to make area safer

## **Equipment**

Various types of playground equipment specifically target one or more of the four major developmental areas (social, mental, creative, and physical) in children. For example, a seesaw requires children to work together socially in order to successfully perform the up-and-down motion the seesaw is known for. This action also allows for physical development by using various leg and hip muscles during this activity.

We focused our research on playground equipment that the youth volunteers could construct using locally available materials. Table 1 lists common playground equipment, the types of playgrounds containing them, and the corresponding developmental benefits. For clarification, climbers include equipment such as monkey bars, suspended hand rings, geodomes, ladders, and climb-towers, and sports equipment can include balls, baskets, and nets. Freestanding panels usually have games and activities like tic-tac-toe, puzzles, and shapes.

Equipment is generally designed for toddlers (younger than 2 years old), preschoolers (ages 2 to 5), or school-aged children (ages 5 to 12) because each of these age groups require development of

different skills. Equipment that is appropriate for preschoolers includes climbers, merry go rounds, monkey bars less than 60 inches high, ladders, slides, and tire swings. School-aged children can use more challenging equipment such as arch climbers, seesaws, overhead rings, flexible climbers, and sliding poles. (CPSC, 2008)

**Table 2. Comparison of common playground equipment and corresponding developmental benefits**

<b>Equipment</b>	<b>Traditional</b>	<b>Contemporary</b>	<b>Adventure</b>	<b>Creative Play</b>	<b>Physical</b>	<b>Social</b>	<b>Critical Thinking</b>
Swing	x	x	x		x	x	
Slide	x	x	x		x		
Playhouse		x	x	x		x	
Climbers	x	x	x		x		X
Sports Equipment	x	x	x		x	x	X
Spring Riders		x	x		x		
Rockers		x	x		x		
Sand	x	x	x	x		x	
Water			x	x		x	
Crawl Tubes	x	x	x	x	x		
Seesaw	x	x	x		x	x	
Freestanding Panels		x	x	x			X
Merry-Go-Round	x	x	x		x	x	
Balance Beams	x	x	x		x		X
Towers/Decks		x	x	x			X
Bridges		x	x	x	x		X

In order to encourage greater physical activity and development on playgrounds, equipment should challenge and engage children. Linking playground equipment improves social interactions and promotes high levels of play among children, while flexible components encourage play that is more cooperative. (Barbour, A. (1999)

## **Materials**

The materials used to build playgrounds have changed. Material choices depend on cost, availability, and intended use. Common materials in playgrounds include metal, plastic, and wood, and each has corresponding advantages and shortcomings. Plastic can be strong and durable, but the

molding procedure needed to manufacture equipment such as slides is expensive and not readily available in Klong Toey. Tow straps and used tires are two materials commonly found locally. A past IQP addressing playground design for the Klong Toey slum used tires in many aspects of their design (Sexton, J. R., Byrne, M. C., Boucher, L. L., & Bida, O. (2003). Rubber is a resilient material that does not rot or decay due to rainy weather. Tires do not catch fire (especially when treated with paint), do not leach, are non-toxic, and have a documented cushioning benefit. Tires used in playgrounds will not attract cats, dogs, rodents or insects to the play area, as well as slowing weed growth. These are all beneficial characteristics that improve potential playground equipment safety (Texas Natural Resource Conservation Commission, 1999). An example of incorporating tires into playground equipment is in Figure 7.



Figure 7. Use of recycled tires in playground equipment

The materials used in playgrounds encompass not only what the playground equipment is made of, but also what material covers the ground. There are natural ground components such as dirt and grass and artificially placed filler such as sand, wood chips, gravel, and ground rubber. The safest ground filler for playgrounds amongst these choices is ground rubber. Not only is it environmentally friendly, but “in almost all cases, recycled rubber products have a longer lifetime than traditional products, creating decreased life cycle costs from maintenance and replacement savings. Cost savings also result from avoided costs of playground-related injuries (medical and liability costs),” (Stutz, Donahue, Mintzer, & Cotter, 2003). Playgrounds need greater depths of the other loose-fill ground covers listed in Table 3 to have the same safe, cushioning effects of ground rubber.

In addition to ground cover, Thailand needs protection from its harsh elements. In the cool season, low temperatures in Bangkok are approximately 21° C (70° F). Alternatively, in the hot season, the high temperatures are around 34° C (93° F) (BBC Weather Centre, 2006). Due to these high

temperatures, humidity, and lack of consistent cloud cover, there is a great need for sun protection. Roofs over parking lots and other open spaces in Klong Toey are often fashioned from a variety of materials. An example of tarps and mesh netting used as roofs within the Klong Toey slum is in Figure 8



Figure 8. Mesh net (left) and tarp (right) roofs in Klong Toey

## Safety

Safety has always been a major concern in playgrounds. The adventurousness of children can lead them to dangerous activities when they constantly challenge their environment. Dr. Ann Barbour (1999) states, “If the environment is insufficiently challenging, children will find ways to make it more stimulating by inventing new behaviors.” A 12 month study of playground injuries in the U.S. discovered that 205,850 playground equipment-related injuries were treated in hospitals from 1998-1999. Seventy nine percent of injuries on public playgrounds were a result of falls, and the great majority of injuries were due to climbers (53%), swings (19%), and slides (17%). To better combat injury, “designers must anticipate these [dangerous] behaviors, try to predict the consequences, and propose design and management responses,” (Barbour, A. (1999).

Though there are not any official Thai regulations for playground safety, the Ramithibodi Hospital in Bangkok (CSIP, 2003), Thailand published a set of recommendations to help make playgrounds safer. Most of these recommendations align closely with U.S. guidelines set forth by the Consumer Product Safety Commission (CPSC), a leading agency in playground safety.

The CPSC (2008) identifies common playground hazards to include crush and shearing points, entanglement, impalement, and suspended and tripping hazards. Crush and shearing points are areas where moving parts can injure body parts, such as near the pivot point in a seesaw. Projections and sharp points, such as exposed bolts or splinters, can lead to impalement or catch loose clothing. If

spaces such as those between ladder rungs are not large enough, children can entrap their head or feet. This can happen when a child tries to climb head first through a space and cannot fit entirely through. Children can run into and catch onto suspended hazards, which are cables or flexible parts such as the chains supporting the seat of a swing. Tripping hazards can range from tree roots to exposed equipment anchoring.

Designs should avoid crush and shear points so that there are areas that cannot crush feet or arms with the motion of the equipment. Equipment can avoid dangers such as entrapment and entanglement by making openings either smaller than 3.5" or larger than 9". Smoothing or capping can help prevent impalement. Designs can avoid suspended hazards by fastening both ends of cables (unless it is a swing) and painting the piece of equipment in bright, noticeable colors. Making changes in elevation obvious using contrasting colors and burying equipment footing and anchoring beneath the ground can reduce tripping hazards. (CPSC, 2008)

Moreover, all materials used should be in good condition. That is, equipment should not use splitting, rotted, or splintered wood, or rusted or corroded metal. To prevent water from pooling, equipment such as platforms and tires should also have proper drainage. Tools should be necessary to disassemble equipment, and children should not be able to loosen any fasteners. Guardrails and barriers can reduce accidental falls from raised platforms. (CPSC, 2008)

The CPSC (2008) recommends using safety zones with each piece of equipment. This zone generally fills a six-foot 'bubble' surrounding the equipment. Zones of moving equipment should not overlap to ensure correct spacing and safety. These zones help prevent children who fall off equipment from being injured by the surrounding equipment.

Children will explore all their surroundings, so the play area should be a safe environment. All of the equipment should be in good, working condition. It is especially important to have sufficient padding in areas where children commonly fall, such as under the swings and at the bottom of slides. Trash receptacles can help facilitate a cleaner environment. For school playgrounds, it is important that teachers are present to monitor children while they play to help prevent injuries (CPSC, 2008).

The most common form of playground injury occurs from falling off equipment (Barbour, A. (1999). Injuries are generally not from dangerous equipment, but from inadequate ground covering. Recommended ground coverings are mulch, sand, gravel, and shredded recycled rubber because they cushion falls much better than concrete or dirt and grass (Stutz et al., 2003). During installation, it is important to note that these coverings compress with use. Table 3 describes the minimum compressed fill-depth of each ground cover to cushion falls from the given height safely. (CPSC, 2008)



Table 3. Minimum compressed fill depths for ground covering (CPSC, 2008)

Fill Depth (inches)	Material	Fall Height (feet)
9	Shredded rubber	10
9	Sand	4
9	Pea Gravel	5
9	Wood mulch	7
9	Wood chips	10

Routine inspections can reduce hazards and help with the maintenance of the playground (CPSC, 2008; Health and Safety Inspection Checklist: *Playground Maintenance (2000)*; *Periodic Playground Maintenance Checklist*; *Public Playground Safety Checklist*). Inspections can include the condition of the equipment, the ground cover, and the play area itself. The type and age of equipment, along with frequency of usage, are factors in the occurrence of inspections. Ramithibodi Hospital recommends playground inspections at least every 3 months (CSIP, 2003). Repairs should occur for broken or damaged equipment as soon as possible to reduce the risk of injuries.

Researchers such as Dr. Marianne Staempfli, an expert on child behavior within the Department of Recreation and Leisure Studies at the University of Waterloo (2009), believe that playground safety has been taken so far as to make newer playgrounds less welcoming for children. She further states that, “We have made playgrounds so monumentally boring that any self-respectable child will go somewhere else to play, somewhere more interesting and usually more dangerous... There is, of course, no doubt that safety is of utmost importance, but at the same time there is always the potential that intervention in and of itself will create new risks that may lead to more and not less harm to our children’s healthy development.” While most professionals and researchers of child development believe that safety is crucial to playgrounds, they also agree that opportunities for adventure, exploring, and excitement are essential to prevent a playground from being uninteresting.

## Conclusion

The research strongly suggests that slum life and poverty can have significant adverse effects on children. Studies have shown that play has positive effects on the social, mental, creative, and physical development of children. This implies that play may be one solution to alleviate the problems caused by living in a slum. Playgrounds in particular offer many advantages to the community, especially the children and teenage volunteers. The Duang Prateep Foundation believes that playgrounds will benefit the entire community of Klong Toey.

## Methodology

The goal of our project was to involve the Klong Toey community, especially a group of ‘at risk’ youth volunteers working with the DPF, in the design, renovation, and construction of safe, durable, low-cost, and engaging playground equipment that promotes the mental, physical, creative, and social development of 3 to 7-year-old children. To achieve this goal, we identified four objectives:

1. Assess the needs, preferences, and concerns of key stakeholders, especially children and youth volunteers, within the community through interviews and focus groups.
2. Create and compare design options for playground layouts and equipment based on child play preferences, material availability and cost, available space, developmental benefits for volunteers and children, and community feedback.
3. Construct and evaluate playground equipment for safety and durability while working with the youth volunteers to develop their trade skills.
4. Provide the DPF and playground managers with organized, easy to read, and descriptive safety and maintenance plans for playground equipment and the general playground area.

In this chapter, we describe and analyze the importance of each objective, the methods used to obtain the information, and how we used the data to complete our goal and formulate recommendations for the DPF and Klong Toey communities.

### Objective 1

***Assess the needs, preferences, and concerns of key stakeholders, especially children and youth volunteers, within the community through interviews and focus groups.***

We considered children, parents, teachers, youth volunteers, the Klong Toey community members, and our sponsor, the Duang Prateep Foundation, as our key stakeholders. We used focus groups and interviews as methods to answer the following research questions about the stakeholders’ needs and desires:

1. What are children’s play preferences?
2. What skills do the volunteers possess, and what skills would they like to develop further?
3. What do the community and children need, in terms of play spaces and development?
4. What are the concerns about existing or to-be-built playgrounds?
5. How would a playground benefit slum communities?



By assessing these needs, preferences, and concerns, we can utilize this feedback to create appropriate and engaging playgrounds that will benefit the whole community.

Consistent communication with the DPF was an important tool to ensure the success of our project. We conducted several meetings with DPF representatives including Kru Prateep (Founder and Director), Dr. Nom (our project liaison), and Khun Dumrong (head of the volunteer firefighters). At these meetings, we presented our progress and future plans to guarantee the project was still going in a direction they desired.

### **Children of Klong Toey**

The most influential stakeholders to our project were the children who used the playgrounds. According to Frost (2006), “A central quality in creating... playgrounds is recognizing that children’s ideas are often better than those of adults.” In order to solicit their opinions, we held three focus groups with children at the Duang Prateep Foundation School, located in Klong Toey. The approach for conducting these focus groups was similar to that in a previous IQP (Sexton, J. R., Byrne, M. C., Boucher, L. L., & Bida, O. (2003) and other community projects such as Bele Vista (Natural Learning Initiatives, 2001). Sexton et al. found that focus groups were particularly beneficial, which is why we chose to implement them into our project. We also chose focus groups because they were a playful way to engage and interest the children. The children would have tired quickly of interviews, resulting in limited and brief answers.

Approximately eight children, male and female between the ages of three and seven, participated in each of these half-hour long focus sessions. The selection of children who partook in these sessions depended on the teachers and classes that volunteered to participate. Although we divided the children into separate groups of three or four, we noticed that the group mentality influenced the individual opinions of the children. When one child said that they liked to swing, the other children quickly agreed. The children’s tendency to agree most likely influenced the data and opinions that we collected. Due to time limitations and constraints of the location, we did not talk with each child individually to confirm that others in the group did not affect their opinions. Despite this limitation in our data collection technique, we feel that incorporating the commonly agreed upon equipment will help in the creation of playgrounds that promote development of social skills.

One challenge with the focus groups was communicating with the children because they spoke only Thai. To overcome this challenge, our Thai project partners ran the sessions so that we could better communicate with and understand the children. In the focus group sessions, we asked the children to

draw their ideal play space individually. We used the term “play space” instead of “playground” to not limit their thoughts to traditional playground equipment. The children could include any toys, games, or equipment they liked to play with and were encouraged to be creative. Once the children finished drawing, we asked the students about their favorite piece of playground equipment and if they desired any specific changes to the school playground.

Our team anticipated that we might have additional difficulties when asking younger children to draw. Children below the age of four tend to lack the dexterity necessary to draw, even though they may know what they would like to express. To address this problem, we asked the three year olds and other children with unclear drawings additional questions to clarify what they were sketching.

During the focus groups, the children did not respond to general questions addressed to the group. They only responded if we directly asked them, and even then, they replied with little elaboration. In school, Thai children do not speak unless a teacher asks them a direct question. To facilitate more of a group discussion, our Thai project partners came prepared with snacks and gifts to use as motivation, inspiration, and ‘thank you’ gifts for the children participating throughout the process. The children responded positively towards the gifts and were eager share their pictures and ideas once they realized they would receive rewards.

We kept a tally during the discussions to see how many children liked each piece of equipment and took notes about any ideas they had for different equipment. We kept track of what each child drew based on their explanations, since some of the drawings were unclear. The pictures and the discussion helped us determine the equipment and types of play activities that the children most enjoy. We used the data that we collected to design engaging play equipment that the children would enjoy using.

We observed existing playgrounds, both with and without children playing on them, as another method to gain information on child play preferences and local playgrounds. Our observations included playground features such as equipment types, materials, and popularity (see Appendix C for the observation sheet). We determined the popularity by the number of children who used the equipment and the length of time spent playing. We noted the most popular equipment and compared it to the data collected from the focus groups. The observed materials used in equipment and groundcover demonstrated what materials were common and available in the area.

## **Parents and Teachers**

Parents and teachers had important insights into their children's play preferences. They also had concerns and desires for what they particularly wanted to see in the playgrounds. We used semi-structured interviews to collect their input. Most questions were the same among the interviews, though there were a few differences tailored to the recipients. Survey questions are included in Appendix D. We addressed the feedback from parents and teachers in our designs for safe and educational equipment.

## **Youth Volunteers**

Eight boys from the Firefighter Relief Youth Volunteer Group helped build and maintain the playgrounds. Khun Dumrong previously trained these volunteers on the construction of six types of equipment. We interviewed the volunteers to learn more about their background, current skill set, what they hoped to gain from the project, and their future plans (see Appendix D for the interview questions). We considered their responses when creating equipment designs to ensure that the volunteers would either practice existing skills or develop new ones during the construction process.

## **Leaders and Other Members of the Community**

Community involvement was one of the most important features for a successful project, as supported by Hata, T. (1996) (1996), who claims, "The people who live in any community are the actual key to its development and their decisions can exert the most important impact on their society." Without the community's approval and support, the playgrounds would not be used or maintained, and may even be opposed from the outset. DeVita (1997) claims that the first imperative for a successful public area (such as a playground or a park) is a strong connection to the community. Inviting community members to the Lock 23-24 playground's opening day was a method used to elicit a sense of pride and ownership over their updated playground.

The Project for Public Spaces (2008) organization also stresses the importance of meeting with the community to address any issues and concerns. We accomplished this by interviewing and talking with community leaders of the Klong Toey sub-sections in order to understand the desires of the communities. We could not talk to all (or even a majority) of the members of one community, let alone all 43, because of the limited time frame of our project. To overcome this obstacle, we determined that community leaders were an effective means of collecting the overall opinion of the community. We determined this from our knowledge of the community leaders' role to unite the community behind

collective decisions, based on input gathered from the residents. Community leaders are knowledgeable about their own communities and the people who reside within them.

We interviewed two community leaders, one from Pra-Ka-Nong where the DPF built their first playground, and one from Lock 23-24, where we installed our redesigned playground. Although we did not have the time to do more interviews, Khun Dumrong had previously spoken to most of the leaders to see which communities were interested in playgrounds and which were not. When we met with the leaders, we asked them questions to learn additional background information on community life, their desires for new playgrounds, how the community feels about playgrounds, and any observations they had on children playing, either on the street or on playgrounds. Interview questions are in Appendix D.

Our questionnaires and interviews raised community awareness and interest in the playgrounds. One question asked if the interviewee would like updates on the progress of our project and if they were interested in being involved in the planning and construction of playgrounds. This gave them the opportunity to become involved if they wished. Additionally, we worked with the DPF to publicize events such as playground openings. These events described the benefits of playgrounds and gave the community another chance to voice any additional concerns, questions, or interest in volunteering.

