

TEMPORARY RESIDENTIAL ARCHITECTURE FOR CONSTRUCTION WORKERS

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วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาสถาปัตยกรรมศาสตรมหาบัณฑิต

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บ้านพักคนงานก่อสร้าง หรือ แค้มป์คนงาน คือที่พักอาศัยชั่วคราวที่ผู้รับเหมาจัดเตรียมไว้สำหรับคนงาน จากการศึกษางานวิจัยที่เกี่ยวข้อง พบว่าที่อยู่อาศัยส่วนใหญ่มีสภาพแออัด นอกจากนั้นที่พักยังไม่มีการระบายอากาศ มีชุมชุม บริเวณโดยรอบส่งกลิ่นเหม็นและเสียงดัง ปัญหาเหล่านี้ส่งผลเสียต่อคนงานซึ่งพักอยู่ในแค้มป์

งานวิจัยฉบับนี้ มีเป้าหมายที่จะปรับปรุงบ้านพักคนงานของโครงการ ลุมพินี ทาวน์ชิป รังสิต-คลอง1 ให้สอดคล้องกับการใช้ชีวิตของคนงานมากขึ้น เพื่อพัฒนาคุณภาพชีวิตของผู้อยู่อาศัย โดยที่บ้านพักของโครงการนี้จะออกแบบเพื่อคนงาน 1,000 คน ที่พักอาศัยเป็นเวลาอย่างน้อยสามปี

งานวิจัยฉบับนี้ถือว่าบ้านพักคนงานขนาดใหญ่ นั้น เป็นชุมชนที่เกิดขึ้นจากคนงานก่อสร้าง งานวิจัยฉบับนี้ มุ่งที่จะแก้ปัญหาด้านความแออัดของที่อยู่อาศัย ที่มีสาเหตุมาจากพื้นที่เก็บของที่มีไม่เพียงพอ การเพิ่มตู้วางของไม่สามารถแก้ปัญหานี้ได้ เนื่องจากตัวตู้เองก็ทำให้พื้นที่ใช้สอยบนพื้นลดลง อีกทั้งยังยากที่จะเคลื่อนย้าย และเกาะเกาะกิจกรรมภายในห้องพัก

งานวิจัยฉบับนี้เชื่อว่า ตัวสถาปัตยกรรมเองนั้น สามารถจัดให้มีที่เก็บของเพิ่มเติมได้โดยไม่ต้องวางเครื่องเรือนเพิ่มเติม ผลของงานวิจัยฉบับนี้จะเป็นการนำเสนองานออกแบบเพื่อแก้ปัญหาในบ้านพักคนงาน โดยจะนำเสนอการออกแบบอาคารห้องพัก และ พื้นที่ส่วนกลางที่สำคัญ อีกทั้งยังมีการจัดทำแผนผังตัวอย่างการจัดวางอาคารของทั้งชุมชนอีกด้วย

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Workers' living quarters, or so-called "campsites", are temporary residences provided by the contractors. According to various researchers, typical problems encountered in the campsites include heat, poor ventilation in the houses, insufficient space, poor smell, mosquitos and disturbing neighbours. These problems cause an unhealthy environment for the residents.

The objective of this thesis is to remodel the "Lumpini Township Rangsit-Klong 1" construction workers campsite according to the workers' daily activities for 1,000 residents for at least three years to improve their living quality.

In this thesis, the campsite is thought of as a community that is made up of the construction workers. The author prioritises the problem concerning the lack of storage space. The storage issue cannot simply be solved by adding a cabinet because the cabinet itself takes up spaces on the floor. Such storage is also difficult to move and may obstruct activities in the residential unit.

The author believes that without adding any furniture, the architecture itself can provide an appropriate space to improve storage methods. As a result, this thesis provides a design proposal to improve the campsite consisting of a remodelled design of the main facilities and a master plan for the whole campsite.

Field of Study: Architectural Design

Student's Signature

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Advisor's Signature

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Chapter 1

Introduction

1.1 Problems and Research Significance

Construction workers are required at every construction site. From the beginning of construction onwards, workers play a major role in the building's erection. Therefore, to aid in better construction management and work efficiency, a campsite is provided for workers, though these residences are typically temporary and not well-built. The campsite is usually located on the construction site, or else on land close to the site, depending on the construction site's available space. All of the workers involved in the construction project stay together in the campsite, separated by sub-contractor or work role, but without gender separation. Unfortunately, most contractors do not consider the construction campsite to be an operational priority because the camp has to be removed after the building construction is completed.

Because of this, workers live in a low-quality and high-density residence. Typically, the worker residences are temporary 1–2 story buildings without windows; consequently, they have no ventilation. Each residential unit is 7–9 square metres with a width of 2.8–3.0 metres. The main structure is constructed of wood and joined by nails. The walls and roofs are corrugated zinc sheets. In order to maintain efficiency, the contractors typically use recycled materials to build the campsite. Frequently, these reused woods and corrugated zinc sheets have been utilised too many times and are of low quality by the time they are used for the campsite – for example, the sheets may have many gaps and holes. This overall effect of the low construction quality reduces the workers' sense of privacy and security.

Most of these construction workers are immigrants. They do not have a sense of belonging in these temporary residences and believe that managing this is the contractor's responsibility. Unfortunately, the campsite is rarely maintained. In fact, it is rather unhygienic, which negatively impacts the workers' health.

With limited space and resources, the residential units are barely enough to stay in overnight. These units perform as shelter and nothing more. They do not support workers' living. In order to live in this miserable condition, the workers are required to make the best use of the existing structure, which is limited. For example, workers hang their clothes everywhere, making the residence unorganised and clothing easily lost. Storage space is also lacking, forcing workers to place their belongings in the corridors, which become obstructions during emergency incidents. The struggle of these workers to utilise the unsupportive structure's space impacts the living conditions of other workers in the campsite.

However, through proper design, the campsite can provide certain elements to support workers' everyday activities and make their lives easier. For example, proper storage space or cloth hanging spots that located within their residences.

1.2 Objective

The objective of this thesis is to remodel Lumpini Township Rangsit-Klong 1 construction worker campsite according to workers' daily activities for 1,000 residents for at least three years.

In this thesis, the campsite is conceptualised as a community rather than a temporary structure. The author aims to improve the quality of life for construction workers that dwell in the campsite. The research focuses on workers' behaviours to

redesign the campsite. Finally, the research outcome is to propose design solutions, including:

1. A remodelling of main facilities in the campsite, with an improvement of workers' living conditions to meet standards.
2. A master plan of the whole campsite regarding the location and zoning of each facility.

1.3 Scope of the Study

In this thesis, the main focus is to redesign the campsite for the Lumpini Township Rangsit-Klong 1 construction project located on Rangsit-Nakornnayok Road. Lumpini Township is an extra-large low-cost condominium cluster project consisting of 10,074 residential units in 50 eight-story buildings. The construction started in 2013, and as of September 2016, it is 83% completed.

In July 2015, the worker campsite for Lumpini Township project suffered from a fire, which burnt down the whole site with approximately 1,000 residential units. It has been rebuilt into the existing campsite with 552 residential units. The existing residences are two-story buildings constructed of corrugated zinc sheets and wood. Each building has 80 residential units. Each unit is 7.5-square metres with a width of 2.5 x 3.0 metres.

Reasons for selecting this site are as follows:

1. Workers are required to live three to four years in this campsite to participate in the construction project. Improving such a campsite will support the wellness of construction workers for a long period of time.
2. This campsite contains more than 1,000 workers when fully occupied. With this scale, the campsite impacts many construction workers' lives.

3. L.P.N. Development PCL is a company that is concerned about the well-being of construction workers. One of the issues in the Sustainability Development Report 2015 published by the company concerns the safety and quality of life for construction workers. It also has a policy focusing on the workers' campsite.

1.4 Research Methodology

This thesis consists of 6 stages including (1) Literature Review, (2) Observation (3) Analysis, (4) Case Studies (5) Programming and (6) Design Proposal. Diagram of the research structure is illustrated in Figure 1.

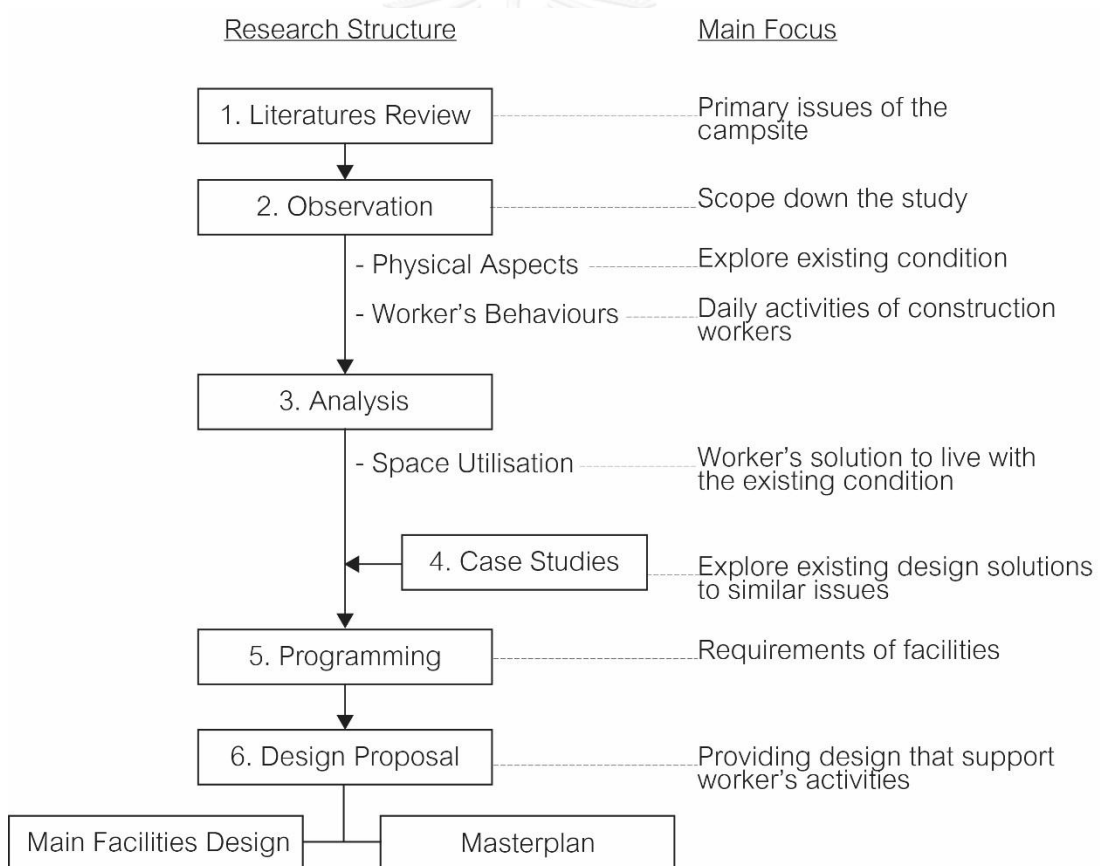


Figure 1. Diagram illustrating steps of research methodology

Stage 1. Literatures Review: The purpose of this stage is to recognise the primary issues of the campsite from related studies in order to scope down the focusing point for the observation. Problems stated in other literature shall be supplementing in this thesis.

Stage 2. Observation: This stage separated into two aspects; physical aspect and workers' behaviours. This stage aims to gather information on the campsite's current conditions.

1. Physical aspect: This aspect focuses on the built structures found in the Lumpini Township Campsite.

2. Workers' behaviours: This aspect focuses on the construction workers' daily routine.

Stage 3. Analysis: This stage shall use the information found during the observation to analyse. The main focus of this stage is space utilisation. Issues found shall be prioritised to provide effective design solutions.

Stage 4. Case studies: This stage aims to explore existing design solutions by study other campsite and design proposed by architects with similar issues.