## Objective 2

***Create and compare design options for playground layouts and equipment based on child play preferences, material availability and cost, available space, developmental benefits for volunteers and children, and community feedback.***

During our research, we analyzed equipment and layout options to decide on new and updated designs based on the criteria listed below:

- Engaging and fun for children by incorporating play preferences
- Safe
- Develops children socially, physically, mentally, and/or creatively
- Uses inexpensive and locally available materials (straight metal pipe, motorcycle and car tires, tow straps, wood, nuts and bolts, stitching materials)
- Uses tools available at the DPF (circular saws, drill press, grinding wheels, welding torches, various hand tools)
- Provides trade skill development for youth volunteers
- Easy to replicate
- Appropriate for the community

This involved researching available materials, brainstorming design options, and finalizing playground layouts and designs. Using past research on playground types, equipment benefits, materials, and the information uncovered in interviews and focus groups, we developed a strategy and the above set of criteria by which to design safe, developmentally beneficial playground equipment. When designing, we took size restrictions, terrain type, surroundings, and other criteria into account. The team selected equipment designs that both suited the site layout and met the needs and desires of the stakeholders.

Researching available materials was critical in determining which of our designs were feasible. While we were brainstorming and comparing design options, we searched the internet and Yellow Pages for local companies from which the DPF could acquire used tires. We contacted the companies found during our research, and we posted a topic on Pantip, a popular Thai social networking website, with the aim of receiving tire donations. When companies were willing to donate tires, we arranged to pick them up with the DPF's help.

We held brainstorming sessions for new equipment designs and ideas. Based on all of the research performed, including community feedback, child preferences, and site observations, we created rough designs and sketches for new playground equipment, as well as improvements for the existing equipment that the DPF already constructed. In these designs, we attempted to incorporate our creative ideas with inspiration from existing playground equipment. Khun Dumrong was present during some of these sessions, and he had helpful feedback and suggestions for many of our ideas. Every piece of equipment we designed had identifiable benefits for the children and the youth volunteers. Each design also used materials that were locally available and inexpensive.

In order to create the layout for the Lock 23-24 community playground, we used Photoshop, scale models, and freehand drawings to re-create the playground area and potential equipment. We took measurements of the equipment and playground's size, noting ground coverings and immovable objects such as trees. We created a scale model of the area and arranged the equipment models with safety buffers. In creating the design for the Lock 23-24 playground, we wanted to ensure that the metal slide was in the shade and that there was ample seating for parents. We also wanted to maximize the number and variety of equipment within the playground to provide developmental opportunities for a large number of children.

### Objective 3

***Construct and evaluate playground equipment for safety and durability while working with the youth volunteers to develop their trade skills.***

The process of building the playground equipment began after the design phase. We selected our designs based on stakeholder and sponsor feedback, then evaluated our design options. After the youth volunteers assembled each component, we tested them for safety and functionality. We used our safety and maintenance checklist (seen in Appendix F) to inspect each piece of equipment to ensure it met safety standards. We altered any piece of built equipment that we deemed unsafe accordingly. After the equipment passed safety standards, the youth volunteers installed it at the Lock 23-24 community playground.

## **Materials**

Once we created sketches of playground equipment, the team identified material resources that were necessary to build the equipment. The team took the following course of action with the aid of Khun Dumrong, (Sexton, J. R., Byrne, M. C., Boucher, L. L., & Bida, O. (2003):

- Identified types of low cost materials
- Located sources for any needed materials
- Contacted local companies and businesses for the cost, availability, and quality of materials
- Compared information to select the best options
- Acquired materials

## **Safety Inspections**

After each piece of playground equipment was completed, the team inspected it in its entirety for anything that was unsafe for children, using the safety maintenance checklist in Appendix F. Such safety checks included ensuring that all nuts and bolts were secure, that there were no sharp edges, and that all of the materials were in good condition (e.g. not weathered, rusted, or rotting). If any item failed to pass our inspections, we explained the problem and proposed solutions to Khun Dumrong and the youth volunteers, and they made the appropriate alterations.

We also performed safety inspections on the existing playground equipment at the DPF School and Lock 23-24 Playgrounds utilizing the Safety Maintenance checklist (Appendix F). After we evaluated each site, we reported all safety issues and recommended fixes to the DPF and Khun Dumrong.

After all the safety inspections were complete, we began the installation of the equipment at the Lock 23-24 playground. The youth volunteers aided in site preparations, which involved removal of weeds and any refuse present on the property, painting the equipment, and rearranging the equipment already present on the site to accommodate new equipment. Construction and installation of the

playground equipment was a task that involved all eight of the volunteers and over three weeks to complete.

## Objective 4

**Provide the DPF and playground managers with organized, easy to read, and descriptive safety and maintenance plans for playground equipment and the general playground area.**

Without proper recurring maintenance, wear and tear will cause equipment to break, which in turn can cause children to injure themselves on the playground. With this in mind, we delegated and communicated playground maintenance and safety through use of a task list with deadlines for completion. We created these task lists to serve as a checklist to ensure that all equipment is operating safely and that the playground area is well maintained for years to come. We developed two different maintenance plans: one catered specifically to the Lock 23-24 community playground and one to playgrounds in general. In addition to these, we developed a list of instructions on how to repair common problems.

“The fundamental purposes of playground maintenance are safety, functional utility and operation ... When equipment is allowed to deteriorate, crucial parts can malfunction or break, creating a hazardous condition ... Damaged equipment is more likely to break, but what's more, a child may try to compensate for the damage and use the equipment in an unusual or unanticipated way. This would place them in danger of an accident” (Christiansen, 2002). Proper maintenance of a playground ensures that aging and use do not reduce safety.

The materials used in building playgrounds all possess properties that cause them to wear and deteriorate with time and use, which can pose serious safety risks to children using these playgrounds. “Metal can wear, bend, dent, break, warp, or corrode... wood may wear, splinter, warp, burn or scorch, crack, check, split, decay or be infected with mold, mildew and subject to insect or animal damage” (Christiansen, 2002). Damage and deterioration varies among different materials, requiring specific maintenance techniques to care for them.

With our finalized plans, we expressed the importance of maintenance and safety to the overall success and quality of the playground to the DPF and Khun Vichian, the community leader of Lock 23-24. We also posted information on safety and maintenance of the within the playground itself. These signs, written in Thai, instructed children to play safely and courteously on the playground equipment.

The finalized maintenance plans for the playgrounds were based on the safety inspection of a team of students from a previous IQP (Sexton, J. R., Byrne, M. C., Boucher, L. L., & Bida, O. (2003) and edited with additional safety requirements from the U.S. Consumer Product Safety Commission (CPSC,

2008) and Thai safety recommendations (*Health and Safety Inspection Checklist: Playground Maintenance (2000)*; Christiansen, 2002; CSIP, 2003; *Periodic Playground Maintenance Checklist; Public Playground Safety Checklist*). The finalized maintenance plans are in Appendix F and Appendix J. A set of maintenance plans specific to the Lock 23-24 community's playground is in Appendix K. We translated copies of these maintenance plans into Thai for the convenience of the DPF and Lock 23-24 community members (Appendix G and Appendix M [Lock 23-24 specific]). These maintenance plans can apply to the current playgrounds in Klong Toey as well as future potential playgrounds.



## Analysis and Results

This chapter begins with an analysis of the community we worked in and the preferences and needs of our key stakeholders, as determined from focus groups and interviews. We determined design options for playground equipment and layouts that resulted in the construction and installation of new equipment in the Lock 23-24 community playground. The chapter concludes with proposed maintenance plans to aid in the general upkeep of the playgrounds. Our findings show that the construction of safe, engaging, and durable playground equipment and layouts can benefit Klong Toey by bringing the community together, developing children, and preparing the volunteers for future careers. Providing the DPF with these findings will assist them in their goal of building 30 playgrounds throughout Klong Toey.

### **Finding 1: Communities such as Locks 1, 2, and 3 are not interested in building playgrounds, but other communities, including Lock 23-24, show a need and desire for playgrounds.**

From interviews with Kru Prateep, Khun Dumrong, and community leaders, and by exploring the area, we discovered that each of the forty-three sub-communities of Klong Toey have a head or leader, who generally makes major decisions for that particular section of Klong Toey. The leaders know the people living in their community closely, and thus can usually represent the consensus and concerns of the neighborhood.

Khun Dumrong spoke to community leaders about installing or renovating playgrounds in their area. He explained to us that certain sections, such as Locks 1, 2, and 3, are not interested in playgrounds. These communities are mostly on the less-developed side of Klong Toey. They would rather use their space for more profitable ventures, such as covered parking spaces that they can rent out. (Khun Dumrong, personal communication, January 12, 2010)

While walking through the Lock 1, 2, and 3 communities, we observed children on the streets, either playing or selling wares to passing cars and people. One child was selling offerings made of flowers and looked to be around the age of five. The other children were of varying ages. Khun Dumrong explained that in the slum, parents expected their children to help to support their families. Many children resorted to selling items on the streets; although they did not earn much income, every bit helped their family.

We did not come across any schools in this area, let alone playgrounds, but that could be due to our lack of knowledge of the location. This non-existence of playgrounds in these areas indicates that

children had no place to play other than at home or on the streets, as seen in Figure 9. Khun Vichian of the Lock 23-24 community stated that children from the surrounding five communities come to Lock 23-24 to use the playground due to not having enough space or funding to have their own. See Figure 10 for a map showing the locations of the Lock 23-24 community and the DPF. This discovery was supported by our original research (Children's Play Council, 2006; Frost, J. L., & Association for Childhood Education International. (2004); Frost, 2006; Jarrett, 2003; Pellegrini, A. (2005) that children in the slums would benefit from playgrounds because they would have a safe alternative to street play.



**Figure 9. Children in Klong Toey often resort to playing in dangerous streets when playgrounds are not available.**

This finding also supports Hata, T. (1996)'s research (1996) related to parents wanting their children to help support the family. These parents would much rather their children roam the streets selling food or crafts than play in their free time. Parents may not be aware of the developmental benefits playgrounds can provide and the importance of play in the growth of their children. Even if they did, it is difficult to support a long-term benefit like child development over short-term, immediate profits. Locks 1, 2, and 3 and various other communities within Klong Toey believe that playgrounds do not have any direct or immediate benefits that will help the living situations of the poor. They are more concerned about having enough money to survive day-to-day than having a safe place for their children to play.

Other communities, such as those surrounding Pra-Ka-Nong, Locks 23-24, and Hua Kong, are eager to install new playgrounds or update their existing ones. Located in the more developed areas of Klong Toey, these communities have established houses, businesses, and access to schools and healthcare. As these communities enjoy more stable living conditions, they can focus on long-term advantages and less on day-to-day survival. Nearly all Klong Toey schools have playgrounds, but these playgrounds are not open to the community or to children not enrolled there. Schools also have students who live in the surrounding four or five communities, which can lead to very crowded playgrounds. The DPF School, for instance, has over 200 students with an approximate playground capacity of less than 80 students with safety, space, and available equipment factored in.



Figure 10. An aerial view of the Klong Toey area, with the DPF marked in red and Lock 23-24 in blue

Based on our observations, communities with playgrounds tended to have fewer children walking the streets selling wares in the evening after school, compared to those communities that did not want playgrounds. However, it is common to see children riding bicycles or playing in the streets throughout Klong Toey. Parents and community members feel that having playgrounds would benefit both the children and neighborhood. Children will have safe places to play, and the community can use the playgrounds for gatherings, meetings, and holiday celebrations.

## **Finding 2: Children in Klong Toey enjoy climbers, swings, play houses, loose tires, and seesaws the most, but will play on other common equipment available in local playgrounds.**

The team assessed the play preferences of children through focus groups, interviews, and observations of the children at play. We conducted three focus groups, which each involved about eight children of mixed genders between the ages of three and six. During the focus groups, we asked the children questions about their favorite and least favorite equipment. A complete list of questions is in Appendix D – Survey Questions. Teachers and community leaders supplied critical feedback on the experiences of children on the playground.

Based on the children's drawings and answers in the focus groups, we established that males generally enjoyed adventurous activities and equipment that involved climbing, while females generally enjoyed swings, seesaws, and playhouses present on the DPF Playground. Both males and females expressed that they enjoyed playing with loose tires, which they could roll along the ground and chase (Figure 11).



**Figure 11. Girls playing in houses (left), boys playing on a tire strap climber (center), and tire play (right) observed at the DPF School playground.**

We encouraged the children in our focus groups (Figure 12) to think beyond what they have seen and played on in existing playgrounds. We suggested ideas such as roller coasters and merry-go-rounds to spark a wider array of responses from the children. Their responses gave the team ideas to consider when decorating playground pieces and designing in general. Some responses included mazes, trains, King Kong, butterflies, castles, mountains, swimming pools, and trees. While it would have been unrealistic to build a replica of King Kong in a playground for children, it would be feasible to adapt this idea and paint a jungle scene involving a large gorilla on the wall of a building. Ideas such as these were thus useful to our team in expanding our own imaginative boundaries when designing.





Figure 12. Focus groups with children aged 3 to 7 at DPF School.

We found that a few of the children who participated in our focus groups lacked the skills necessary to draw what they wanted on their playground. These children were around the age of three and capable of communicating their ideas through speech. Therefore, we sat with them and asked specific questions about their drawings that were useful in gathering information about child play preferences. We also found during these focus groups that the data collected was not perfect. Children tended to change their opinion to agree with one another, so although we separated the groups, some children might have had their opinions drowned out by the majority.

It was difficult to tell which equipment children preferred to play with while observing the DPF School playground. The school has about 200 children enrolled, at least 50 of which were present on the playground at the time of observation. Children may have their preferences, but in a playground with limited space and equipment, they use every piece of equipment regardless of favoritism. Children will play with whatever is available to them at the time. For example, children who were waiting to use the movable seesaw pushed around loose tires or played on the nearby slide until the seesaw became available.

Focus groups were an effective means of confirming observations and learning new information that we could not have obtained through observation alone. Children stated that they would enjoy having sandboxes, which did not exist on the DPF School playground. We also learned that more than half of the children we interviewed were hurt while playing on the equipment present on the DPF playground, although no injuries were serious.

We interviewed teachers in order to attain information related to the level of safety on the DPF Playground and to support the statements made by the children during our focus groups. A list of interview questions is in Appendix D – Survey Questions. Teachers confirmed that the injuries were from

children misusing the equipment by jumping off swings or pushing others down a slide, rather than from unsafe equipment. The only problems encountered with the play equipment were with the tow straps breaking apart from one another due to the equipment's popularity and constant stress of children playing. When asked how the children played in the playground, one teacher described it as varying and involving the use of all equipment present, which supported our observations.

When the team questioned which equipment the teachers would like to see more of at the DPF School playground, they responded overwhelmingly with seesaws. One teacher claimed that the seesaw at their playground was the most popular piece of equipment they owned, and they wished they had more than one so more children could play with them. She also asked if the DPF could provide sandboxes for the children to play in and sand surrounding the slides and swings to cushion falls.

**Finding 3: While DPF youth volunteers do not have specific career goals, they benefitted from developing trade skills and gaining more experience by constructing and installing the playground equipment.**

We learned from interviews that previously the volunteers had very limited to no training or background in mechanics. In the year or so that they have worked with Khun Dumrong and the DPF, they learned basic skills related to measuring, cutting materials to size, using hand tools, welding, drilling, and sanding. The volunteers primarily taught themselves, with training from Khun Dumrong on the use of the more complicated tools. They said that they also learned by watching others and working together.

We interviewed six of the eight volunteers individually, and they all had very similar answers. The volunteers felt like they could not build other equipment because it would either be too complicated or involve tools that they did not have access to or did not know how to use. Khun Dumrong presented the volunteers with ideas for equipment designs, and the volunteers figured out, through trial and error, how to construct the equipment. When we asked if there were any skills that they would like to develop or gain, they did not have an answer. None of the volunteers had thought about careers or what they wanted to do with the skills they learned at the DPF; they were just grateful to have an extra job besides firefighting. We were surprised that none of the volunteers had technical plans for the future. This prevented us from catering the construction of our equipment to teach them specific skill sets. Instead, we designed the equipment to further develop their general training and current skill set, as requested by the DPF.

Kru Prateep, Khun Dumrong, and Dr. Nom did not have any specific skills in mind for the volunteers either, but were hoping the experience at the DPF would help the volunteers get higher

paying jobs as skilled laborers or mechanics in the future. Kru Prateep also pointed out that due to their past experiences with drugs, a major part of having the volunteers work was keeping them busy and out of trouble.

After the volunteers completed construction of the Lock 23-24 playground equipment, we interviewed them again to determine their progress. They affirmed that they used all available tools and further practiced their skills while building each piece of equipment. The construction challenged them to a reasonable degree when building the equipment to incorporate our safety recommendations for the first time, but they claimed that it was a helpful learning experience. For instance, we worked with Khun Dumrong to develop a new design for the broken wooden swings of the Lock 23-24 playground. The improved design involved using a circular saw to cut a car tire in half. A drill press was then required to create two slots capable of threading the weight-bearing tow straps through. They had not practiced these skills prior to our design. Our designs helped teach the volunteers new skills, while encouraging them to develop their existing skills in construction.

We utilized technology as a way to develop the volunteers' skills to help them become productive members of society. By fine-tuning their technical abilities while using a wide array of available tools, we helped the volunteers improve their own lives and their community.

#### **Finding 4: Available materials such as tires, tow straps, and metal pipes effectively constructed equipment that was capable of providing developmental benefits for children and youth volunteers.**

Our design ideas for playground equipment incorporated child and volunteer development, safety regulations, and available materials. We discovered that tires are a readily available material that many companies are willing to donate. We created thirteen design ideas for playground equipment that met all of the criteria set by the DPF. Of these design ideas, Khun Dumrong incorporated our suggestions for swing improvements into the Lock 23-24 playground renovation.

#### **Materials**

The equipment we designed incorporated only materials that we could find or purchase locally. If a piece of equipment required a material that the Duang Prateep Foundation could not obtain through donation or purchase, then we eliminated the equipment from consideration. The most common materials used in our designs were tow straps, used motorcycle and car tires, straight metal pipes, and fasteners such as nuts and bolts.

The DPF initially informed us that they had access to an unlimited supply of free used tires. During a discussion of our design ideas, we learned that the DPF only possessed around twenty tires and did not have a source for more. To use tires in our designs, we had to locate a source for additional used tires. We found that, as we originally predicted, tires are a readily available resource that companies are willing to donate. They were simple, cost-efficient, and beneficial to incorporate in the design of our playground equipment. We discuss information on companies willing to donate used tires in Table 6.

The tire companies that proved to be the most useful were Michelin and NV-Yangyont. Michelin could not donate tires, but offered to donate pre-made equipment through their playground program. Michelin donates complete playgrounds that use tires to schools and communities across the world.