Stage 5. Programming: This stage aims to determine the requirements of the main facilities which based on the workers' space utilisation.

Stage 6. Design Proposal: Design proposed at this stage shall be made according to the requirements from the programming stage. Design proposal shall cover two aspects; main facilities design and master plan.

1. Main facilities design is a design proposal that aims to improve the built structures in the campsite. It shall provide space utilisation and construction for the facilities that workers frequently occupied.

2. Master plan is a design proposal on the overall campsite. It shall provide zoning and location of every facility in the campsite.

1.5 Terminology

Frequently used terms are listed below:

- 1.5.1 “Campsite” refers to the whole area that identifies the perimeter where workers live. Area for permanent building construction is not included.
- 1.5.2 “Camp” refers to the built structures for the construction workers
- 1.5.3 "Facility" refers to each building or area that can serve a particular function in the campsite.
- 1.5.4 “Workers” refers to labours and craftsmen that work at the construction site and stay in the campsite. Chief-officers such as site manager, architect, engineer, and foreman are not included.
- 1.5.5 “Residential Unit” refers to a personal quarter in the campsite where the workers live. Mostly refers to the room that workers spend the night include both indoor and personal outdoor space.
- 1.5.6 “Corrugated Zinc Sheet” refers to a type of cheap galvanised metal sheet which Thai people commonly called **สังกะสี** or Zinc.
- 1.5.7 “Metal Sheet” refers to a high quality galvanised metal sheet with multilayer coatings. It is neat and durable.

1.6 Benefits of the Study

Research results in this thesis are expected to benefit both construction workers and contractors. For workers, it shall elevate their living quality in the campsite. Workers will be able to spend better quality time in their residences or common areas where they spend most of their time apart from working. They will be able to have better rest in their residence. For contractors, better living spaces will increase working efficiency of the construction workers.

Chapter 2

Literature Reviews

2.1 Literature Reviews

The literature review in this thesis focuses on the problems and conditions of the construction workers' campsite. The review is separated into two aspects: the appearance of the campsite and the living conditions of construction workers.

2.1.1 Appearance

Aram Lurpromchai described a worker's campsite in "Labours' living quarters on site of small and medium scale constructions in Bangkok Metropolis" as a single- or two-story residential building mostly constructed of corrugated zinc sheets. It expressed that workers' living quality is lower than standards. The residences are temporary and can be rapidly erected and dismantled. Most of the residential units have no window. The infrastructures in the campsite are provided by contractors, and workers are not required to pay for them. This can be why workers' salaries are lower than the minimum wage stated by law (Lurpromchai 1996).

Lurpromchai also stated the problematic issues in the residential area as follows:

1. The residential units are congested. The materials of which they are built are corrugated zinc sheets, which absorb heat and raise the indoor temperature. Units' ventilation is insufficient.
2. Sanitary conditions in the campsite are poor, and there is wasted water in some areas. There is no proper waste disposal space.
3. Working hours exceed the limitations stated by laws.
4. Workers' average daily salaries are lower than the minimum wage stated by laws.

5. School-aged workers' children still live with their parents on the construction site, which is not secured.
6. Leading workers' problems are wrangling, stealing and gambling.
7. There is not enough workers' welfare, including no proper days off or vacations. In addition, they have no accident or health insurance. There is a high risk of accidents at the construction site. Leading accidents are nail scratches, being hit or cut by steel, and injuries from construction equipment.

According to Sombat Vanichprapa in "Development of worker's accommodation in large construction project: A case study of Bang-Pa-In Pakkret Expressway Project", residences have lower quality than standards, and their problems can be separated into three aspects.

1. Appearance: Vanichprapa separated workers' residences into two types. 'Corrugated Zinc Residences' have no window for ventilation. The only opening is a door made of corrugated zinc sheets, unlike 'Tile Residences', which have a wooden door and windows covered by mosquito nets.

2. The size of the unit: 'Corrugated Zinc Residences' are 6–7 square metres with a maximum of two residents, while 'Tile Residences' are 8–9 square metres, with a maximum of three residents. However, 'Corrugated Zinc Residences' are cheaper and easier to build. All workers in the construction project need to live together, with no separation according to marital status or gender.

3. Infrastructure: There are fences at the entrance of the campsite, but not around the residences. An electrical system and tap water supply are provided. There is no proper water drainage; used water flows to the nearby land, with no grease trap. There is no land-filling on the land that built the camp. Lower ground caused a wastewater overflow in the campsite, and there is no waste management system.

Indeed, workers' waste is thrown into nearby lands. The campsite has abundant mosquitos: overall, it is in poor hygienic condition.

Vanichprapa suggested solutions including changing building materials and investing in increasing the standard of the residences and decreasing other costs. For example, the campsite should be managed according to the working period, numbers of workers and living period can minimise each day's transportation time and cost (Vanichprapa 1998).

Chakkrid Khantiwong stated in "The development of temporary housing for itinerant construction workers: a case study of West con co.,ltd., Bangkok Metropolitan" that the interior of residential unit is hot. There are openings for ventilation but not a window. The air cannot flow properly. Utilising corrugated zinc to construct the wall and roof is the cause of heat.

Problems of the campsite in his research including noise and water leakage. Most workers prefer to stay in a single story residence to a multi stories. They claimed that workers on the second floor are disturbing and can drop some waste. Multi-stories buildings are also difficult on walk up and down stairs.

Khantiwong also suggested that two-story corrugated zinc building has lower construction cost. However, it can be reused only 1–1.5 times. A prefabricated steel system instead, can be reused over four times. Khantiwong calculated the construction cost and came up with a conclusion that the prefabricated system is more cost efficient when used 2.86 times (Khantiwong 2006).

2.1.2 Living Condition

According to “โครงการศึกษาปัญหาสังคมและสาธารณสุขของคนงานก่อสร้างในเขตกรุงเทพมหานคร” by *Pirom Kamolratanakul* and *Kua Wongboonsin*, construction workers have following problems:

1. Poverty: Workers earn their salary every 15 days. Sometimes they also got cheated by the contractor.
2. Education: Most worker received only primary education. Some of them are illiterate.
3. Lack knowledge and experiences in building construction: New workers required to learn from their experience during work. They require amount of time to develop into a skilled craftsmen.
4. Family problems: Most workers are married. Workers spend most of their time working. They have less time to be with their partner. Workers cannot bring their children to live with them. Children were sent to their hometown and unable to receive warmth of their parents.
5. Social Association: Most workers do religious practice in their hometown. They have less time for practice after move to work in Bangkok.
6. Social adaptation: After the building construction is done, workers need to move. Workers are required to adapt themselves to a new place frequently.
7. Residential environmental problems: Interior of their residences is dark. There are construction materials, garbage and waste water overflown in the residential area. They also release bad odours. Workers share toilets and bathing area without gender separation.
8. Alcohol consumption: Group of workers occasionally drink alcohol after work, frequently on the payment date. It leads to violent behaviours among workers.
9. Status of female construction workers: Female construction workers earn less salary than male workers that work in the same field.

10. Relationship with chief officers: some workers have low experience in building construction. It caused a conflicted between workers and their chief officers.

Vanichprapa (1998) described construction workers' living conditions in two aspects.

1. Family condition: workers wish to bring their partner and child to live in the campsite. However, the contractor will charge rental fees for residents whom are not working for them. Furthermore, there is no childcare facility provided. Workers have to send their back to their hometown.

2. Social condition: construction workers left campsite 7:30 and arrived back after 20:00 via delivery truck provided by the contractor. They spend most of their time rest in their residences. Workers have less contact with each other. Single workers may have to live with other workers that haven't known each other before. Some of them are willing to pay rental fee in order not to share the room. Problems found in the campsite including disturbing neighbours, wrangling, and loss of belongings.

Vanichprapa suggested that the campsite should encourage the socialising between workers such as provide central canteen and sport activities. It will reduce social problems among workers (Vanichprapa 1998).

Watana Siriratana stated in "The Study of Attitude Construction Industry Group to Mass Transit Rapid Authority of Thailand Worker Residence Design" that workers have less accommodation and low-quality residences. It leads to decreasing work efficiency of construction workers (Siriratana 2004).

According to Prasarn Srisuppachaiua in “Current shelter situation and temporary shelter and permanent housing expectation of construction workers”, 57% of workers are satisfied with their residences. Though, the unsatisfied workers felt so because of the congested space and noise pollution. The research also present the expectation of worker to their residences as follows (Srisuppachaiya 1996):

1. Larger residential unit
2. Sufficient standard bathroom
3. Safety of life and belongings around the residence
4. Locate close to the construction site
5. New Material for residences, not reused

In conclusion, previous researchers identify workers' campsites as existing under challenging conditions; workers' living quality is lower than standards. Most of them shared the same issues, including hot and uncomfortable interior space caused by the utilisation of corrugated zinc sheets. Most of the campsites also have poor drainage, as well as sanitary and waste management systems. However, workers manage to live in such conditions. Understandably, the workers are humble and have low expectations of living in such a temporary campsite; however, its living quality and environment are inadequate. There are disturbing neighbours, wrangling and the loss of belongings.

2.2 Laws and Regulations

The campsite is considered as a temporary building. Temporary buildings must apply for building permission before construction similar to permanent buildings. Since there are many campsites with hygienic issue, Bangkok Metropolitan issue a regulation that requires contractor to submit the sanitary plan of worker campsite in order to gain the permission.

ระเบียบกรุงเทพมหานคร

ว่าด้วยการสุขาภิบาลเกี่ยวกับการขออนุญาต
และการควบคุมการก่อสร้างชั่วคราว พ.ศ.

๒๕๒๗

ข้อ ๔ “อาคารชั่วคราว” หมายความว่า สิ่งปลูก
สร้างซึ่งปกติบุคคลอาจเข้าอยู่หรือเข้าใช้สอย
ได้ และมีกำหนดเวลาการรื้อถอน

“ผู้ขออนุญาต” หมายความว่า ผู้ขออนุญาต
อาคารชั่วคราว

ข้อ ๕ ผู้ใดจะปลูกสร้างอาคารชั่วคราว ให้ยื่น
คำขอรับอนุญาตจากผู้ว่าราชการ

กรุงเทพมหานคร ผู้ขออนุญาต จะต้องเป็น
เจ้าของอาคารชั่วคราวที่จะปลูกสร้าง หรือเป็น
ตัวแทนซึ่งได้รับมอบอำนาจโดยชอบด้วย

กฎหมาย

ข้อ ๖ ผู้ขออนุญาตต้องกำหนดเวลาการรื้อถอน
และต้องแสดงแผนผังแบบก่อสร้างเกี่ยวกับ
การสุขาภิบาลดังนี้

๖.๑ อาคารชั่วคราวที่จะปลูกสร้างต้องมีทาง
ระบายน้ำใช้แล้วไหลได้สะดวกและเพียงพอ
ก่อนไปปล่อยออกสู่ทางระบายน้ำสาธารณะ

Bangkok Regulations

Issued on sanitary regarding building
permit and control of temporary
construction 1984

Clause 4 "Temporary building" refers to
the construction that person can stay or
utilise and stated with a time of
demolition.

"Applicant" refers to the applicant for
permission regarding temporary building
Clause 5. Person that wish to build a
temporary building must grant a
permission from the governor of Bangkok
The applicant must be owner of the
temporary building or a legal
representative

Clause 6. Applicant is required to state a
time of demolition and a sanitary planning
as follow

6.1 Temporary building must have proper
and sufficient waste water drainage

จะต้องมีตะแกรงดักขยะอยู่ในที่สามารถ
ตรวจสอบได้สะดวก

๖.๒ ต้องจัดให้มีส้วมที่ถูกสุขลักษณะ สำหรับ
คนงานที่เข้าพักอาศัยในอัตรา ๑ ที่ ต่อ ๒๕
คน

system and must have grease trap net
before release to public sewage located
on a place that can be checked easily.
6.2 Must provide well-sanitized toilet for
dwelling workers at a ratio of 1 to 25
people

The owner of the temporary building must apply for a building permit before construction. However, the documents that required to gain permission are fewer than those of permanent building. The ministerial regulation issue 9 also allow many exceptions for the worker campsite which make the campsite has fewer limitations.