We traveled to NV-Yangyont, located about 15 km from the DPF in Bangkok, with two pick-up trucks and received about fifty tires, the maximum the trucks could carry. This amount was sufficient for our proposed designs, though the company offered to donate an additional fifty tires.

## **Design Options**

We determined that our proposed designs met each desired criterion outlined in the list below.

- Easy to replicate
- Safe
- Develops children mentally, creatively, physically, or socially
- Appropriate for community
- Engaging and fun for children
- Provides trade skill development for youth volunteers
- Uses inexpensive and locally available materials
- Uses tools available at the DPF

The tools available for the youth volunteers to use were two circular saws, a drill press, grinding wheels, welding torches, and various hand tools.

For example, the seesaw balance swing (refer to Appendix Q for design details) incorporates safety considerations and the children's preferences for swings and seesaws. It develops children socially and physically, while providing education about balancing. The seesaw swing would be very inexpensive to construct; the only piece that the DPF needs to purchase is the center pivot joint. Constructing the seesaw swing will develop the volunteers' skills in cutting tires and poles, working with moving joints, and securing tow straps.



We finalized our design ideas during our brainstorming sessions with Khun Dumrong. Based on knowledge gained from past research and our informed assessments, we categorized each design as being capable of providing development for children in at least one area. Thus, every design developed children either socially, mentally, physically, creatively, or a combination thereof.

Every proposed design for playground equipment is also capable of providing trade skill experience and development for the youth volunteers. When deciding on specifications, we designed the construction of the equipment to be new and challenging for the youth volunteers. Through the construction of our designs, the youth volunteers at the DPF acquired and practiced a new set of skills usable throughout their future personal and professional lives. Table 4 lists our proposed designs and the corresponding areas of development for children and youth volunteers. “Smoothing” in Table 4 refers to the use of a grinding wheel, “cutting” to the use of a circular saw, “welding” to the use of welding tools, and “drilling” to the use of a drill press.

**Table 4. Benefits for children and youth volunteers from our proposed equipment designs**

Piece of Equipment	Benefits for Children				Skills Learned by Youth Volunteers
	Social	Creative	Physical	Mental	
See-Saw Balance Swing	X		X	X	Smoothing, Cutting, Welding, Drilling
Elevated Strap Netting	X	X	X		Smoothing, Cutting, Welding, Drilling
Vertical Tire Climb			X		Smoothing, Cutting, Welding, Drilling
Double Vertical Climb			X		Smoothing, Cutting, Welding, Drilling
Stand-up Spinning Tires		X	X		Smoothing, Cutting, Welding, Drilling
Tire Hoop Climb/Platform		x	X		Smoothing, Cutting, Welding, Drilling
Strap Swing		X	X		Smoothing, Cutting, Welding, Drilling
Flat Spinning Tires	X	X	X		Smoothing, Cutting, Welding, Drilling
Maze		X		X	Cutting, Welding
Platform and Tire Swings		x	X		Smoothing, Cutting, Welding, Drilling
Tire Shapes	X			X	Drilling
Tire Train	x	X			Smoothing, Cutting, Welding, Drilling
Bridge		X			Smoothing, Cutting, Welding, Drilling

**Finding 5: Some existing playground equipment in the DPF School and Lock 23-24 playgrounds was unsafe, but it was possible to incorporate safety recommendations into designs for new equipment.**

The Duang Prateep Foundation requested safety inspections of all available equipment, which included equipment at the DPF School, the Lock 23-24 community playground, and the newly

constructed equipment built by the DPF youth volunteers. Based on our safety observations, we found that 100% of the existing equipment either purchased or built by the DPF was in need of repairs or improvements. Seventy two percent of these desired repairs were simple fixes, but we considered the remaining safety concerns to be crucial. We designed and built the new equipment with safety considerations in mind, so there were no additional safety problems that we needed to address. In our safety recommendations (see Appendix H – Safety Inspection of the Duang Prateep Foundation School Playground and Appendix I), we divided the repairs into two categories – “major” and “minor.” We urged the DPF to address the major safety problems as soon as possible because these were safety problems that could seriously injure children. We considered other less important and not immediately harmful repairs minor.

*Note: No members of the team have had training in playground safety. Our knowledge comes primarily from major playground safety guidelines set forth by the CPSC (2008), Thai safety regulations (CSIP, 2003), and from personal experiences with using playgrounds and constructing equipment. Therefore, our knowledge of safety is limited. We made our observations based on our research, and we believe that they are sufficient to account for the safety of any children using the playground equipment.*

### **Safety at the Duang Prateep Foundation School Playground**

The playground at the Duang Prateep Foundation School consists of equipment that the DPF made and purchased from outside sources prior to our arrival. The most important safety concerns related primarily to broken tow straps and loose or missing bolts for the equipment that was previously constructed. We found that broken tow straps are a common, reoccurring problem. A teacher working within the DPF School stated during an interview that as soon as they fixed one strap, another broke due to the stresses children put on them during play. Khun Dumrong also stated that they were the most frequently repaired part of any piece of equipment. Figure 13 shows the tire strap climber with missing bolts and broken straps. The picture also shows one of the center straps hazardously attached to a tire due to its initial fastening to a side pole breaking. We observed that within three weeks, the damage to the tire strap climber significantly increased due primarily to a number of missing bolts.

Another recurring and important safety concern was protruding bolts. Bolts that extend beyond the nut can scrape or impale children or catch their clothing (CPSC, 2008). Figure 13 shows a protruding bolt on the underside of the netting of the cube climber. The tire strap climber also possessed several bolts of hazardous lengths.



Figure 13. The tire strap climber has major safety concerns with missing bolts and broken straps (left), as does the cube climber with a protruding bolt on the underside of the climbing net (right).

Up to two hundred children can play on the equipment of the DPF School playground in one day, which explains the wear and tear that the equipment undergoes. The wear on the equipment purchased for the playground shows that children use each piece frequently, especially the slides. The major safety concerns of the slides were unsecured or missing wooden boards for platforms and stairs. The single slide had loose, splintered stairs and broken floorboards. The Mickey Mouse slides had similar issues with missing and splintered floorboards. Pictures of both slides are in Figure 14. Loose and unsecured stairs are dangerous because children can trip or fall backwards while trying to climb up to the slide. The missing floorboard was a major concern because it was located on the second level of the slide, approximately 2 meters above ground. Children could easily fall through or get stuck in the gap created by the missing wooden plank.

We observed that approximately half of the children wear flip-flops or sandals while running around the playground. Large splinters are capable of piercing through thin sandals. Young children also tend to use their hands when climbing, so the stairs should ideally be secure and smoothed of splintered areas to ensure safety.



Figure 14. Major safety concerns on the single slide include loose and broken stairs (left) and missing or cracked floorboards on the Mickey slides (right).

Water from heavy rains could pool within the tires of the climbers and swings, creating an ideal breeding ground for mosquitoes and an unhealthy temptation for young, active, and thirsty children. Rusting and peeling paint were concerns with almost every piece of equipment. Rust deteriorates metal, compromising its integrity and strength. The paint used was non-toxic and not harmful to children and provided a protective coating to the metal by preventing weathering and rust. The moveable seesaw had broken decorative spokes on the tires with sharp edges and a poorly lubricated center joint.

The DPF was not surprised when we presented them with the results of our safety observation. They were aware of some of the problems, namely the broken straps and missing bolts, but not of the minor concerns. They thanked us for helping to make their playgrounds and equipment safer for the children and asked us to perform an additional inspection of the Lock 23-24 community playground.

### **Safety at the Lock 23-24 Community Playground**

The playground in the Lock 23-24 community (Figure 15) was comprised of equipment purchased by the community. We inspected this playground throughout its remodeling process. The major safety concerns related to the spinner, stationary seesaw, swings, and metal barrel climb present on the playground comprised of 28% of total safety concerns.

Floods plagued the playground due to its location alongside a canal. With this location came additional concerns relating to ball-play and a desire for netting surrounding the perimeter of the playground to prevent the loss of loose equipment. The Recommendations Chapter further discusses this matter, as well as that of a roof.



Figure 15. The Lock 23-24 community playground in Klong Toey, Bangkok, prior to its renovation

We found during our initial inspection that the spinner was missing a wheel atop it that was vital to its functionality. Without this wheel, children did not have a handle and could not successfully spin themselves on the center pivot. The seats of the spinner were insufficiently secured and wobbly at the base of the device. The combination of these two concerns made the piece of equipment useless until repaired. The stationary seesaw created another major safety concern. The center pivot of all four seesaws wobbled and fit poorly, which prevented the seesaws from moving up and down in a smooth, aligned manner. In addition to this, all of the seats on the seesaw contained bolts that extended too far beyond the nut beneath the seat and were capable of catching a child's shirt or shorts as they sat down.

The swings on the Lock 23-24 playground posed additional major safety concerns. Two of the swing's seats were broken where the bolts held the wood to the chain, mostly likely due to excessive use and weakened weathered wood. The remaining two swings showed similar signs of weather wear, but posed no risk. We discovered a large hole within the bottom of the metal barrel climb caused by corrosion. This could pose a risk of injury if a child were to get a finger or foot caught within the sharply edged hole. The only remaining major safety concern was with the metal slide. Due to the location of the slide on the playground, the heat of the sun caused the metal of the slide to become excessively hot. This posed the potential risk of burning children who may use the slide during the daytime.

Minor concerns comprised the remaining 72% of total safety problems, most of which were exposed footings. The remaining problems included peeling paint, rusted surface features, splintered seats, missing caps on the ends of pipes, and inadequately lubricated moving parts. The volunteers addressed and fixed 75% of the major safety concerns prior to the re-opening of the Lock 23-24 community playground, and they scheduled to fix the other problems later. A complete, detailed list of the safety inspection along with pictures and recommendations for improvements is in



### Newly Constructed Equipment

The DPF and the fire fighter youth volunteers labored for weeks to build new equipment to install in the Lock 23-24 community playground. The equipment they built for the final layout of the playground consisted of one tire strap climber, two tire swings, two movable seesaws, and one climber with hanging handles. The DPF asked us to perform safety inspections on all of the built equipment prior to installation, and we found only two minor safety concerns.

Using a new method, the youth volunteers connected the straps of the tire strap climber with the use of thick needles and nylon thread. They stitched a square pattern on the cross-section of the straps, which successfully held them together as seen in Figure 16. They combined this with an additional method that involved stitching the corners of this cross-section for added support, thus decreasing the chance for the straps to tear apart at the corners. This method is also in Figure 16. We found these methods to be effective and far safer than the previous method that used a single nut and bolt positioned at the cross-section of the two straps.



Figure 16. Square stitching method (left) and corner stitching method (right) for stitching tow straps together.

The tire swings also used tow straps as a weight-bearing device on which we attached the tires. The volunteers stitched the straps around the upper metal bar support of the swing using the corner stitch method. We found this method met safety standards and did not impede with the functionality of the swing. The tires themselves lacked holes for proper drainage, but the volunteers scheduled to fix them when tools became available.

The two movable seesaws similarly met safety standards once we addressed all minor problems. When we inspected them, the seesaws were lacking proper seats and cushioning between its seat and the ground. The volunteers constructed and fixed the seats prior to opening day, but scheduled the

installation of the buffer between the seats and ground for later. The climber with hanging handles possessed no major or minor safety concerns other than final positioning on the playground itself, which we discuss in the next section.

**Finding 6: The new layout for the Lock 23-24 playground addressed the developmental and safety needs of the community by using a safer layout and a greater variety of equipment.**

The Lock 23-24 community playground lacked a safe, efficient layout. We found that due to a lack of space, not all of the fourteen available pieces of equipment listed in the following Equipment Considerations section could be included in the new layout safely. We also found that we needed to include buffer zones when placing the equipment to ensure enough safe space for the children to play. An interview with the community leader, Khun Vichian, gave us invaluable insight into the concerns that the community had about the playground.

**Equipment Considerations**

We designed a layout for the Lock-23-24 community playground using scale models of equipment available on the playground as well as newly built equipment from the DPF. The new layout considered the use of the following equipment (described in Appendix R):

- Metal Barrel Climb
- Swings
- Large Metal Climb
- Metal Slide
- Stationary Seesaw
- Metal Tube Tunnel
- Metal Spinner
- Half Circle Climb
- Tire Strap Climb
- Tire Swings (2)
- Moveable Seesaw (2)
- Climber with Hanging Handles

Based on our safety inspection of the playground, we determined that all of the existing playground equipment needed repairs, and we addressed most repairs prior to Opening Day. The swings, tire swings, and the metal slide required safety buffers of at least 2m, which limited their potential placement within the playground.

We narrowed our equipment considerations greatly due to space constrictions and the features discussed in Table 5. This table lists each piece of equipment considered for Lock 23-24, along with characteristics such as dimensions and child capacity. We determined capacity and popularity based on child observations, focus groups, and interviews with teachers and community leaders. We do not have measurements for the metal spinner and stationary seesaws because we initially did not plan to include

them in the final layout. We referred to this table when deciding which equipment to include in the layout.

**Table 5. Characteristic comparison of Lock 23-24 playground equipment**

Equipment Name	Measurements	Capacity	Safety Concerns	Popularity	Size
Metal Spinner	--	4	Yes	Med-High	Small
Seesaw (movable)	0.9m x 2.1m	2	No	High	Movable
Tire Swings	1.25m x 4.45m	4	No; 2m front and behind	Med-High	Large
Half Circle Climb	0.95m x 2.85m	2-6	No	Medium	Narrow
Tire Strap Climb	1.4m x 3.8m	10+	No	High	Large
Metal Tube Tunnel	0.75m x 2.5m	1-2	No	Low	Small
Seesaw (stationary)	--	8	Yes	Medium	Large
Metal Slide	1.35m x 2.6m	2	No; 2m front; shade	Med-High	Narrow
Large Metal Climb	1.7m x 3.1m	10+	No	High	Large
Swings	1.8m x 4.15m	4	Yes; 2m front and behind	High	Large
Metal Barrel Climb	0.45m x 1.9m	1-2	No	Low	Small
Hanging Handles	1.2m x 2.4m	2-4	No	Medium	Medium

### Layout Considerations

Khun Vichian, the leader of the Lock 23-24 community, asked that we construct a roof to cover part of the playground. Children and adults, she said, would be more likely to go to the playground if it were shaded. She explained that a roof could protect the metal parts of equipment from overheating in the sun and the children. A roof could also provide cover during events such as holiday parties or community gatherings.

Khun Vichian's other major concern was that the existing fence did not prevent soccer balls and badminton birdies from falling into the canal alongside the playground. The children could not afford to continue replacing lost equipment, which discouraged them from coming to the playground. She recommended using a net above the fence. When we designed the new layout for the Lock 23-24 playground, we considered her two suggestions but could not implement them due to budget



constraints. Plans for a possible roof and net for the Lock 23-24 playground in the future are in the Recommendations Chapter.

We presented our initial layout ideas to Khun Dumrong prior to redesigning the Lock 23-24 playground. Based on the measurements taken during our initial safety inspection, we created scale models of the playground area and equipment. Khun Dumrong worked with us to arrange the scale models to incorporate safety barriers between pieces and maximize available space. The initial layout is in Appendix O. We used 13 out of 14 available pieces of equipment, excluding only one tire swing. The stationary seesaw and metal spinner remained positioned on the elevated cement area near the community spirit house seen in Figure 17.



Figure 17. Cement area between football field and grass of Lock 23-24 playground.

### Final Layout

Unforeseen problems arose with the arrival of the additional tire swing on Lock 23-24 property along with the anticipated new equipment. The community was unwilling to remove a piece of their own equipment to accommodate the new tire swing. We created a new final layout with the aid of several community members and the youth volunteers and attempted to optimize use of the available space while retaining safety buffers around the swings and slide. The final layout incorporated all 14 available pieces of equipment and is in Appendix P.

The youth volunteers repaired 75% of the major safety concerns prior to the playground opening. Although the equipment placement is not ideal, it was the best that the team could accomplish under the circumstances. Figure 18 shows the final positioning of the gravel area. The metal tube climber and metal barrel climber are too close together, similarly, the hanging handles are too close to the fence and other equipment.



Figure 18. Final positioning of the tire swings, metal barrel climb, and metal tube (left) and the hanging handles (right).

The grassy area alongside the gravel area contained the large metal climb and metal slide in the final layout. Final positioning of this equipment is in Figure 19. The metal slide did not have two meters in front, and the children could fall right into the large metal climb at the end of the slide.



Figure 19. Final positioning of the metal slide (left) and large metal climber (right).

The larger grass area contained the tire strap climb, half circle climb, and swings. The center of the playground held the tire strap climb and half circle climb, which fit ideally with no potential surrounding hazards. The only drawback was the lack of shade within the area only solvable by a roof, which the DPF could not afford at this time. The final positioning for the tire strap climb, half circle climb, and swings are in Figure 20.





Figure 20. Final positioning of swings (left), tire strap climb, and half circle climb (right).

The volunteers positioned the stationary seesaw, metal spinner, and two movable seesaws on the cement area at the beginning of the football field. We previously considered the cement area as off-limits in our initial designs due to equipment interfering with sports activities and cement being a substandard playing surface. We later discovered that the community intended these pieces stay within this area, so we incorporated them in our final design. As long as the seesaws have appropriate buffers between their seats and the cement beneath them, these pieces are safe for that area. The final positioning for the stationary seesaw, metal spinner, and two movable seesaws are in Figure 21.



Figure 21. Final positioning of metal spinner, movable seesaws (left), and stationary seesaw (right).

### Opening Day of the Lock 23-24 Playground

The DPF and the Lock 23-24 community set the opening ceremony for the new playground on February 20, 2010. The Mr. Thomas B. Wells Charitable Fund sponsored this playground. Over sixty children and forty adults from the community came. Mr. Wells, Kru Prateep, the volunteer fire fighters, and dozens of other representatives from the DPF and surrounding communities also attended (Figure 22). During the opening ceremony, there was a demonstration by the volunteer firefighters on how to

extinguish a gas fire in the household. In her opening remarks, Khun Vichian stated that this playground would not only benefit the Lock 23-24 community, but also the other five communities surrounding it. Children in these communities lack the space to play due to the increasing number of families in the area, and so this playground is vital to their healthy development. The playground at Lock 23-24 will keep their children busy and help protect them from the dangers of drugs.



Figure 22. Children and adults gathered for the opening of the playground on February 20th, 2010.

Based on our observations, everyone seemed happy and excited with the new addition to their community. Nearly every child played on the new equipment, especially the tire strap climber, swings, and movable seesaws. We asked six children how they felt about this new playground; they agreed that, “This playground is much better than the old one.” They preferred the new equipment because it was “more fun.” We interviewed three parents who said that the new playground “looked safer” than the old one, namely the swing set, whose old seats were made from metal and wood. One child claimed that the old metal and wood swing hit him in the head in the past, requiring stitches. He said that the new swings were much better and would not cause him further harm. A comparison between the old and new swings is in Figure 23. One parent stated that her children do not have to fight each other to play anymore; there was now enough space for everyone.



Figure 23. The new swings (left) were an improvement upon the old swings (right).

**Finding 7: The DPF and Lock 23-24 community did not have a method for maintaining their playgrounds but expressed a need and interest in a plan to facilitate general upkeep and safety repairs.**

The team found, based on interviews with community leaders and members of the DPF, that there was a desire for a maintenance plan for community and school playgrounds. Volunteers maintained the community playgrounds by picking up trash and keeping the general area clean. They had little knowledge of how to maintain and repair the playground equipment. For instance, upon our arrival we observed a man who was cleaning up the Lock 23-24 playground. The man deliberately “fixed” a broken swing by placing the broken board of the seat onto the metal chain. If a child were to sit unknowingly on the seat of this swing, they would fall through and onto the ground. Broken and unsafe equipment, such as the swing set and metal spinner at the Lock 23-24 playground, were left alone onsite because the community volunteers did not know how to make repairs. This illustrates one relation between technology and society that is true worldwide. Though the general community knows how to use the playground technology, they do not usually have the knowledge to maintain and repair it. In order to sustain playgrounds, the community should have at least basic knowledge (or access to an expert) on repairing equipment.

Based on our observations of three playgrounds throughout the Klong Toey communities, we determined that every playground we encountered was in need of maintenance and safety repairs. This was even more evident based on our safety inspections. Regular playground maintenance can reduce the need for equipment replacement and repair and significantly reduces safety hazards (CPSC, 2008). Equipment can deteriorate to the point of becoming unsafe due to lack of regular maintenance. We address many common safety concerns in our maintenance plans, as well as how to fix them.

We provided a maintenance plan in Thai to Khun Vichian, the community leader of the Lock 23-24 playground. Pleased, she stated that it would help their community greatly. This maintenance plan included a simple checklist of items and a timeline explaining how often to conduct these safety and maintenance checks. The plan noted specific playground hazards, as well as the safety of specific equipment. For example, the playground was alongside a canal, requiring it to have a wall and high fence around its perimeter to prevent children from falling into the river. According to Khun Vichian, the wall is not high enough to prevent the river from overflowing into the playground during heavy rainstorms. We designed our maintenance plan to aid in the area’s recovery in the event of the playground flooding. The finalized maintenance plan for the Lock 23-24 community playground is in

Appendix K – Safety & Maintenance Checklist for Lock 23-24 Playground in English and Appendix M in Thai.

The team developed an additional maintenance plan that could apply to future playgrounds built by the DPF. It consists of safety and maintenance checklists for a variety of equipment that could appear in a future playground, along with the general playground area maintenance and instructions for equipment repairs. Though this manual does not contain site-specific information and may not be applicable to every piece of equipment, it is general enough to apply to many areas. Future users can add new sections for different equipment based on the existing sections' contents and layout. Our finalized general maintenance plan is in Appendix F (English) and Appendix G (Thai). Maintenance plans for the routine maintenance of the playground are in Appendix F (English) and Appendix J (Thai).

## Conclusions and Recommendations

In this chapter, we give readers a summary of our key findings and provide recommendations to the Duang Prateep Foundation for future improvements for playground design, safety, and maintenance. Through our research, we learned the preferences and needs of our key stakeholders and how to incorporate this into our playground designs. We describe thirteen recommended pieces of equipment for the DPF to build and incorporate into their future playground designs. We supply recommendations to improve the safety of the existing DPF School and Lock 23-24 Playgrounds. Finally, we recommend a maintenance plan to help with the upkeep of the playgrounds in the future. We based these recommendations off our findings that we analyzed in the previous chapter.

### Summary of Key Findings

We developed the following three conclusions based on our observations and research. Playgrounds and the construction of playground equipment benefit the sub-communities, children, and DPF's youth volunteers of Klong Toey. All of the existing equipment we inspected had safety concerns, but it was possible to incorporate safety recommendations into new equipment designs and layouts. Finally, the DPF and communities of Klong Toey did not have maintenance plans, but showed a need and interest in keeping their playgrounds safe, maintained, and up-to-date.

#### **Conclusion 1: Playgrounds and the construction of playground equipment benefit the sub-communities, children, and DPF's youth volunteers of Klong Toey.**

Through focus groups and interviews, we learned that six sub-communities expressed an interest in installing playgrounds. However, several other communities preferred to use any open space for more profitable ends, namely covered parking that they could charge drivers for. We also learned what children desired on the playground through our focus groups, observations on the playground, and interviews with their parents and teachers. We referred back to these preferences when we designed equipment. The construction of our designed equipment helped the youth volunteers develop trade skills that would aid them in their future careers.

#### **Conclusion 2: All of the existing equipment we inspected had safety concerns, but it was possible to incorporate safety recommendations into new equipment designs and layouts.**

We performed safety inspections on the existing equipment at the DPF School and the Lock 23-24 Community. We found that all existing equipment had safety concerns, but not all of them required immediate attention. We separated the safety concerns into major and minor concerns, and found that 28% of the problems we found were major. 37% of the equipment inspected was broken and needed



repairs. We incorporated the safety concerns found into our new equipment designs in order to prevent future safety problems from arising. When we designed the new layout of the Lock 23-24 Community playground, we gave each piece of equipment buffer zones for additional safety.

**Conclusion 3: The DPF and communities of Klong Toey did not have maintenance plans, but showed a need and interest in keeping their playgrounds safe, maintained, and up-to-date.**

The equipment in sub-communities such as Lock 23-24 was deteriorating and breaking due to a lack of maintenance. This causes safety concerns and sometimes injuries to the children playing on this equipment, so we formed maintenance plans in order to prevent this from occurring. We made maintenance plans for both specific equipment and for playgrounds in general. This ensured that even when they build new playgrounds in the future, the DPF and communities will still have a general safety checklist that they can use to keep their playgrounds up-to-date.

Based on these conclusions, we formed a set of recommendations for the Duang Prateep Foundation and sub-communities within Klong Toey with the purpose of designing and maintaining future playground equipment, and keeping playgrounds safe and up-to-date. We also formed a contact list for the DPF to use for acquiring materials in the future. We presented these deliverables to the Duang Prateep Foundation in a final report.

**We recommend 13 beneficial designs for future playground equipment.**

Based on our findings about the needs of the communities and youth volunteers, child play preferences, and available materials, we recommend that the DPF incorporate any of the following thirteen designs for equipment into their future playgrounds. We recommend these thirteen ideas because they each incorporate the DPF's originally set criteria on page 23, the communities' desires and needs, the play preferences of Klong Toey children, and DPF volunteer skill development.

Khun Dumrong saw these designs and affirmed that he could teach the youth volunteers how to build each one. The DPF has a large enough supply of materials to build most of these designs and is capable of acquiring more materials, if necessary. We have also provided a list of tire companies who expressed interest in donating used tires to the DPF (see Table 6 on page 57). The designs integrate safety considerations and should not need any major safety improvements upon completion of construction.

1. Seesaw Balance Swing
2. Elevated Strap Netting
3. Triangular Vertical Tire Climb



4. Double Vertical Climb
5. Stand-up Spinning Tires
6. Tire Hoop Climb and Platform
7. Strap Swing
8. Flat Spinning Tire
9. Maze
10. Platform and Tire Swings
11. Tire Shapes – Pyramid, Cube, Tetrahedron
12. Tire Train
13. Bridge

We hope these designs will help the DPF accomplish their goal of creating thirty playgrounds throughout Klong Toey that use safe, educational, and enjoyable equipment.

#### **We recommend the following safety and general improvements.**

The results from our safety inspections of the Duang Prateep Foundation School and the Lock 23-24 Community Playground showed that every piece of equipment had safety concerns, and 37% of the equipment had parts that were broken or working improperly. We developed recommendations in order to address these safety problems. Our recommendations stem from playground safety guidelines described by the CPSC (2008), as described in Safety section of our Background Chapter. Implementing our recommendations will also enhance equipment durability. More detailed safety recommendations organized by individual piece of equipment are in Appendix H and Appendix I.

#### **Major Equipment Safety Concerns**

**Broken Fasteners.** Broken fasteners on the tire strap climbs were the most common safety problem. We have a variety of recommendations to fix and improve the methods for securing tow straps together. Metal fasteners are the strongest, but can get hot in the sun and rust. Certain types of fasteners are not strong enough, so we recommend fasteners that will not allow the straps to pull apart. Stitching the straps together is a weaker alternative, but stronger threads and a different pattern can improve the stitching. Industrial sewing machines could provide extra strength that hand sewing cannot, but overall sizing of the net pattern must be determined prior to using these machines.

An alternative idea that we recommend is using knots. The constrictor knot is strong and will only tighten when the straps are pulled on (WebKnots, 2010). The drawback to using knots to make a climbing net is that it may be difficult to replace broken straps in the middle of the net. There was also

concern with whether the knot would work properly or be strong enough using flat straps. Out of these options, we recommend using knots or metal fasteners because they are stronger and will last longer than stitching alone.

**Protruding Bolts.** Protruding bolts can catch loose clothing or injure children. We recommend that shorter bolts replace those that extend 2 threads (or 1/8 inch) beyond the nut or cut longer bolts down to size.

**Broken & Worn Tow Straps.** Broken tow straps were a common safety concern on the popular tire strap climbers at the DPF School Playground. We recommend replacing these broken straps immediately. On the climbers especially, one broken strap will add extra strain on the other straps and make them more likely to break. We recommend that playground attendants or inspectors frequently test the worn straps for weight capacity and durability. Replacing a worn strap before it breaks is safer than waiting for the strap to break while a child is climbing on it.

**Unsecured Pieces of Equipment.** Loose parts of equipment can lead to children falling off balance or being injured. We recommend properly securing loose pieces, especially the seats on the seesaws and stairs to the slides by tightening all bolts and replacing any missing fasteners. Reattaching the metal side frames with new bolts can secure the seats of the swings at the Lock 23-24 playground. Swings made from tires can also replace broken wooden seats.

**Cracked, Splintered, & Broken Wood.** The wooden stairs and platforms of the slides at the DPF School playground were in substandard condition. We recommend replacing cracked and missing boards. Sand splintered wood down and paint it to seal and protect it from weathering.

**Sharp Edges.** We recommend smoothing down or covering all sharp metal edges. The edge of the slide at the Lock 23-24 Playground came loose from its side fastener. Fix this by gently hammering down the dent in the slide and inserting the metal back into the side covering. Sandpaper or a grinding wheel can smooth down other sharp edges.

#### **Minor Equipment Safety Concerns**

**Rust & Paint.** We found small areas of rust and weathering on some equipment. The easiest way to fix this is to sand off the rust, using a grinding wheel or extra-strength sandpaper. Fix holes caused by major rust, such as the one in the Metal Barrel Climb in the Lock 23-24 Playground by welding another piece of metal to cover the opening. Repaint all exposed metal with non-toxic paint.

**Water Pooling in Tires.** Stagnant water can pool within open tires, such as those in the tire swings or tire strap climbers. We recommend drilling or cutting a small hole in the bottom of the tire to allow the water to drain. Small holes will not interfere with the structural integrity of the tires.

**Exposed Footings.** Exposed equipment footings are trip hazards that are avoidable by burying the footings. This will additionally provide stability to the equipment by securing it into the ground.

**Metal in the Sun.** The metal slides get very hot during the day and could burn children while they play. Replacing the metal with another material or applying a protective coating would be expensive, but another alternative is to keep the metal shaded by trees or under a roof. We recommend that adults check slides by hand prior to children's use to ensure that the slide is not too hot.

**Lubrication.** Any equipment with moving joints, such as seesaws, should move freely and smoothly. We recommend regularly lubricating these joints. Proper lubrication extends the lifetime of the joints, reducing noise while ensuring that the equipment is functioning properly.

**Open S-Hooks.** Open hooks, such as those on the Lock 23-24 Playground swing set, can catch loose clothing. A simple fix is to pinch the hooks closed with pliers.

### **General Playground Improvements**

**Shade.** Based on our results from focus groups and interviews, we recommend installing roofs or planting trees to provide shade on playgrounds. Roofs can be as simple as a tarp tied to four poles or to a building. Trees are another way to provide shade and incorporate natural elements into the playground design. Shaded areas will encourage children to use the playground during the hot and sunny afternoons. The community can also use these areas for celebrations or events on the weekends. Shade helps maintain painted finishes and prevent weathering of equipment. Based on our research, the cheapest materials for roofs are tarps or plastic netting, both of which are locally available in Klong Toey.

**Ground Cover.** From our safety inspections, we concluded that the playgrounds had unsafe ground covers of concrete, dirt, or grass. We recommend that the DPF use sand or pea gravel in playgrounds because it is cheap, easily available, and will cushion falls better than the current ground coverings. The drawback to using sand is that it can be hard to maintain and may wash away with heavy rain. Gravel is less difficult to maintain and less likely to wash away, though it does not provide the best cushioning. If funding is limited, the most important areas to cover in sand are under swings, in front of slides, and

other areas where children commonly fall. Other alternative ground covers, such as recycled rubber, provide better cushioning but are more expensive and harder to obtain in Klong Toey.

**Water Fountains.** From our observations, we noted that children lacked nearby sources for water. We recommend that future playgrounds incorporate the use of water fountains into their designs, if budgeting allows. The climate in Thailand can leave children dehydrated in a matter of minutes when playing, making easy access to water a great benefit for playgrounds full of active children.

**Safety Zones.** We recommend using safety zones or buffers between each piece of equipment. Two playgrounds we observed had equipment placed very close together. Equipment surrounded by safety zones of approximately 2 meters will be safer for children running around or falling off equipment. Fewer pieces of equipment will fit within the playground, but the playground will be much safer overall.

**We recommend a maintenance plan to organize, schedule, and follow through with the general upkeep and safety repairs of each playground.**

Our results showed that communities and the DPF did not have a concrete or specific way to check on the safety or maintenance of the playgrounds. Based on this finding, we recommend that the DPF implements and utilizes a maintenance plan for their playgrounds to prevent equipment breakage. Our maintenance plans have easy to use instructions and check lists so that a schoolteacher, parent, or community volunteer could complete it without previous safety training. The maintenance plans include a suggested timeline for how often to check the playgrounds and instructions on how to address and repair common problems.

The playground general safety and maintenance checklist (Appendix G) includes general hazards, specific equipment hazards, and surrounding area and protective surfacing concerns. General hazards include components that can be present in a variety of equipment pieces, such as bolts, straps, welds, and joints. Specific equipment hazards include items that are present on specific pieces of equipment such as seats, seesaw cushioning, and swing chains. Surrounding area and protective surfacing covers what remains of the playground. Roots, rocks, litter, trees, and specific requirements for surface material are included there. A trusted community member should carry out inspections at least every three months to ensure that the playground is in safe operating conditions. Depending on the amount of use, some playgrounds may need more frequent inspections. Document and report all problems to the Community Leader or DPF for necessary repairs.

We developed a list of recommendations for repairs (Appendix N) to address any common problems encountered during routine maintenance checks. Repair these problems as soon as possible to

ensure playground safety. The DPF possesses tools capable of performing many of the tasks listed and should be contacted in the event a repair is needed. For more complicated repairs not addressed in Appendix N, contact Khun Dumrong at the DPF. Complete maintenance plans in both English and Thai and a repairs list in English are in Appendix F, Appendix G, and Appendix N, respectively.

We recommend maintenance plans tailored specifically to each playground. This will allow for maximum safety considerations. Specific tailoring could relate to the types of ground cover, the surroundings of the playground, the specific equipment present, and the number of children that utilize the area.

We developed an area-specific maintenance plan for the Lock 23-24 community playground incorporating these considerations. We added and subtracted details from the general safety and maintenance checklist in Appendix F based on present equipment and the area in which the playground is located. The safety and maintenance checklist for Lock 23-24 community playground is in Appendix M.

*Our maintenance plans were developed using information gathered from the CPSC and various other sources (Health and Safety Inspection Checklist: Playground Maintenance (2000); CPSC, 2008; Sexton, J. R., Byrne, M. C., Boucher, L. L., & Bida, O. (2003); Public playground safety checklist). If necessary, consult these sources for additional information.*

**We recommend for the DPF to stay in contact with the following companies and organizations for future assistance and support in building new playgrounds.**

As the DPF wants to continue building new playgrounds in the future, we have a list of organizations that we recommend contacting for support. We realized that the DPF did not have access to some sources needed for building playground equipment, so we provided the DPF with sources for used tires, design ideas, and safety guidelines.

In order to continue building playgrounds, the DPF will need a larger supply of tires. NV-Yangyont, the company that donated fifty tires to the DPF, said they are willing to donate more free tires in the future. To foster this relationship, we recommend the DPF send ‘Thank You’ cards that include pictures of the equipment built using the donated tires. NV-Yangyont intends to post the note and pictures on their website, showing their involvement in the community and generous donation to charitable foundations, and the DPF can receive free tires that are necessary for their equipment designs. Table 6 lists other companies that were willing to donate used tires. We recommend staying in contact with most, if not all, of these companies so that the DPF will have a sufficient supply of tires for

future playgrounds. It will be easier to acquire a certain type of tire with twelve different contacts as opposed to just one company.