กฎกระทรวง

ฉบับที่ ๙ (พ.ศ. ๒๕๒๘)

ออกตามความในพระราชบัญญัติควบคุม

อาคาร พ.ศ. ๒๕๒๒

The Ministerial Regulation

Issue 9 (1985)

According to the Building Control Act

1979

ข้อ ๔ อาคารชั่วคราวเพื่อใช้ประโยชน์ในการ
ก่อสร้างอาคารถาวร ซึ่งสูงไม่เกินสองชั้น หรือ
สูงจากระดับพื้นดินถึงหลังคา หรือส่วนของ
อาคารที่สูงที่สุด ไม่เกินเก้าเมตร และมี
กำหนดเวลาหรือถอนเมื่ออาคารถาวรแล้วเสร็จ
ต้องขออนุญาตตามมาตรา ๒๑ แต่ให้ได้รับ
การผ่อนผันไม่ต้องปฏิบัติตามกฎกระทรวง
ข้อบัญญัติท้องถิ่น หรือประกาศของ
รัฐมนตรีว่าการกระทรวงมหาดไทยซึ่งออกตาม
ความในมาตรา ๘ (๑) (๒) (๓) (๔) (๖) (๗)
(๘) และ (๑๐) และให้ได้รับการยกเว้นไม่ต้อง
ขออนุญาตหรือถอนอาคารตามมาตรา ๒๓

Clause 4 temporary building which its
purpose for construction of permanent
building with maximum of 2 stories or 9
metres from ground to roof and stated
with the demolition time Must apply for
building permit according to the building
control act (1979) section 21 but it does
not required to follow local regulations or
announcements of the minister of interior
that issued under the building control act
(1979) section 8 (1) (2) (3) (4) (6) (7) (8)
and (10) and does not required to apply
for building demolition permit according
to section 23

Section 8 of building control act (1979)

- (1) Type, characteristic, design, form, proportion, area and location of building;
- (2) Load bearing, resistance, durability as well as characteristics and property of materials to be used;
- (3) Load bearing, resistance and durability of the building or the ground which support the building;
- (4) Design and installation method relating to the sanitary system, electrical system, gas system, and fire protection system for chaos.
- (6) Management system of building environment such as lighting, ventilation, air conditioning, air cleaning, drainage, wastewater treatment, and garbage and waste disposal;
- (7) Characteristics, height, exterior open space or building line
- (8) Distance or level between buildings, or between building and property line of reputable, or between building and road, alley, lane, footpath or public place;
- (10) Area in which construction, modification, demolition, relocation, occupancy or change of occupancy of any class or types of building is prohibited;

Apart from Laws and regulations, there are standards issued by a reliable organisation. According to "Standard and construction drawings of a temporary building for construction workers and pre-school children" by the Civil Engineering Committee, Engineering Institute of Thailand, standards for the worker residence are as follows:

1. The building should be elevated from the ground not over than 1 metre. It should not be construct on a swamp area or junk landfill. The exception will be made if there are over 30 centimetres of soil on top. The building must be sanitised.
2. The unit should have width or length over 2.4 metres with overall unit area over 9 square metres for one family. It must be over 5.5 square metres for a two-resident unit. With openings more than 10% of room area.
3. Must provide at least 1 set of door and window.
4. The indoor corridor must be at least 1 metre wide and well-illuminated.
5. Room height must be at least 2.4 metres
6. The stairs must be at least 90 centimetres width with a 20 centimetres maximum riser and 22 centimetres minimum tread.
7. The building foundation should be permanent and stable enough to bear the load safely.
8. Provide rainwater drainage system and provide a waste trap in before drain to public sewage in a place that can be checked.
9. Each room equipped with at least 1 set of light bulb and power outlet. The electrical system must be sufficient and safe.
10. At every 20 metres of the building, provide at least 1 set of hand-held fire extinguisher on
11. List of recommending materials including
 - Wall – 4 millimetres thick, smooth ceramic, pressured paper, smooth plywood or 2 millimetres thick plywood
 - Floor – 1 x 8 inches of wood plank or 12 millimetres thick, smooth plywood
 - Roof – waved ceramic roof

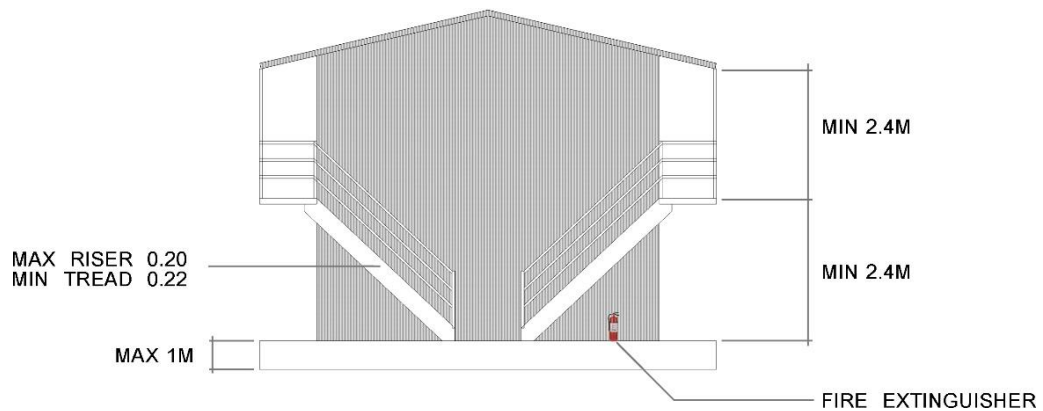


Figure 2. Diagram summarised standards for worker residence

Regarding the cost efficient, worker campsite frequently contains too many residents. However, the number of residents in residential buildings is limited according to the announcements of the ministry of public health.