**Table 6. Contact information for companies willing to donate tires.**

<b>Company Name/Address</b>	<b>Telephone Number</b>	<b>Fax Number</b>
Michelin(Thailand) <sup>†</sup> Siam Michelin Co., Ltd	0-2793-6900 0-2619-3000	0-2619-3179
Kasemyont Supply 629/14-6 Jarunsanitwong Bangkhoontiean Bangkoknoi, Bangkok	0-2882-4460 to 63	-
Ha-Thai Yangyont 9,11,13 Mitrijitr Pomprabsuttrupai, Bangkok	0-2221-8452 0-2221-0850 0-2221-0838	0-2623-1793
Sahayangyont (Yangchareon) 618 Luang Road Pomprabsuttrupai, Bangkok	0-2222-3447	-
Wuttana Ramkhamhang 30,32 Ramkumhang Saphansoong, Bangkok	0-2729-3415 to 16 0-2322-4429	-
Dumrong Yangyont (Pure) 453 Mitrijitr Pomprabsuttrupai, Bangkok	0-2222-3789 0-2623-2042 0-2223-8014 0-2221-4726	0-2226-3806
Tuntirat Company 1014-20 Pattanakarn Suanluang, Bangkok	0-2318-2895 0-2314-6757 0-2318-2892 to 93	0-2319-4312
NV-Yangyont	08-5433-4554 08-6308-1452	0-2326-6374
Ninto Company	0-2722-4535 08-4133-1456	-
Suwan Karnyang Service 457/353 Soi Wutjannai BangKlo Bangkorlhome, Bangkok	08-6614-3327	-
Banmai Auto-Service Klongsan, Bangkok	0-2437-1165 0-2862-4565	-
Luck 888 Company Susapiban 1 Bangkai, Bangkok	0-2802-6868 to 69	0-2802-6862
Pattanayont Karnchang Ngarmwongwarn Road, Bangkok	0-2589-6396 0-2589-1278	-
Dunlop Thailand <sup>†</sup>	0-2329-0111	0-2329-0809
Cherry Group(Thailand) .LTD <sup>†</sup> Rama II Bangmod, Bangkok	0-2450-0008 to 09	-
CG Soon-400 <sup>†</sup> Bangken, Bangkok	0-2519-4042 0-2519-4299	0-2519-4011

Note: <sup>†</sup> denotes companies that requested more information or a copy of our proposal before agreeing to donate tires.

Michelin has a program where they donate a completed playground with equipment made from their used tires. We recommend utilizing this program to build one (or more) of the playgrounds. To

apply for a playground, the DPF must send a letter describing their organization, goals, why the area needs a playground, and how it will benefit the community.

The GoPlay! Organization builds school playgrounds from inexpensive, local materials in Northern Thailand, Laos, and Burma. Their focus on using local workers to build safe, age-appropriate, and fun playgrounds is very similar to the DPF's goal. One of the members of the organization, Marcus Veerman, offered to work with the DPF to build more playgrounds, share equipment ideas, and have official safety inspections of the equipment. We recommend that these two organizations work together towards a common goal. They have built 26 playgrounds in the past two years, so their experience could only help the DPF with their future plans. Below is contact information for the GoPlay! Organization and Mr. Veerman, specifically.

	<b>GoPlay! Organization</b>	<b>Marcus Veerman</b>
Email	<a href="mailto:info@playgroundideas.org">info@playgroundideas.org</a>	marcusveerman@gmail.com
Phone	0896443701	0834389289
Website	<a href="http://playgroundideas.org">http://playgroundideas.org</a>	<a href="http://picasaweb.google.co.th/marcusveerman/">http://picasaweb.google.co.th/marcusveerman/</a>

If the DPF plans to build new pieces of equipment, we recommend that they consult either the Ramithibodi Hospital or the CPSC websites for more detailed and in-depth versions of our safety guidelines. The former website is in Thai, and the latter in more detailed, but in English. This will help ensure that the equipment is safe.

## **Long-term Implications of Playgrounds for the Communities**

We hope that the people of Klong Toey will share long-term benefits from the playground that we redesigned and any future playgrounds built with our proposed equipment. Though we only improved one playground, this will directly affect the Lock 23-24 community as well as residents around Lock 23-24 that use the playground. Children will grow up with a safe place to play that also provides physical, social, emotional, and mental development. If the DPF builds thirty playgrounds throughout Klong Toey, children in each community will have access to a nearby playground and the accompanying developmental benefits. The youth volunteers also benefitted from our designs. Constructing the equipment gave them a paid job that helped develop their trade skills. We hope that this will assist them find future technical careers.

The DPF will directly benefit from our findings and recommendations, though other organizations that plan to build playgrounds, especially in urban slums, might find the information interesting and useful. The GoPlay! Organization has expressed interest in working with the DPF. Putting these two organizations in contact with each other will hopefully foster a long-term relationship in which both groups would help one another.

## **Questions for Future Research**

*Do all children have the same preferences for playground equipment?*

It would be beneficial and interesting to see if children in areas outside of Klong Toey also favor seesaws, swings, playhouses, loose tires, and climbers. Future research could compare child preferences between Klong Toey and other slums, in either Bangkok or another part of the world. Other comparisons made to children in other countries, or more specifically to children in richer communities within Thailand could also result in interesting findings. There are countless opportunities for future research relating to child play preferences across the world.

*What measurable differences, if any, are there in the communities related to playgrounds being nearby?*

If we could return to Klong Toey in 5 or 10 years, it would be interesting to see if there were noticeable improvements in the communities with playgrounds. Future researchers could see if children's grades in school had improved since the installation of the playgrounds, showing their mental development. Observations of the area could help researchers determine if children are still utilizing the playgrounds, rather than the streets, to play. Further observations and interviews could describe how well the youth volunteers were more skilled and seeking technical careers. This research could support the concept that playgrounds develop children and can help slum communities in the long run.

*Have the youth volunteers benefitted from working on projects with the DPF, and do they wish they had learned any specific skills?*

If we could return to Klong Toey in 5 or 10 years, we would want to know if the youth volunteers who constructed the playground equipment had tried to apply their skills for technical careers and if constructing our equipment helped them. We would also want to know if, in retrospect, they wished that they had learned other additional skills. This would help to see if the equipment was, in fact, useful and if there was any room for improvement.



## Project Conclusion

The goal of this project was to design safe and engaging playground equipment and layouts in order to promote the development of children and youth volunteers in Klong Toey. Additionally, we conducted safety inspections of existing playgrounds at the DPF School and Lock 23-24 community. We found that 100% of the equipment needed repairs, though most were minor in effect. We based our proposed equipment designs on community and youth volunteer needs, child play preferences, material availability and cost, and safety. To improve their playgrounds, we suggest the DPF follow our recommendations for equipment ideas, safety, maintenance, and future contacts. These recommendations will help the DPF accomplish their goal of building 30 playgrounds in the Klong Toey slum, thereby developing the local children and youth volunteers and improving the overall quality of life in these communities.

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## Appendix A – Duang Prateep Foundation: Sponsor Description

Prateep Ungsongtham Hata founded the Duang Prateep Foundation (DPF) in 1978. Hata was born and raised in the slum of Klong Toey, which is where the offices of the Foundation are now located. Hata worked and saved her earnings from the age of 12 in order to attend secondary school, where she took night classes from the age of 16. From her experience, she understood the importance of an education and the difficulties faced by underprivileged children in the slums. She started her own school before she was 20 years old in her home of Klong Toey specifically to cater to their needs. (Duang Prateep Foundation, 2009)

Hata, seen in Figure 24, soon realized that she was spending less time formally teaching and more time helping families cope with life in the slums. Her mission was, and still is, to reach out to the poor and needy in slum communities and to bring them hope and enablement. She set up the Foundation in order to realize this goal. Even when threatened with eviction, Hata was able to bring her story to the news media, reach a compromise solution with the property owners, and relocate to a new site.

The DPF is a non-profit charitable organization. It started with five workers and slowly grew to around 100 full-time workers today. The Foundation also attracts a large number of part-time volunteers. The DPF sponsors projects primarily through private donations from individuals and organizations and government grants and contracts. For example, the Thai Children's Trust (a large organization from the United Kingdom), the Vancouver Women's Club, and FedEx are just a few of many organizations that made donations within the past year. Thomas Wells also set up a Charitable Fund that helped finance some of the DPF's work, including the construction of the Lock 23-24 Playground. Government departments like the Education Ministry and the Ministry of the Interior sponsor specific DPF projects such as promoting literacy in primary schools and reducing childhood drug use. The Foundation receives many in-kind donations, such as dentists doing check-ups for children in orphanages and companies installing new water purification systems in the community for free. (Duang Prateep Foundation, 2009)

The DPF sponsors a wide array of projects that address a number of concerns within the slum community such as access to education, community development, HIV/AIDS awareness, senior citizen



Figure 24. Hata with a group of children

medical care, special education, and tsunami relief. The former two topics are described in more detail below. (Duang Prateep Foundation, 2009)

Ostensibly, public education in Thailand is free, but there are costs associated with attending school. For example, students have to purchase books, uniforms, and school bags. Some schools even impose charges to make up for inadequate government funding. Children from poor homes often cannot afford to attend school not only because of these 'hidden' costs, but also because they must work to help provide for their families at home. Consequently, the DPF annually sponsors over 2,300 deprived children from slum and rural communities by paying for books, uniforms, and other school supplies. (Duang Prateep Foundation, 2009)

The DPF assists members of the slum communities through a number of programs and activities that include registering residents with the government, providing loans for building materials and land purchase, and establishing kindergartens and child-care centers for child and community development. One particular effort, the New Life Project, provides opportunities for slum children who are abused, overworked, or addicted to drugs to escape from the difficulties of slum life by living in a sheltered community outside of Bangkok. The children have a chance to attend school and learn vocations like farming, while being in a more stable, safe, and supportive environment. (Duang Prateep Foundation, 2009)

For more information on the Duang Prateep Foundation and their projects, see their website: <http://www.dpf.co.th/>.

## Appendix B – Playground Types

### *Traditional*

Traditional playgrounds were initially “called ‘outdoor gymnasiums’ and had exercise apparatus, running tracks, and space for games,” (Maraini, 2009). More modernized traditional playgrounds, commonly found in the United States and Europe, are “characterized by large, metal equipment, such as climbers, slides, and swings [in “single unit structures”], on which children can exercise” (Barbour, A. (1999). These separate structures are generally spaced somewhat far from one another and zoned off as separate activities for safety reasons, which is one characteristic that separates the traditional playground from the contemporary playground. “Playgrounds traditionally have been no more than a large combination of large playthings placed together in one location ... to provide opportunities for gross motor activity by simulating, in galvanized steel, some primitive jungle setting,” (Brown, J. G., & Burger, C. (1984). Starting in the early 20<sup>th</sup> century, traditional playgrounds were developed as recreational alternatives to dangerous street play in urban areas (Frost, 2006). The main purpose of the traditional playground is to provide for physical exercise and recreation, which fails to consider the creative and social needs children require throughout the course of their development. “Playgrounds in general are duplicated from site to site in a monotony of stereotyped apparatus. They are essentially static, tubular, safe, [and] predictable,” (Brown, J. G., & Burger, C. (1984). Figure 25. Traditional playground (photo cropped) (Domain Playground 009) depicts a traditional playground.



Figure 25. Traditional playground (photo cropped) (Domain Playground 009)

### *Contemporary*

The contemporary playground was a result of the criticism that traditional playgrounds had received. Starting after WWII to “enhance imaginative play and promote learning” (Frost, 2006). The terms ‘alternative’, ‘contemporary’, or ‘comprehensive’ playground have replaced the traditional



(Brown, J. G., & Burger, C. (1984). Major changes in the age-appropriateness and safety of the playground equipment, supported by theories on child development by various psychologists such as Erik Erikson and Jean Piaget, led to the development of contemporary playgrounds. Vygotsky, Bruner, and Huizinga are other leading figures in child development that have supported the notion that play equipment could have positive developmental effects on children (Frost, 2006).

Some equipment types found in contemporary playgrounds include sandboxes, swings, slides, climbing equipment, seesaws, and balance beams (Maraini, 2009). Other equipment options include tire hurdles, tire walks, climbing equipment, tunnels, ladders (vertical and horizontal), and observation towers and platforms (Gabbard & LeBlanc, 1980). Contemporary playgrounds include multi-purpose linked structures with many entrances and exits (Barbour, A. (1999), as in Figure 26. Synthesized contemporary playground in Ludlow, MA. This provides the children with more opportunities to make decisions and apply problem-solving skills using fixtures which promote dramatic play (Barbour, A. (1999); (Gabbard & LeBlanc, 1980). The modular equipment also encourages physical activity by connecting multiple motor activities together (climb up ladder, run across bridge, go down stairs, go down slide) (Frost, 2006). Overall, the developmental benefits of contemporary playgrounds improved from those of traditional playgrounds. Children have the option to think more creatively and cooperatively, instead of being isolated using the mostly single-person equipment found in traditional playgrounds.



Figure 26. Synthesized contemporary playground in Ludlow, MA

### *Natural*

The natural playground is quite simply an area found in nature where children play. There are “three unique qualities about nature; the high diversity, the fact that nature is not made by man, and the impression of timelessness. Furthermore, several studies indicate that a diverse and adventurous

playground stimulates creative play,” (Fjørtoft, I., & Sageie, J. (2000). A natural playground is completely unstructured, dynamic, and manipulative, which children tend to prefer because it allows for creative play and improves their motor fitness. The “equipment” found in natural playgrounds consists of whatever the area has to offer. Rocks, trees, bushes, sticks, hills, dirt, and snow all become tools for the creative mind of the child.

Greenhouses, gardens, wildflower fields, logs, or animal habitats can improve any other type of playground. Leading researchers of playgrounds state that integrating nature into playgrounds is especially important for children living in urban areas who do not have access to the natural wilderness (Fjørtoft, I., & Sageie, J. (2000); Frost, 2006; Maudsley, 2009). England’s Forestry Commission (Forestry Commission, 2009) has a guide of ideas for nature play. This includes providing climbable trees and using logs, plants, and boulders to create hiding spaces and pathways.

### *Adventure*

The adventure playground is the most recent trend in playground design. It “attempts to allow for a child-oriented perspective in play; children are, for instance, encouraged in these playgrounds to build their own appropriate play structures,” (Maraini, 2009). These playgrounds are far more common in Europe and Asia than in the United States. The layout and equipment present within adventure playgrounds encourage children to play together and formulate friendships, an important aspect to their development (Staempfli, M. B. (2009)). Adventure models are very different from other playground models in that they have “movable items such as wood, tires, crates, cable spools, etc. which allows for children to construct their own play structures. Moveable items also stimulate creative play and problem-solving (Gabbard & LeBlanc, 1980). The diverse and abstract nature of these playgrounds makes play more imaginative and exciting for children because “children have a sense of ownership of the play space and the construction of the play structures—as well as the rate of play itself,” (Staempfli, M. B. (2009). This results in a more enriching experience for all children. Adventure playgrounds challenge children creatively, test their sense of adventure, and allow them to work cooperatively in a setting unique from any familiar home or school environment.

The equipment used in adventure playgrounds ranges from parts intentionally made for use in playgrounds, like swings and slides, to materials altered to accommodate children and their mode of play. Much of what can be found in an adventure playground can be found in contemporary playgrounds with the addition of various recycled materials such as tires and remodeled metal drums. These new materials and structures provide physical obstacles for children to run, climb, and crawl through. A sense of accomplishment and pride can accompany overcoming a particularly challenging

obstacle in the playground. Due to the use of a wide variety of non-standardized building materials, adventure playgrounds often require adult supervision or hired safety attendants to help prevent child injuries. Figure 27. Adventure Playground in Berkeley, CA. (Adventure Playground - City of Berkeley, CA.) is an example of a well-known adventure playground. Adventure playgrounds possess the widest range of developmental benefits among the four playground types considered.



Figure 27. Adventure Playground in Berkeley, CA. (Adventure Playground - City of Berkeley, CA.)

## Appendix C – Playground Observation Sheet

Location: \_\_\_\_\_

Date: \_\_\_\_\_ Time: \_\_\_\_\_

Draw simple layout of playground, labeling equipment.

Playground surroundings (buildings, streets, etc.): \_\_\_\_\_

\_\_\_\_\_

Type and number of equipment: \_\_\_\_\_

\_\_\_\_\_

Materials Used: \_\_\_\_\_

Ground Material: \_\_\_\_\_

Benches/trash cans/tables (number and location): \_\_\_\_\_

\_\_\_\_\_

Size of area, spacing of equipment: \_\_\_\_\_

Maintained/safe/clean: \_\_\_\_\_

Number of kids present throughout observation: \_\_\_\_\_

Equipment/activities they used and popularity: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Did they come with other kids or parents: \_\_\_\_\_

Other: \_\_\_\_\_

## Appendix D – Survey Questions

General questions for everyone:

1. How do you feel about having a playground in the area?
2. Do you think it will benefit the children and the community? If so, how?
3. Is there anything that you would like to see incorporated into the playground design?
4. Do you have any concerns about the playground (e.g. safety, privacy, crime, etc.)?
5. Are you interested in volunteering or participating in the planning and construction of the playground? Would you like to receive updates on our progress?

Parents only:

6. How do your children spend their free time?
7. What kinds of toys or games do your children like to play with?
8. How often do your children play (multiple times a day, daily, only on weekends, etc)?
9. Where do they play and with whom?
10. Have you or your children ever used a playground? Where it, and what was was your experience like?
11. Do you typically go to the playground with your children?

Neighbors/Community Leaders only:

12. Do you think having a playground so close affects your life? If so, how?
13. Do you think this is an appropriate area for a playground?
14. How safe do you think your neighborhood is, compared to other areas in Klong Toey?
15. How often do you see or know of children playing in this area?

Teachers only:

16. Do the kids ever get hurt on the playground?
17. What equipment do they particularly like playing on?
18. Which equipment do they dislike or don't use?
19. Is there any equipment or toys that they want in addition to what is already on the playground?

Volunteers only:

20. What pieces of equipment do you know how to build?
21. What other experience do you have?
22. How long have you been working here at the DPF?
23. How long does it take to build each piece of equipment?
24. How much does it cost to build each piece of equipment?
25. Are there any problems in building and assembling the equipment, either with the tools or materials you use?

26. When do you plan to work on the equipment (what is your schedule like)?
27. How can we stay in contact?
28. What types of jobs do you plan on doing after this? What skills will be most useful in the future?

## Appendix E – Focus Group Drawings

The following are four of seventeen drawings produced by DPF School children between the ages of three and seven years old. Refer to the Methodology Chapter for further information on these focus groups.



*The above drawing was made by a three year old and includes a Ferris wheel, a house, flowers, a sandbox, and a river containing fish.*



*The above drawing was made by a five year old and includes several houses, a dog, tree, and several balls.*



*The above drawing was made by a five year old and includes a sky train, train with tracks, a box on wheels, and a slide.*



*The above drawing was made by a six year old and includes climbing equipment, a house, flowers, and tire swings.*



## Appendix F – General Safety & Maintenance Checklist

Inspector:

Area:

Date:

Safety inspections should be performed a minimum of every 3 months.

For items that need repairs, refer to Appendix N.

Item Code (ex. A1) - Item to be checked	OK	Repairs Required
<b>A. General Hazards</b>		
1. Equipment footings are not exposed, cracked, or loose		
2. No broken or missing equipment parts		
3. No sharp edges or unsafe protrusions (metal corners, bolts, seats, etc.)		
4. No missing bolts, screws, nuts, etc.		
5. All bolts, screws, nuts, etc. are tightly connected		
6. All stitching is secure and not loose		
7. No straps are worn, broken, or loose		
8. Connectors are not broken or cracked		
9. All joints are secure		
10. Welds are intact and free of cracks		
11. No exposed mechanisms, junctions of moving parts, or component posing possible pinch or crush points		
12. All moving parts are well lubricated and not excessively worn		
13. Clamps have no sign of slippage, cracking, or failure and the screws and/or pins holding them are secure		
14. No splintered, cracked, or otherwise deteriorated wood (check high traffic areas where screws or bolts thread through wood and where wood contacts the ground)		
15. Metal parts are not rusted, cracked, bent, dented, warped, or broken		
16. The equipment paint is not damaged, peeled, or cracked		
17. No areas capable of pooling water (holes present to drain)		
<b>B. Specific Equipment Hazards</b>		
1. No potential clothing entanglement such as open S-hooks or protruding bolts		
2. There is adequate clearance between equipment pieces (2m in front of and behind swings, 2m at end of slides)		
3. All seats have no sharp edges and are tightly secured		
4. All seesaws have adequate cushioning between seat and ground		
5. Swing connectors and chains/straps have free movement		
6. Sand in sandboxes is clean and replenished		
<b>C. Surrounding Area and Protective Surfacing</b>		
1. All pathways to the playground are unobstructed or accessible		
2. Area is clean of litter (plastic wrappers, bottles, etc.)		
3. No roots, rocks, benches, or other objects are causing tripping or injury hazards		
4. No trees show the risk of potential falling dead wood or sharp branches at eye height		
5. Surface material is not scattered or excessively worn (especially under swings or at end of slides)		
6. Surface material is adequately deep to retain fall absorbing abilities		

Note: Altered from past IQP with additional information added (Sexton, J. R., Byrne, M. C., Boucher, L. L., & Bida, O. (2003))

## Appendix G – General Safety & Maintenance Checklist (Thai)

ภาคผนวก- แบบตรวจสอบความปลอดภัยทั่วไป และการดูแลรักษา

ผู้ตรวจสอบ :

วันที่ :

การตรวจสอบควรกระทำทุก 3 เดือน หากเครื่องเล่นสนามขึ้นใดมีความจำเป็นต้องได้รับการซ่อมแซม กรุณาติดต่อหัวหน้าชุมชน หรือ  
มูลนิธิดวงประทีป

อุปกรณ์	สภาพดี	ชำรุด
<b>A. ความปลอดภัยทั่วไป</b>		
18. ฐานเครื่องเล่น มั่นคง แน่นติดกับพื้น และไม่แตกหัก		
19. ส่วนประกอบทุกชิ้นของเครื่องเล่น อยู่ครบและสมบูรณ์		
20. ไม่มีส่วนคมหรืออันตรายที่ยื่นโผล่ออกมา เช่น มุมโค้งของเหล็ก, นอต เป็นต้น		
21. จำนวน นอต หรือ ตะปู อยู่ครบ		
22. นอต หรือ ตะปูทุกตัว ไขอย่างแน่นหนา		
23. รอยเย็บทุกที่ ควรแน่นหนา และ มีความปลอดภัยต่อการรับน้ำหนัก		
24. สายรัด ไม่มี รอยขาดหรือมีลักษณะหลวม		
25. รอยเชื่อมต่อไม่มีรอยแตกหัก		
26. ข้อต่อของอุปกรณ์มีความปลอดภัย		
27. รอยเชื่อมแน่นหนา		
28. ระบบกลไก, การเคลื่อนไหว ปกติอย่างมีขีด		
29. ส่วนของเครื่องเล่นที่มีการเคลื่อนไหว มีน้ำมันที่ให้ความหล่อลื่นที่พอควรและไม่มากจนเกินไป		
30. อุปกรณ์ที่ใช้หนีบเครื่องเล่นไม่มีการแตกหัก หรือ ไม่ลื่นจนเกินไป รวมไปถึง นอตและตะปู อยู่ในลักษณะที่แข็งแรงปลอดภัย		
31. ไม่มีเศษเสี้ยนไม้ รอยแตกของไม้(พยายามเน้นตรวจเป็นพิเศษบริเวณ นอต หรือสกรูที่เจาะลงในเนื้อไม้ หรือบริเวณ ไม้ที่ติดกับพื้น)		
32. ส่วนที่เป็นเหล็กของเครื่องเล่นสนามไม่เป็นสนิม ไม่มีการหักงอของชิ้นส่วน ไม่มีการหลุดของชิ้นส่วน		
33. สีที่ใช้ทาเครื่องเล่นสนามยังติดทน ไม่หลุดลอก เครื่องเล่นสนามยังไม่เป็นสนิม		
34. ขากรทุกชิ้นที่ใช้ทำเครื่องเล่นสนามไม่มีน้ำขัง มีการเจาะรูเพื่อระบายน้ำทุกอัน		
<b>B. ความปลอดภัยเฉพาะของเครื่องเล่น</b>		
7. ไม่มีสิ่งกีดขวางลอดหว่าง S หรือ ตัวน็อต		
8. ระยะโดยประมาณระหว่างเครื่องเล่นสองชนิด ห่าง2เมตร( ด้านหน้าและด้านหลังของชิงช้า และ ปลายสไลด์)		
9. บริเวณที่นั่งไม่มีมุมที่เป็นส่วนคม และ ที่นั่งมีลักษณะแน่นหนา, ปลอดภัย		
10. ไม่กระดานหก มีตัวรับการกระแทก หรือ น้ำหนักระหว่างที่นั่งและพื้นดิน		
11. ตัวเชื่อมของชิงช้าหรือโซ่ ,สายรัด ควรเคลื่อนไหวได้อย่างอิสระ		
12. ทราย์ที่อยู่ภายในสนามมีความสะอาด และเติมให้เต็มอยู่เสมอ		
<b>C. สภาพแวดล้อมภายในพื้นที่และพื้นที่สนามเด็กเล่น</b>		

7. ทางเดินเท้าไม่มีสิ่งกีดขวาง		
8. พื้นที่สะอาดปราศจากขยะ เช่น ถูขยะ หรือขวดพลาสติก		
9. ไม่มีรากไม้ หินหรือ สิ่งอื่นๆที่สามารถก่อให้เกิดการสะดุด		
10. ไม่มีส่วนของกิ่งต้นไม้ ในระดับสายตาที่อาจก่อให้เกิดอันตรายได้		
11. วัตถุของพื้นผิวโดยเฉพาะได้ซึ่งช้า และ สไลด์ ไม่น้อย หรือมากเกินไป เช่นปริมาณของทราย		
12. พื้นผิวของพื้นมีความสามารถเพียงพอในการรองรับการหล่น หรือ สัม		

หมายเหตุ: ปรับปรุงมาจากเอกสารข้อมูลของ กลุ่มอดีต IQP (Sexton, Byrne, Boucher, & Bida, 2003)

## Appendix H – Safety Inspection of the Duang Prateep Foundation School Playground

- **Bolded descriptions are major safety concerns.**
- Standard text descriptions are minor safety concerns.
  - Sub-bullets are recommendations for improvements.

### Tire Strap Climb:



- **Broken stitching and straps**
  - Restitch using a different pattern and/or a stronger thread or use a metal fastener.
  - Possibly use strong knots in the future to fasten straps together.
- **Protruding bolts securing straps**
  - Replace with shorter bolts that do not extend beyond the nut or use a different method of fastening straps.
- Sharp edges at welding points on the top of climber
  - Smooth the sharp edges with grinding wheel.
- Metal slightly rusted and peeling paint
  - Sand away rust and repaint exposed metal.
- Possible water pooling in tires
  - Drill or cut small hole into bottom, center of each tire to allow water drainage.

### Small Single Slide:



- **Rusted and paint peeling**
  - Sand away rust and repaint exposed metal.

### Tire Swings:



- **Straps fraying and worn**
  - Test straps for weight capacity and durability. Replace the straps as needed if the weight of the tire plus a child is beyond the capacity. Frequently check worn straps to ensure safety.
- Bolts at joints protruding
  - Replace with shorter bolts.
- Metal slightly rusted and paint peeling
  - Sand away rust and repaint exposed metal.
- Possible water pooling in tires
  - Drill or cut small hole into bottom, center of each tire to allow water drainage.
- Tree roots exposed (trip hazard)
  - Rebury tree roots or remove them.

### Tire Strap Cube Climb:





- **Bolts holding straps together are broken or missing**
  - Secure straps using methods listed above.
- **Protruding bolt**
  - Replace with shorter bolts.
- **Bolts rusted**
  - Replace rusted bolts.
- **Paint peeling**
  - Repaint exposed metal.
- **Possible water pooling**
  - Drill or cut small hole into bottom, center of each tire to allow water drainage.

Climber with Hanging Handles:



- **Footings exposed**
  - Rebury footings.

Tall Slide:



- **Wooden stairs are not secure to metal rungs**
  - Properly secure stairs to metal frame.
- **Wooden stairs and floor are broken, cracked, and splintered**
  - Replace missing and broken boards.
- **Broken metal pipes on sides with loose and rusty joints are possible crush hazards**
  - Remove loose metal poles or reattach to original play equipment.

- Replace and tighten rusted joint components.
  - Sand away rust and repaint exposed metal.
- Metal slide is hot in sun
  - Keep metal out of direct sunlight and test slide temperature by hand prior to use.

Metal Barrel Ladder Climb:



- Metal slightly rusted and paint peeling
  - Sand away rust and repaint exposed metal.

Mickey Mouse Slide:



- **Splintered wooden platform, missing floor board**
  - Replace missing and broken boards.
  - Sand down wood to remove splinters.
- Sharp points where rusted; paint peeling
  - Sand away rust, smooth out sharp edges, and repaint exposed metal.



#### Moveable See-Saw:



- **Bolts attaching tires to frame are rusty and loose**
  - Tighten bolts.
- Not well lubricated
  - Lubricate center joint so that the see-saw moves smoothly.
- Protruding bolts
  - Replace with shorter bolts.
- Missing bolts and splintering seat
  - Replace seat or sand down splintered area, then replace and fasten bolts.
- Sharp edges on handles
  - Put caps on handles.
- Broken spoke attaching frame to tire
  - Reattach spokes or remove spokes completely.
- Rusty joints
  - Sand away rust and repaint exposed metal.
- Paint peeling
  - Repaint exposed metal.

#### Metal Tube Climb:



- Caps missing at ends of poles
  - Replace missing caps.
- Paint peeling
  - Repaint exposed metal.

Half Circle Monkey Bars:



- Metal slightly rusted and paint peeling
  - Sand away rust and repaint exposed metal.

## Appendix I – Safety Inspection of Lock 23-24 Community Playground

- **Bolded descriptions are major safety concerns.**
- Standard text descriptions are minor safety concerns.
  - Sub-bullets are recommendations for improvements

### Metal Barrel Climb:



- **Rusted hole within barrel with sharp edges**
  - **Weld hole closed and smooth edges**
- Exposed footing
  - Bury footing to secure equipment

### Swings:



- **2 broken seats -chain not attached to seat**
  - **Replace wooden seat or replace with tire seats**
- S-hooks aren't closed enough
  - Pinch closed with pliers
- Splintered wood on seats

- Sand down the splinters or replace with tire seats
- Rebar anchoring swings is exposed as a trip hazard
  - Bury in ground
- Paint peeling
  - Repaint

#### Large Metal Climb:



- Ladder attachment is not secured and is a crush point
  - Add a second bolt
- Exposed footing at ladder
  - Bury footing

#### Metal Slide:



- **Slide metal is hot**
  - **Relocate slide to a shaded area**
- Footing exposed
  - Bury footing
- Protruding bolts underneath steps
  - Replace with shorter bolts
- Metal at edge of slide protrudes above weld point, dented
  - Hammer down to make slide smooth



See-Saw (stationary):



- **Broken seat**
  - Replace seat
- **Center pivot unstable and not well-fitted/wobbly**
  - Weld tube perpendicular to metal strap to refit on base support
- **Protruding bolts underneath seats**
  - Replace with shorter bolts
- **Not well lubricated**
  - Lubricate joints
- **Rusty joints**
  - Sand away rust and repaint
- **Caps for handles missing**
  - Replace caps or fill in holes

Metal Tube Tunnel:



- **Footings exposed**
  - Bury footings
- **Missing caps at tube ends**

- Replace caps or fill in holes

Metal Spinner:



- **Missing center wheel that children hold in order to spin themselves**
  - Replace missing part, maybe using a small tire as the wheel
- **Seat unsecured**
  - **Secure seats**
- Protruding bolts underneath seat
  - Replace with shorter bolts
- Paint peeling
  - Repaint

Half Circle Climb:



- Footing exposed/not secured into ground
  - Bury footing

## Appendix J – General Playground Routine Maintenance Task List

Inspector:

Area:

Date:

Task	Frequency	Recommended Completion by:	Notes
Watering Plants	Daily	Community volunteer or group	Varies with season
Picking up Litter	Daily	Children, parents, or community members	
Disposing of Trash	Weekly	Community volunteer or group	Varies with location
Raking Leaves	Weekly	Community volunteer or group	Varies with season
Cleaning Equipment	Monthly	Children, parents, or community members	
Washing Benches/Tables	Monthly	Children, parents, or community members	
Refinishing Tires*	Yearly	Community volunteer or group	If funding allows
Painting Tires**	Yearly	Children, parents, or community center	
Removing Graffiti	As Needed	Children, parents, or community center	If funding allows

\*This task requires applying sealant to tires to prevent weathering

\*\*This task requires painting supplies

Note: Altered from past IQP (Sexton, J. R., Byrne, M. C., Boucher, L. L., & Bida, O. (2003).



## Appendix K – Safety & Maintenance Checklist for Lock 23-24 Playground

Inspector:

Date:

Safety inspections should be performed a minimum of every 3 months.

Consult the Community Leader or the Duang Prateep Foundation for necessary repairs.

Item Code (ex. A1) - Item to be checked	OK	Repairs Required
<b>A. General Hazards</b>		
1. Equipment footings are not exposed, cracked, or loose		
2. No broken or missing equipment parts		
3. No sharp edges or unsafe protrusions (metal corners, bolts, seats, etc.)		
4. No missing bolts, screws, nuts, etc.		
5. All bolts, screws, nuts, etc. are tightly connected		
6. All stitching is secure and not loose (check tire strap climb and swings)		
7. No straps are worn, broken, or loose (check tire strap climb, swings, and monkey bars)		
8. Connectors are not broken or cracked		
9. All joints are secure		
10. Welds are intact and free of cracks		
11. No exposed mechanisms, junctions of moving parts, or component posing possible pinch or crush points		
12. All moving parts are well lubricated and not excessively worn (check spinner and seesaw)		
13. No splintered, cracked, or otherwise deteriorated wood (check slide stairs)		
14. Metal parts are not rusted, cracked, bent, dented, warped, or broken		
15. The equipment paint is not damaged, peeled, or cracked		
16. No areas capable of pooling water (holes present to drain)		
<b>B. Specific Equipment Hazards</b>		
13. No potential clothing entanglement such as open S-hooks or protruding bolts		
14. There is adequate clearance between equipment pieces (2m in front of and behind swings, 2m at end of slides)		
15. All seats have no sharp edges and are tightly secured		
16. All seesaws have adequate cushioning between seat and ground		
17. Swing connectors and chains/straps have free movement		
<b>C. Surrounding Area and Protective Surfacing</b>		
13. All pathways to the playground are unobstructed or accessible		
14. Area is clean of litter (plastic wrappers, bottles, etc.)		
15. No roots, rocks, benches, or other objects are causing tripping or injury hazards		
16. No trees show the risk of potential falling dead wood or sharp branches at eye height		
17. Surface material is not scattered or excessively worn (especially under swings or at end of slides)		
18. Surface material is adequately deep to retain fall absorbing abilities		

Note: Altered from past IQP with additional information added (Sexton, J. R., Byrne, M. C., Boucher, L. L., & Bida, O. (2003).