ประกาศกระทรวงสาธารณสุข
ที่ ๖ / ๒๕๓๘

Announcements of the ministry of public
health

Issue 6 / 1992

เรื่อง กำหนดจำนวนคนต่อจำนวนพื้นที่ของ
อาคารที่พักอาศัย ที่ถือว่ามีคนอยู่มากเกินไป

Topic: number of people regarding area
of residential building that considered as
congested

ข้อ ๒ อาคารที่พักอาศัยที่มีคนอยู่เกินกว่าหนึ่ง
คนต่อพื้นที่สามตารางเมตร ให้ถือว่ามีคนอยู่
มากเกินไป

Clause 2 Residential building that
contains more than one person per 3
square metres is considered as too
congested.

2.3 Conclusion

Most of the literature focusing on construction workers' campsites stated that they are beleaguered by problematic conditions. The campsites described in this literature review shared the common problems, as follows:

1. Interior residential units are hot and uncomfortable: Most campsites have similar problems due to Thailand's weather and the use of inappropriate materials. The residential units also lack natural ventilation.
2. The campsite is congested and lacks space: Workers need more space for storage, which should be secure and separated from other residents.
3. Insufficient space for such worker activities as dining and sports: The campsite only consists of residences, with no space remaining for sports.
4. Smell: Garbage is carelessly disposed of around the campsite. There is also waste water under the residences due to the poor drainage system. Such waste releases bad odours.
5. Mosquitos and pests: The residential unit depends on natural ventilation. However, mosquito screens are not provided in the residential unit. All workers are required to install a mosquito net before sleeping.
6. Disturbances: There is little privacy between neighbouring units. Neighbouring residents sometimes generate disturbing noise. Residents on the second floor also generate noise while they move around.

Regarding laws and regulations, several laws control the campsite directly, though there are many exceptions for temporary buildings. For example, the campsite is not required to follow the laws on setbacks because they were issued under Building Control Act Section 8 (8), which is included in the exception stated in the Ministerial Regulation Issue 9. On the other hand, there are several guidelines published by reliable organisations regarding how campsites should be managed.

Chapter 3

Observation

3.1 Site Observation

This chapter's objective is to gather information regarding the Lumpini Township Rangsit-Klong1 Campsite's existing condition. The observations focused on two aspects: site observation, focusing on the campsite's existing physical condition; and workers' behaviours, focusing on the construction workers' daily activities.



Figure 3. Lumpini Township Rangsit Campsite, Rangsit, Tri Group Ratchada, 2016

The Lumpini Township Rangsit-Klong1 campsite is located on Rangsit-Nakornnayok Road. Tri Group Ratchada is a contractor company that works for the L.P.N. Development PCL. in this project.

The site covers 10,150 square metres (Figure 4) and contains 584 residential units, separated into 552 worker residences and 32 chief residences. The chief residences are for the chief officers required to reside close to the construction site, such as the foreman. The campsite is located adjacent to the building construction site. The worker residences are two-story buildings constructed of corrugated zinc sheets

and wood (Figure 3). Each building has 80 residential units, and each unit is 2.5 x 3.0 metres wide.

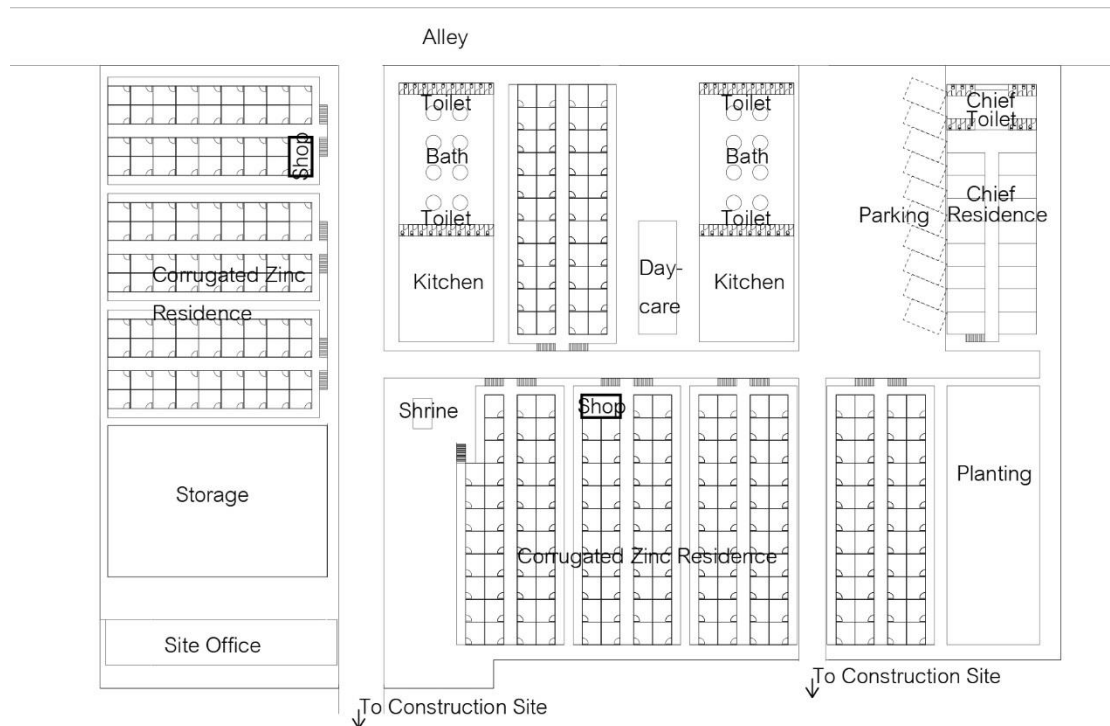


Figure 4. Existing Lumpini Township Rangsit-Klong1 Campsite, Tri Group Ratchada, 2016

Scale 1:1000

จุฬาลงกรณ์มหาวิทยาลัย
CHULALONGKORN UNIVERSITY

For the sake of cost efficiency, the campsite was built in long rows of residential units. The toilet and bathing areas were combined in an adjacent structure. Residents in the peripheral unit had to walk approximately 100 metres to access the bathroom.

The campsite is composed of 13 facilities as shown in Figure 5. The residence took the majority of the campsite's available space.

Facility	Area (Square Metres)	Proportion to Site	Main Users
1. Residences (2-Stories)	(3,600 Each) 7,200	35.47%	Workers
2. Kitchen	350	3.45%	Workers
3. Toilet & Bathing Area	500	4.93%	Workers
4. Shops	30	0.30%	Workers
5. Day-Care	75	0.74%	Workers' Children
6. Chief Residence	400	3.94%	Chief Officers
7. Planting Area	420	4.14%	Workers
8. Garbage House	10	0.10%	Caretakers
9. Guardhouse	2	0.01%	Security Guards
10. Parking Space	400	3.94%	Chief Officers
11. Storage	625	6.16%	Workers and Chief Officers
12. Site Office	165	1.63%	Chief Officers
13. Circulation and Open Spaces	3,570	35.17%	Workers
Site Area	10,150	100%	

Figure 5. Table presenting a list of facilities in Lumpini Township Campsite

1. Residence: The residential building (Figure 6) is constructed with corrugated zinc sheets and wood. It has no windows. There are wood corridors in the middle and around the building. The first floor is elevated 30 centimetres above the ground. Reused wood flooring on the second floor is built with low-quality craftsmanship. There are several significant gaps in the floor.
2. Kitchen: The kitchen (Figure 7) is provided for workers to cook in. Cooking in residential units is prohibited as it increased fire risks. All workers must use an

electrical pan to cook. Raw materials can be purchased from the campsite's shop or from street vendors that may set up a temporary stand nearby. The drinking water machine and washing machine are located in this facility. Hand-held fire extinguishers are installed in multiple locations within the kitchen area. Even though the kitchen is filled with workers before meal times, this space is unoccupied during the daytime.

3. Toilet: The toilets and bathing areas (Figure 8) are located adjacent to each other and are gender separated. They are constructed with corrugated zinc sheets and wood. The toilet is elevated 30 centimetres above the ground for efficient piping allocation. PVC pipe is used for the toilet's water supply. Used black water from the toilet is connected to underground septic tanks.
4. Bathing Area: Water basins are provided for storing water for bathing and for additional campsite utilisation. Utilising prefabricated water basins can reduce the bathing areas' construction time. They are also durable and reusable.
5. Shop: Campsite shops (Figure 9) provide general goods, food and raw cooking materials. Workers can buy either cooked food or raw materials to cook themselves.
6. Day-Care: Workers prefer to live with their families in the campsite. The contractor concerned that they should provide a day-care in order to take care of the workers' children while their parents are working at the construction site. The day-care (Figure 10) provided facilities for children, such as a slider, climber and seesaw. After work, the parents are required to pick up their children from the day-care. This space is then unoccupied until the next morning.
7. Chief Residence: Chief residences are for chief officers, such as the foreman, who are required to reside close to the construction site. These residences have better components and are well- built. There are toilets and shower rooms reserved for chief officers adjacent to the residences.

8. Planting Area: The campsite provided extra space for planting. Even though there is a pipe connected to a nearby sink using grey water for irrigation, this is still insufficient. Caretakers or concerned workers have to water them every day.
9. Garbage House: For a better campsite management system, a garbage house is provided with a garbage separating bin. Caretakers in charge of cleaning the campsite are also responsible for separating the garbage. The garbage house has proper cover from the rain and is located apart from the residence in order to avoid bad odour and germs.
10. Guardhouse: The guardhouse is located in front of the campsite. It is tiny, and the security guard never sits inside. It used only for records storage. A security guard would sit in front of the campsite or occasionally patrol around the camp.
11. Parking Space: The campsite parking space is occupied by the contractors' cars. Most contractors and superior officers use a pick-up truck.
12. Storage: The campsite is located adjacent to the building construction site. Some of the construction materials are stored in the campsite, including construction tools, paint, gas and chemicals used in the construction.
13. Site Office: The site office is located in the campsite. This facility is a working space for chief officers. Every day before and after work, workers are required to register in front of this facility.



Figure 6. Residence



Figure 7. Kitchen



Figure 8. Bathing area



Figure 9. Shop



Figure 10. Day-care



Figure 11. Chief residence

3.2 Workers' Behaviour

3.2.1 Demographics

Most of the construction sites are short of Thai workers because of changes in the population structure. Their expected life spans are longer, while the birth rate is decreasing. Thus, Thai workers change their occupation to other fields, such as motorcycle taxi or street vendors, to earn better compensation. Thai workers also go to work in foreign countries that provide a better salary, as explained by Somkiat Chayasriwong, Permanent Secretary of the Ministry of Labour (Matichon 2013).

Apart from construction workers, there are other personnel living in the campsite, including chief officers, the head resident, caretakers and security guards.

Chief officers are foremen that lead the workers at the construction site. Some of them came from other provinces and did not reside in Bangkok. There are 10–20 chief workers in the campsite.

The head resident (พ่อบ้าน) is a role appointed by the contractor. He stays at the campsite all day. His responsibility is to take care of the campsite's overall condition. For example, he will walk around the residences to check whether workers left any lighting fixtures or electrical devices on.

Caretakers (แม่บ้าน) are former workers that have been appointed this role by the contractors. Their responsibility is to clean the entire campsite while the other workers are at the construction site. There are 4–6 caretakers in the campsite. The caretakers also live in the campsite. They have to clean toilets and pick up garbage that was carelessly disposed around the campsite. They put the garbage into garbage house, waiting for garbage pickers to pick them up.

Security guards are former workers who were selected by the contractors to watch for other workers' risk behaviours, such as hassling. With day-shifts and night-

shifts, security guards can look over the campsite 24 hours a day. There are two security guards, one sitting at the front gate to open the door for visitors and another patrolling the campsite.

The Lumpini Township Campsite contains over 1,000 construction workers. The majority of the campsite's users are construction workers. Construction workers' daily routines are this thesis's main focus.