## Appendix L – General Playground Routine Maintenance Task List (Thai)

ภาคผนวก- รายการ และตารางระยะเวลาการตรวจสอบสนามเด็กเล่นทั่วไป

ผู้ตรวจสอบ:

สถานที่:

วันที่:

รายการ	ความถี่	ข้อเสนอแนะ : ควรทำโดย	หมายเหตุ
รดน้ำต้นไม้	ทุกวัน	อาสาสมัครชุมชน	ขึ้นอยู่กับฤดู
ถอนหญ้า	ทุกวัน	เด็กๆ ผู้ปกครอง หรือ สมาชิกชุมชน	
เก็บขยะ	รายสัปดาห์	อาสาสมัครชุมชน	ขึ้นอยู่กับสถานที่
เก็บเศษใบไม้	รายสัปดาห์	อาสาสมัครชุมชน	ขึ้นอยู่กับฤดู
ทำความสะอาดเครื่องเล่น	รายเดือน	เด็กๆ ผู้ปกครอง หรือ สมาชิกชุมชน	
ทำความสะอาดโต๊ะ หรือม้านั่ง	รายเดือน	เด็กๆ ผู้ปกครอง หรือ สมาชิกชุมชน	
* เช็ควงล้อรถของยาง	รายปี	อาสาสมัครชุมชน	หากมีเงินทุน
** ทาสียาง	รายปี	เด็กๆ ผู้ปกครอง, สมาชิกชุมชน หรือ ศูนย์กลางชุมชน	
ทำความสะอาดภาพที่เขียนตามกำแพงที่ ไม่ต้องการ	ตามความต้องการ	เด็กๆ ผู้ปกครอง, สมาชิกชุมชน หรือ ศูนย์กลางชุมชน	หากมีเงินทุน

\* ต้องใช้กาวฉนวน

\*\* ต้องใช้เครื่องมือการทาสี

หมายเหตุ: ปรับปรุงมาจาก กลุ่มอดีต IQP (Sexton, Byrne, Boucher, & Bida, 2003)

## Appendix M – Safety & Maintenance Checklist for Lock 23-24 Playground (Thai)

ภาคผนวก - แบบตรวจสอบความปลอดภัยและสภาพทั่วไปของเครื่องเล่นสนาม สำหรับสนามเด็กเล่นของชุมชนแฟลต 23-24

ผู้ตรวจสอบ :

วันที่ :

การตรวจสอบควรกระทำทุก 3 เดือน หากเครื่องเล่นสนามชิ้นใดมีความจำเป็นต้องได้รับการซ่อมแซม กรุณาติดต่อหัวหน้าชุมชน หรือ  
มูลนิธิดวงประทีป

อุปกรณ์	สภาพดี	ชำรุด
<b>A. ความปลอดภัยทั่วไป</b>		
17. ฐานเครื่องเล่นไม่ไผ่ลื่นพื้น หรือหละหลวม ยึดติดกับพื้นดิน และไม่มีส่วนที่แหลมคม		
18. เครื่องเล่นอยู่ในสภาพสมบูรณ์ ไม่มีส่วนใดส่วนหนึ่งขาดหายไป หรือเสียหาย		
19. เครื่องเล่นปลอดภัย ไม่มีส่วนที่แหลมคมหรือยื่นออกมาเป็นอันตราย		
20. เครื่องเล่นทุกชิ้นมีน๊อตครบ ไม่หลุดหรือหลวม ข้อต่อแน่นดี ไม่ขาดหรือเปื่อยยุ่ย		
21. เครื่องเล่นสำหรับปีนป่ายอยู่ในสภาพดี ด้ายที่เย็บไม่หลุดหรือขาด น๊อตไม่หลุด ส่วนที่ต้องติดกันยังคงสภาพเดิมที่มีความปลอดภัย (ตรวจสอบทั้งเครื่องปีนป่ายและชิงช้า)		
22. สายชกเกรนที่ใช้ประกอบเครื่องเล่น(สีส้ม)ยังคงเหนียว ไม่ร่วน และไม่ขาด		
23. ข้อต่อทุกชิ้นของเครื่องเล่นไม่หัก หรือเสื่อมสภาพ ลงทุนและปลอดภัย ไม่สามารถทำให้หลุดจากกันได้ง่าย		
24. หมุด น๊อต รวมไปถึงส่วนที่เชื่อมต่อแข็งแรงดี		
25. ไม่มีส่วนของเครื่องเล่นสนามที่แยกออกจากกัน กระจัดกระจายแตกหัก หรือแหลมคม		
26. ม้าหมุนสามารถหมุนได้คล่อง ไม่โยกเขกจนเกิดอันตราย มีราวจับหมุนอยู่ในสภาพดี		
27. เครื่องเล่นโยกเขกสามารถขึ้นลงได้ตามปกติ ไม่หั่นเหวหรือเหวี่ยงไปมาเวลาเล่น ไม่มีอะไรไปติดหรือขัดขวางการเคลื่อนไหว		
28. แผ่นสังกะสีของเครื่องเล่นสเตลไมล์ไม่ผกขึ้น บันไดแผ่นไม้ยังอยู่สภาพดี ไม่แตกหักเสียหายและไม่มีรู (พยายามเน้นตรวจเป็นพิเศษบริเวณ นอด หรือสกรูที่เจาะลงในเนื้อไม้ หรือบริเวณไม้ที่ติดกับพื้น)		
29. ส่วนที่เป็นหลักของเครื่องเล่นสนามไม่เป็นสนิม ไม่มีการหักงอของชิ้นส่วน ไม่มีการหลุดของชิ้นส่วน		
30. สีที่ใช้ทาเครื่องเล่นสนามยังติดทน ไม่หลุดลอก เครื่องเล่นสนามยังไม่เป็นสนิม		
31. ขาแรงทุกชิ้นที่ใช้ทำเครื่องเล่นสนามไม่มีน้ำขัง มีการเจาะรูเพื่อระบายน้ำทุกอัน		
<b>B. ความปลอดภัยเฉพาะของเครื่องเล่น</b>		
1. ไม่มีสิ่งกีดขวางลวดห่าง S หรือ ตัวน๊อต		
2. ระยะโดยประมาณระหว่างเครื่องเล่นสองชนิด ห่าง2เมตร( ด้านหน้าและด้านหลังของชิงช้า และ ปลายสไลด์)		
3. บริเวณที่นั่งไม่มีมุมที่เป็นส่วนคม และ ที่นั่งมีลักษณะแน่นหนา, ปลอดภัย		
4. ไม่มีการคานหก มีตัวรับการกระแทก หรือ น้ำหนักระหว่างที่นั่งและพื้นดิน		
5. ตัวเชื่อมของชิงช้าหรือโซ่ ,สายรัด ควรเคลื่อนไหวได้อย่างอิสระ		
6. ทรายที่อยู่ภายในสนามมีความสะอาด และเติมให้เต็มอยู่เสมอ		
<b>C. สภาพแวดล้อมภายในพื้นที่และพื้นที่สนามเด็กเล่น</b>		
1. ทางเดินเท้าไม่มีสิ่งกีดขวาง		

2. พื้นที่สะอาดปราศจากขยะ เช่น ถังขยะ หรือขวดพลาสติก		
3. ไม่มีรากไม้ หินหรือ สิ่งอื่นๆที่สามารถก่อให้เกิดการสะดุด		
4. ไม่มีส่วนของกิ่งต้นไม้ ในระดับสายตาที่อาจก่อให้เกิดอันตรายได้		
5. วัตถุของพื้นผิวโดยเฉพาะได้ซึ่งช้า และ สไลด์ ไม่น้อย หรือมากเกินไป เช่นปริมาณของทราย		
6. พื้นผิวของพื้นมีความสามารถเพียงพอในการรองรับการหล่น หรือ สัม		

หมายเหตุ: ปรับปรุงมาจาก กลุ่มอดีต IQP (Sexton, Byrne, Boucher, & Bida, 2003)

## **Appendix N – Playground Safety & Maintenance: Recommended Repairs**

This sheet is intended to be used with the General Safety & Maintenance Checklist to recommend how to repair common hazards. Not all recommended repairs will apply to every encountered problem. For additional or more serious repairs, consult the Community Leader or the DPF for guidance.

### **A. General Hazards**

- A1. Bury equipment footings
- A2. Replace missing parts or remove equipment from playground until repaired
- A3. Smooth down sharp edges with a grinding wheel or heavy strength sand paper; remove or cut down unsafe protrusions (ex. long bolts) and replace if necessary
- A4. Replace missing bolts, screws or nuts with appropriate tools
- A5. Tighten bolts, screws, or nuts with appropriate tools
- A6. Re-stitch areas where stitching has come loose or broken
- A7. Replace worn or broken straps; reattach loose straps by stitching
- A8. Replace broken connectors
- A9. Secure all unstable joints (ex. pipe in pipe)
- A10. Re-weld cracked areas
- A11. Cover exposed mechanisms with protective barrier to prevent pinch or crush points
- A12. Lubricate noisy mechanisms to prevent excessive wear and improve equipment functionality
- A13. Replace broken clamps and tighten all connectors
- A14. Sand away splintered areas on wood with sand paper; replace cracked or deteriorated wood
- A15. Sand away surface rust; replace heavily rusted, cracked, bent, warped, or broken metal parts
- A16. Repaint affected areas
- A17. Drill holes in bottom of tires to allow for drainage

### **B. Specific Equipment Hazards**

- B1. Close all open S-hooks using pliers; remove protruding bolts and replace with shorter bolts
- B2. Rearrange equipment to allow for appropriate safety buffers of at least two meters
- B3. Smooth down sharp edges with a grinding wheel or heavy strength sand paper; tighten all loose bolts, screws, or nuts with appropriate tools
- B4. Add cushioning (ex. tires or protective ground cover) below seat
- B5. Ensure that connectors allow for chain/strap movement and that chains/straps are not entangled
- B6. Clean sandboxes as necessary and replenish low sand levels

### **C. Surrounding Area and Protective Surfacing**

- C1. Remove obstacles preventing playground entrance and exit
- C2. Clean area as necessary
- C3. Bury or remove roots and rocks; rearrange benches or other objects if necessary
- C4. Remove dead wood from trees; trim branches which may pose risk of injury
- C5. Redistribute scattered surface material using rake or appropriate tools; replace worn surface material
- C6. Replenish areas with low levels of surface material

## Appendix O – Initial Layout for Lock 23-24 Community Playground

The following two pictures are models for the proposed layout of the Lock 23-24 community playground. Refer to the Analysis and Results Chapter for further information on the layout designing process.



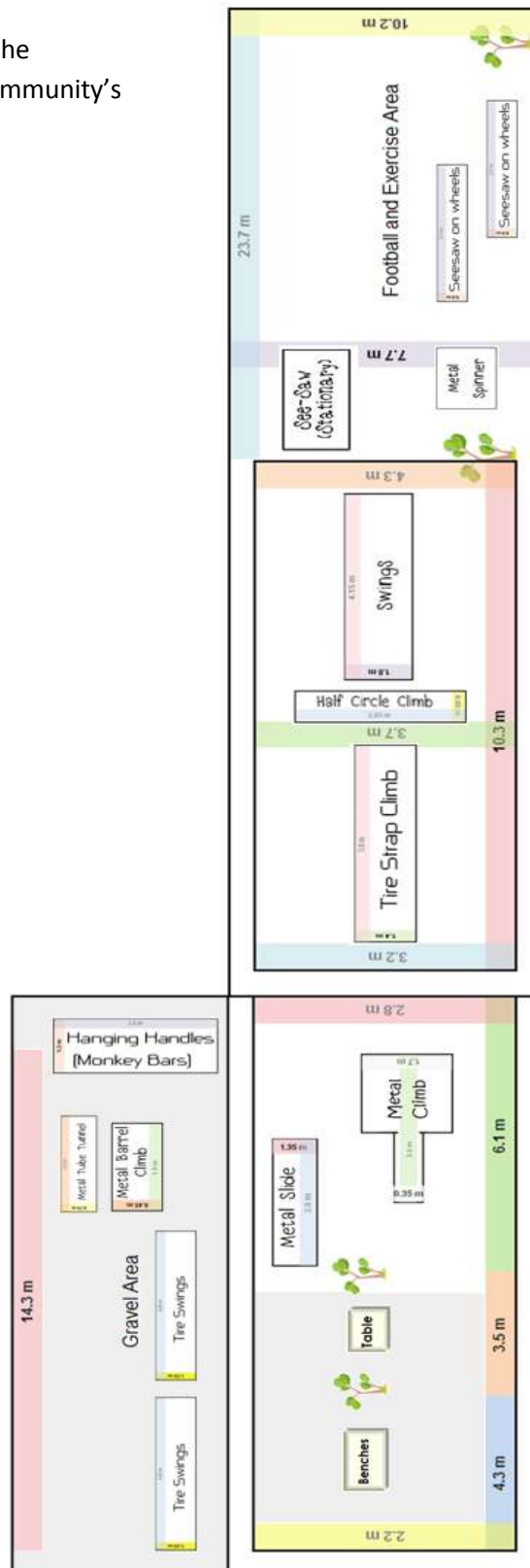
The above picture displays the large grass area containing two movable seesaws, swings, and tire strap climb.



The above picture displays the gravel area containing the metal barrel climb, metal tube climb, tire swings, and metal slide. The area also contains the smaller grass area containing the half circle climb, large metal climb, and hanging handles.

## Appendix P – Final Layout for the Lock 23-24 Playground

This layout contains the final positioning of the playground equipment on the Lock 23-24 community's playground.

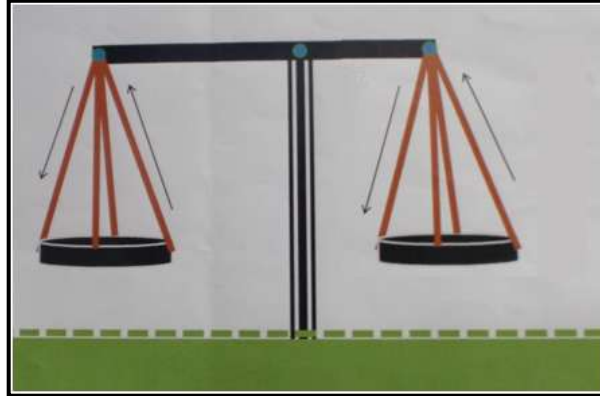


## Appendix Q – Proposed Equipment Designs

Below are sketches for the equipment designs we presented to the DPF to build in future playgrounds.

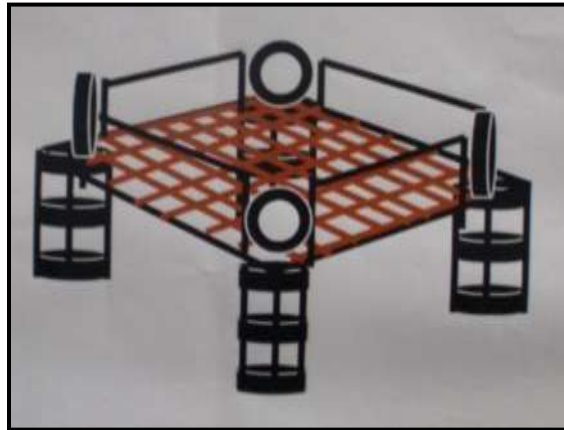
### 1. See-saw Balance Swing

This piece contains two horizontal tire swings attached on opposite ends of a pole. These tire swings shift upwards and downwards depending on the weight applied on them. Children sit within the tire and balance themselves while swinging.



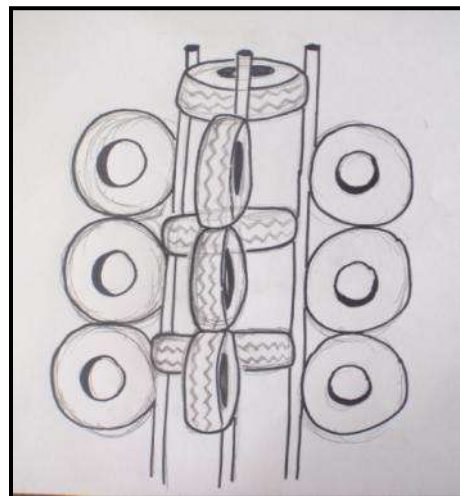
### 2. Elevated Strap Net Climb

This piece contains four corner towers built from three tires stacked atop one another combined with metal poles. These four corner towers are connected by metal poles and contain a network of straps stretching between them.



### 3. Triangular Vertical Tire Climb

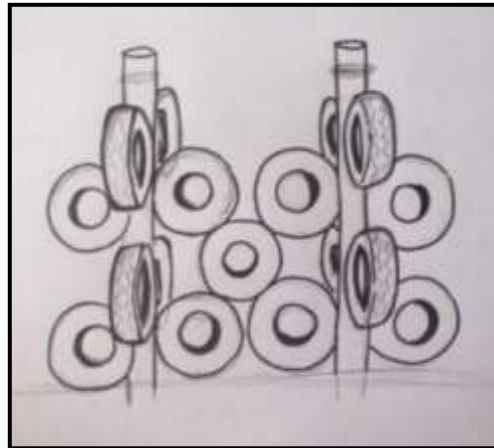
This piece contains a tower of tires connected by three metal poles anchored into the ground. There are additional tires attached to these poles, forming a vertical triangular climbing apparatus.





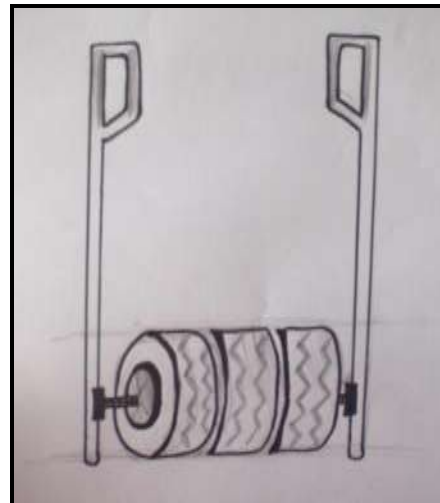
#### 4. Double Vertical Tire Climb

This piece contains two large poles anchored into the ground. Five tires are connected between these poles, and additional tires are attached to the surrounding edges for further climbing possibilities.



#### 5. Stand-up Spinning Tires

This piece acts as a treadmill, allowing children to run in place while holding the handles depicted. Three tires contain rims and are anchored to the handle bars using clamps.



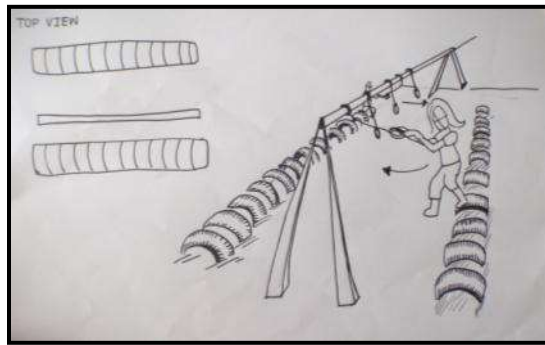
#### 6. Tire Hoop Climb and Platform

This piece contains four tires and a large amount of wood or metal pipes. This piece serves as a climbing structure and may contain a roof, if budgeting allows. Children may climb up to the platform to view their surroundings.



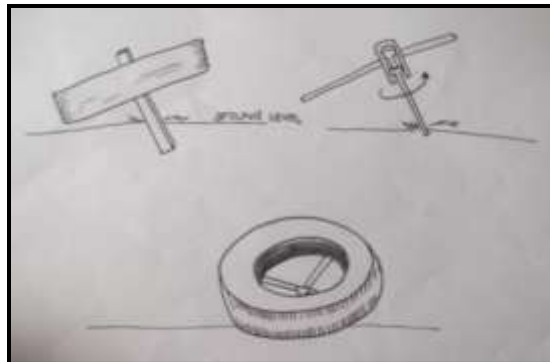
### 7. Strap Swing

This piece contains two rows of tires buried within the ground. Children may use these tires as platforms and swing to them using the ropes attached to the structure anchored between the rows of tires.



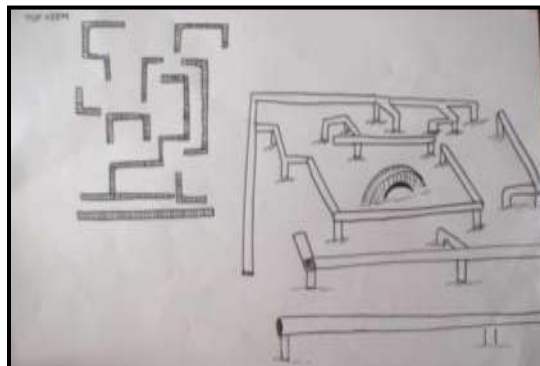
### 8. Flat Spinning Tire

This piece contains a single tire attached to a pivot point that sits on the ground and spins. Children sit upon the tire and propel themselves by kicking off the ground beside them.



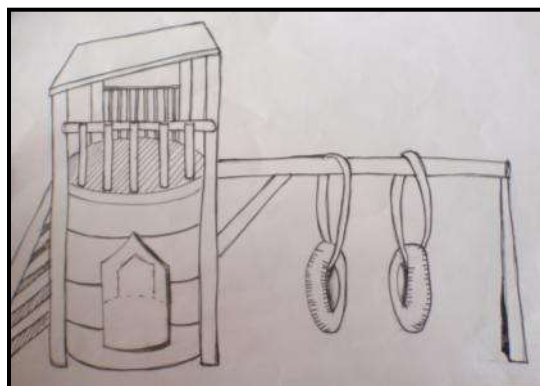
### 9. Maze

This is a maze built out of tires and metal or wooden poles buried beneath the ground for children to walk through and balance on.



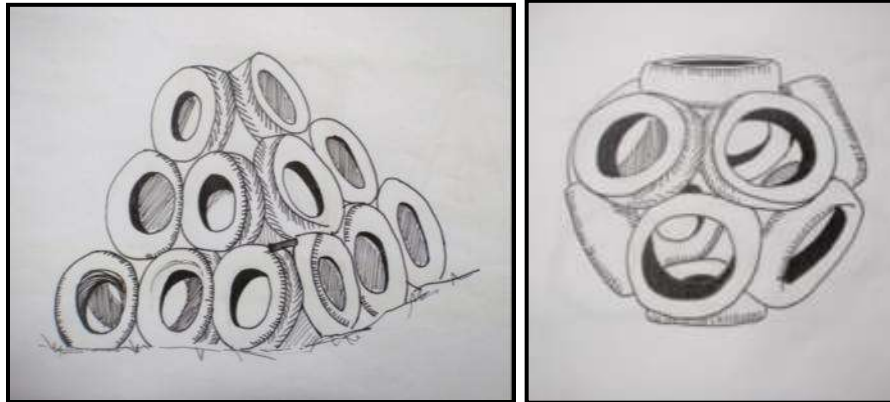
### 10. Platform and Tire Swings

This piece is a climber with a roof and tire swings attached on the side. The metal barrel beneath it can be replaced with a structure built from metal pipes and tires.



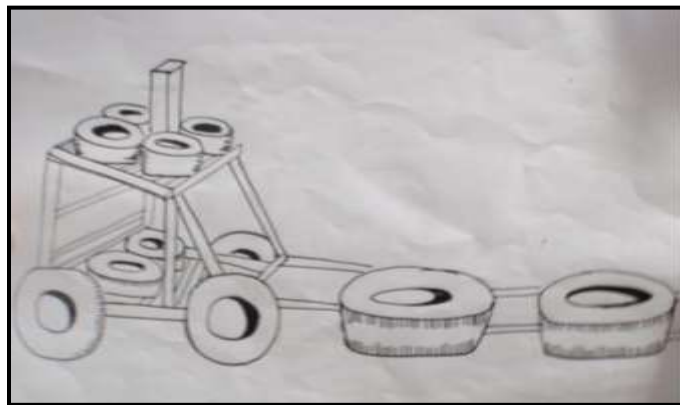
### 11. Tire Shapes – Pyramid, Cube, Tetrahedron

These are climbers built from tires. They can teach children about 3D shapes.



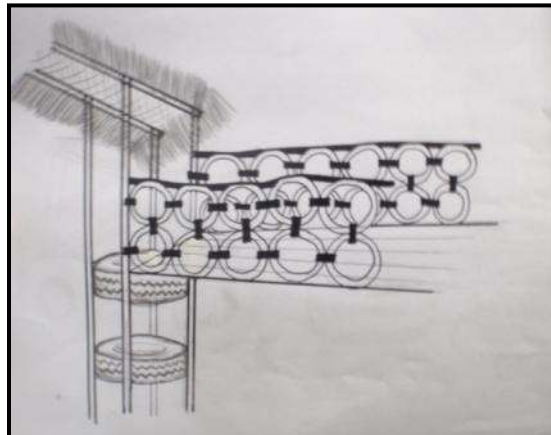
### 12. Tire Train

This piece is a train made of tires and metal pipes for the children to use when playing creatively.



### 13. Bridge

This piece is a bridge with sides. The children can climb up one section and climb across the bridge to another section.



## Appendix R – Index of Playground Equipment

### DPF SCHOOL PLAYGROUND & LOCK 23-24 COMMUNITY PLAYGROUND

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**Key:** *Equipment [where present]*

**Climber with Hanging Handles** [DPF School Playground & Lock 23-24 Playground]



**Half Circle Climb** [Lock 23-24 Playground]





**Half Circle Monkey Bars** [DPF School Playground]



**Large Metal Climb** [Lock 23-24 Playground]



**Loose Tires** [DPF School Playground]



**Metal Barrel Climb** [Lock 23-24 Playground]



**Metal Barrel Ladder Climb** [DPF School Playground]



**Metal Slide** [Lock 23-24 Playground – Before & After Renovation]



**Metal Spinner** [Lock 23-24 Playground – Before & After Renovation]



**Metal Tube Tunnel/Climb** [DPF School Playground & Lock 23-24 Playground]



**Mickey Mouse Slide** [DPF School Playground]





**Playhouse** [DPF School Playground]



**Seesaw - stationary** [Lock 23-24 Playground – Before & After Renovation]



**Seesaw - movable** [DPF School Playground & Lock 23-24 Playground]





**Small Single Slide** [DPF School Playground]



**Swings** [Lock 23-24 Playground – Before & After Renovation]



**Tall Slide** [DPF School Playground]



## Appendix S – Personal Culture Learning Essays

### Elizabeth Casey: “Ready, Set, Generalize”

It was an untypical day. Our group decided to break up into two smaller groups in order to cover more ground. Three of us went to inspect a playground and interview a community leader, the remaining two went to obtain a generous donation of tires for use in building future equipment for playgrounds. I was among the group of three. We drove to the site, accomplished our objectives, and decided to walk back to our sponsor’s office through part of the Klong Toey slum. We walked past dozens of dilapidated houses crammed beneath an underpass alongside a canal. Unnoticed by those walking above and hidden from those driving past on the opposite side by bushes and trees. Makeshift fences were the only barrier between these houses and the garbage that floated downstream past them.

We continued through crowded alleys and narrow streets littered with street vendors ever approaching our destination. We happened upon a frozen drink stand along the way that was separate from the others. The woman working there was in her mid to late twenties, of average height and slightly heavier build. She bore a smile and greeted our group without hesitation. We studied the menu, written in both English and Thai, for roughly two minutes before ordering. Only to discover that there was a pineapple shortage that day and that there were but 3 fruit options. Joy and I ordered an orange smoothie, Cailah a lime. The woman asked us in Thai how sweet we would like our beverages to be. Joy requested sweet; Cailah, a little; me, not at all. The woman smiled and remarked in Thai mid-blending that, “Farangs always stop here. All farangs are the same, they like drinks with no sugar.”

The woman stated it candidly, not trying to hide what she had said from our ears. She knew that Joy had been translating to us all along and would continue doing so. She knew her statement to be truthful, likely perceived after years of working the same job in the same area. A narrow street in the slums may not receive many outside visitors. The stand is located near a foundation run by a white man. The bulk of her farang business may come from visitors to this foundation or to the others nearby. They all look similar, dress similar, and order similar beverages. They must all be the same.

Joy laughed upon hearing the woman, translating her statement to Cailah and I shortly afterwards. “Farang” is a term used frequently in Thai speech to describe a person who is a foreigner or tourist. It is not a derogatory term to Thais, merely a descriptive one. People are tall, short, brown haired, black haired, Thai or farangs. Joy stated that the way she ordered her drink, with sugar, was the

way it normally came, without needing to ask. “No sugar” might be a strange request, but she knows from working with us for over a month that we are all very different people.

I laughed at first. Then I thought more about what the woman had said. I was being placed into a mass stereotype. I was being lumped into the same category as the farangs who wander the beaches topless, farangs who are rich, farangs who are impatient, impolite, and disrespectful. I wondered what Thai people thought of me when they saw me on the street. Was I just another ignorant tourist? I have never liked being generalized, as I’m sure many can agree with. While disliking sugary fruit beverages is not an offensive stereotype, assuming that all people foreign to your country fall within the same category is. Among the IQP students in Bangkok alone, there are a slew of different backgrounds. How can someone assume that we are all the same? I have not gone a single day here without feeling completely open to ridicule and judgment. I felt degraded, although the feeling did not last.

Our group reunited at our sponsor’s office and walked the same route towards a nearby foundation. We passed by the same frozen drink stand, where there were two new customers. Two Caucasian women holding iced coffees. Maybe she was right, in a way. If her sole interactions with foreign people who she cannot communicate with involve observing their behaviors, from her perspective she could be correct. Maybe she’s just amused by our strange behaviors and preferences. Our Thai group partners have offered on many occasions to take us to Khao San Road, a popular destination for backpacking tourists. “People watching” is one of their favorite activities, and Khao San Road is the place to do it. They have told us that Thai people will often intently watch foreigners waiting for them to do something odd. Parents will point out farangs to their children, who will then run up to get a closer look or touch us for good luck. The Thai’s attitude towards tourists and foreigners is that of an amused bystander. In a country where the vast majority of people are Thai, it is easy to notice someone who doesn’t quite fit in.

### **Mac Ciampa: “Encounter with Father Joe”**

During research for the project, my group (Joy, Whan, Cailah, Liz, and I) wished to talk Father Joe, the leader of the Mercy Center. We had sent an email to him asking for an interview explaining, “We are a group of students from Worcester Polytechnic Institute in Worcester, MA and Chulalongkorn University in Bangkok working with the Duang Prateep Foundation to build playgrounds in the Klong Toey area in efforts to provide safe areas for children to play and develop.” He sent an email back inviting us to give him a call or stop by for an interview.

Upon arrival we found out we needed an appointment, so a Thai woman offered to give us a quick 5 minute tour before her meeting. Near the end, we reached Father Joe's house. Compared to the houses in the slums, it looked like a mansion. Elevated four feet above the rest of the center and surrounded by a moat filled with huge fish, it had the look of a New Hampshire winter retreat house or log cabin. Father Joe was on the steps feeding bread to the fish, wearing shorts and a t-shirt. He asked a few questions in Thai to our tour guide and then spoke to our group. This is how the conversation went as best as we could remember it:

**FJ:** So tell me, what are you doing to help the poor?

**Mac:** We're building playgrounds in Klong Toey for the children in the slum.

**FJ:** But what about the poor?

**Mac:** ...

**FJ:** Well, good luck building your playgrounds. Let me tell you something. There's a woman a few streets over that spent the whole day working and made a profit of 3 Baht. The whole day, just for 3 Baht. A few weeks ago, we had a fire that destroyed a number houses. We saved children from that fire. But yes, good luck building your playgrounds, I'm sure that will help. Who are you working with, anyway?

**Mac:** The DPF.

**FJ:** Sorry, who?

**Mac:** Duang Prateep Foundation, right down the street. They're trying to build 30 playgrounds in Klong Toey.

**FJ:** Well, that's a complete waste of time. The children here play in the rock garden. They play with rocks. We let them invent their own games, they don't need fancy equipment. And I'm not trying to insinuate you, I'm your friend. I'm just letting you know that you're wasting your time, and if you really want to help, you should look elsewhere.

With that, Father Joe Wai'ed to us and went back into his house. The group Wai'ed to him and left. (I actually did not Wai, but everyone else did.) The Thai lady started to continue the tour, but the group implored that we not make her late for her meeting. We then left and went back to the DPF. I realized later that Joy and Whan were not angry or upset at all, whereas Cailah and I were visibly angry. Liz was upset but did not show it.

What I want to point out is the difference in reactions between the Thai and American group partners. I asked Joy and Whan afterwards how they felt during the encounter. They said that they were disappointed, but were not angry at all. They explained that they were not upset either, even though they knew full well he was being condescending and at points sarcastic. They were only disappointed that he had turned out to not be the extremely kind person they were expecting, and that we could not get any help from him. I, on the other hand, was too angry for words, and Cailah was mad too. Liz compromised and said that perhaps he had had a bad day, but was still very upset and a little angry about the encounter.

After I had calmed down, I was confused how Joy and Whan could were not even a little angry. Someone had talked down to them, and they brushed it off like they would a fly. After talking with them and remembering everything Ajarn Somali had taught us, I reached a few possible explanations. The first was that in Thai culture, especially in Buddhism, age and religion are much more significant factors of respect than in America. Just because someone is older than I am or a holy man does not necessarily mean that they earn my respect. In Thai culture, age is often parallel with wisdom, which is to be respected. Father Joe was older and a holy man, so even if Joy and Whan personally disagreed with him, they would most likely take anything he said in stride. He is older and therefore it is not our place to disagree. However, I still do not think this explains the lack of anger or grief they had. Even if someone I fully respect talks down to me, I will still be very upset.

Another explanation could be how in Thailand, speaking loudly, getting outwardly angry or upset, or showing any extreme emotion does not happen often at all. In one month here, I have not seen any Thai person yell or get visibly upset, including Joy and Whan. Other WPI students concurred that they have rarely or never seen their Thai partners angry. Perhaps Joy and Whan are simply less angry than typical Americans. When people learn to control their outward anger and actions, they generally become less angry and reactive people. Instead, they become much more proactive people.

These are the only explanations I could think of. It is one thing to not show anger, but another thing entirely to actually not feel angry. In general, I have noticed that Thai culture is much more relaxed, laid back, and calmer than American culture. This could be because of the teachings of Buddhism. For instance, going out to eat could take hours in Thailand, whereas in America we wonder where our food is after 15 minutes. When I forget my bus passes, the bus driver has always waved it off and let me ride anyways. That has never happened to me in America.

Perhaps Thai people are actually calmer in general and do not take offense to people as much as Americans do. I can't tell if I like this or not. I would like to be a calmer person, but I genuinely enjoy having the ability to show my emotions. Although I don't show emotions as often as the next American, I still enjoy having the ability to. If I grew up in Thailand, I bet I would think the exact opposite. Showing emotions can be seen as being very weak and insecure. It is generally better to have control over your emotions rather than the other way around. This way, you can make decisions without letting your emotions cloud your judgement. It's strange how I do not prefer one over the other.

So what did I take from this whole experience? I maintain that I have a right to be angry when someone is condescending towards me and does not treat me with respect. However, I never would have thought it possible for a normal person to take verbal abuse like that and brush it off. I'd like to try and mold my personal demeanor between these two extremes. I would like to be in better control of my emotions so that I can care less about encounters like this. So although I wish our encounter did not happen at all, I'm glad that I found my silver lining.

### **Cailah DeRoo: "A Fruit Juice Experience"**

There are many differences between American and Thai cultures. Anyone who spends more than a day in Thailand will notice the different language, ways, and the overall sense of modesty and respect. Other cultural differences are less evident, such as the way others treat you. Liz, Joy, and I stopped by a smoothie stand in the Klong Toey slum for a refreshing drink. We had various options for fruit juices; Joy and Liz chose orange, and I chose lime. The woman running the stand spoke limited English, so Joy helped translate for her.

She was not surprised at seeing two *farangs* at her stand; she said that a couple other foreigners who worked nearby frequented her shop. Joy asked me how I would like my smoothie – sweetened or bitter. I responded with slightly sweet and a little salt. When Joy told the woman this, she seemed somewhat surprised and asked again if that was really how I wanted my drink. We both confirmed it, and while she made my drink, she continued speaking to Joy in Thai. Joy relayed that Liz wanted her drink slightly sweetened but gave no instructions for how she wanted her own drink. The woman presented both Liz and Joy with their orange smoothies, without ever asking Joy her preference.

While we were walking away, Joy explained to us their conversation. She said that our orders surprised the woman because the other two *farangs* did not order the same way. She said that all foreigners liked their juice plain, without sugar or salt. The woman thought that all foreigners were from

the same country, spoke the same language, and had the same likes and dislikes. Joy said that all Thais like their juices sweetened, which is why the woman never asked how she wanted her drink.

The point of this story is not that different cultures have different drink preferences, but that the lack of diversity in the Thai culture is evident in their treatment of foreigners. I realized that many Thais share the mentality that all foreigners are the same. When I walk into a restaurant and order a spicy dish, it usually has very little spice. The servers and cooks see that I am a farang, and they think that I must not actually like spicy food. Dishes will usually be less spicy, without any request. Even the Thai students are surprised when I eat the same food as them at lunch. If they had not seen me eat the whole dish, they would not have believed that I like spicy food. Similarly, when I get in a tuk tuk, the driver will always offer to take me shopping, even after I tell them I'm going to Chula. They think that all farangs are tourists who want to go shopping at MBK or Paragon.

I understand that the cooks are just trying to be helpful and accommodating by tuning down the spice. If they believe that all farangs are the same in not liking spicy food, it makes perfect sense to give each foreigner mild food, even if it normally would be a spicy dish for Thais. If Joy had not been there to translate for us, the juice woman would have probably just given us each straight juice because that is how she knows other farangs like it.

I was slightly shocked when Joy said that the smoothie woman believed that all foreigners are the same. In the United States, I grew up in an atmosphere where diversity and individuality was embraced and encouraged. I was taught about different cultures and beliefs in school and travelled to various countries, so I never had the idea that all foreigners were the same. If I put myself in the smoothie women's shoes though, I can understand why she thought that. She has likely lived in Klong Toey her whole life and has probably never been outside of Thailand, let alone Bangkok. She has not had much experience with foreigners because very few tourists or farangs visit Klong Toey. If she attended school, cultural diversity surely was not taught or even explained. If all you know is your own culture, then all foreigners will be similar in the simple fact that their culture is *different* from your own.

This experience illustrated a few aspects about both American and Thai culture. Most Americans are exposed to cultural diversity every day. The American population is made up of nationalities and cultures from around the world, where the Thai population is much less varied. In America, I cannot pick out foreigners walking down the street based on their dress or skin color. In Thailand, anyone who is not Asian is targeted as a foreigner. This makes it easy for Thais to treat foreigners differently.



The underlying cultural aspect of this story is that Thais are very accommodating. It is in their culture to help others. Thais will go out of their way to help someone, even if it is inconvenient. They do this not because it is expected, but because they truly believe that helping and cooperating with others is the right thing to do. Rarely would you see an American go out of their way to help someone if it will take too much time, effort, or thought. Though farangs may feel that the Thais are not helping by giving us unsweetened limejuice and bland food, the Thais are just trying to give us what they think we want.