3.2.2 Construction Workers' Daily Routine

The construction workers' daily routine is summarised in a diagram in Figure 12. Some workers wake up at approximately 05:50–06:00 to take a bath. Meanwhile, others immediately begin preparing breakfast in the kitchen. They prepare sack lunches along with breakfast, as all of the workers bring sack lunches to the construction site so as to save on costs. They then have breakfast with their friends and families.

After breakfast, families with children 3–6 years old drop their children at the day-care. With day-care provided, both the husbands and wives can work at the construction site. Meanwhile, the wives who are mothers of children 0–2 years old are required to remain at the camp in order to take care of their new-borns. Children over seven years old will be sent back to the workers' hometown to attend school in order to avoid frequently transferring schools because of the uncertainty of their parents' workplace. Their grandparents or other relatives take care of them in their hometown.

Construction workers work at the construction site every day. However, they have better earnings in the weekend. Workers leave the campsite at approximately 07:00–08:00. They do a morning registration at the site office, and then they start working. At 12:00, workers have a lunch break, eating the lunch that they brought from the campsite and resting before they continue working at 13:00.

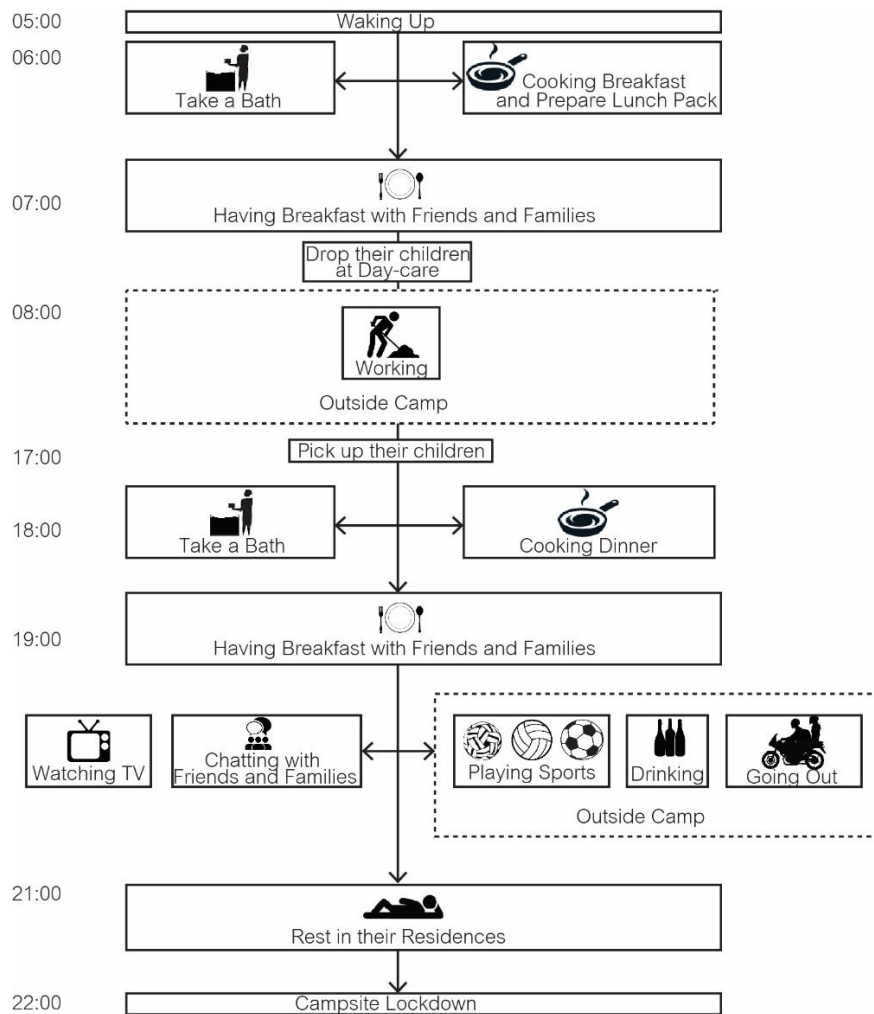


Figure 12. Diagram summarised construction workers' daily routine

Work hours end at 17:00, workers then walk back to the campsite and do the day-end registration at the site office (Figure13). Arriving at the campsite, they then change their clothes and take a bath. Some workers begin cooking right away. Workers with children pick their children up from the day-care. Meanwhile, the wives that are not working at the construction site had begun bathing and cooking before the workers arrived at the campsite in order to avoid struggling with others for bathing and cooking space. Workers are required to prepare their dishes in the kitchen to avoid fire incidents from cooking in such congested spaces, like their unit (Figure 14). However, workers cook rice in front of their room.

Workers dine in groups. “Married workers prefer to be with their families in the residences” (Pirom Kamolratanakul 1995). Single workers may dine with their friends. They occasionally drink alcohol afterwards, even though the camp rules restrict it.



Figure 13. Workers arrived at the campsite Figure 14. Workers cook in the kitchen

After dinner, workers spend their free time with friends and family. While some workers prefer to watch TV or chat with their friends and family in their residences, other workers prefer playing sports, such as sepak-takraw, volleyball or football, on empty land nearby. Workers with motorcycles might prefer to go out for a ride. Workers occasionally spend time outside the camp, such as by shopping.

Some workers work overtime for better earning. They have a break before the overtime hours start in order to rest and have dinner. After the overtime period ends, they arrive at the campsite at approximately 21:00. With extreme fatigue, they then take a bath and immediately rest in their residences.

The campsite is locked down at 22:00, with everyone prohibited from entering or exiting the camp. At night, common area lighting will be on all night for any worker that goes to the toilets. Rules of the campsite are very strict, and every worker respects it. Wrangling or stealing rarely occurs within the campsite.

3.3 Analysis

From the workers' daily activities, the facilities that are frequently occupied throughout the day are residences, the kitchen, the toilets and the bathing area. These facilities served as the campsite's primary functions, so they are the main focus for analysis.

3.3.1 Residence

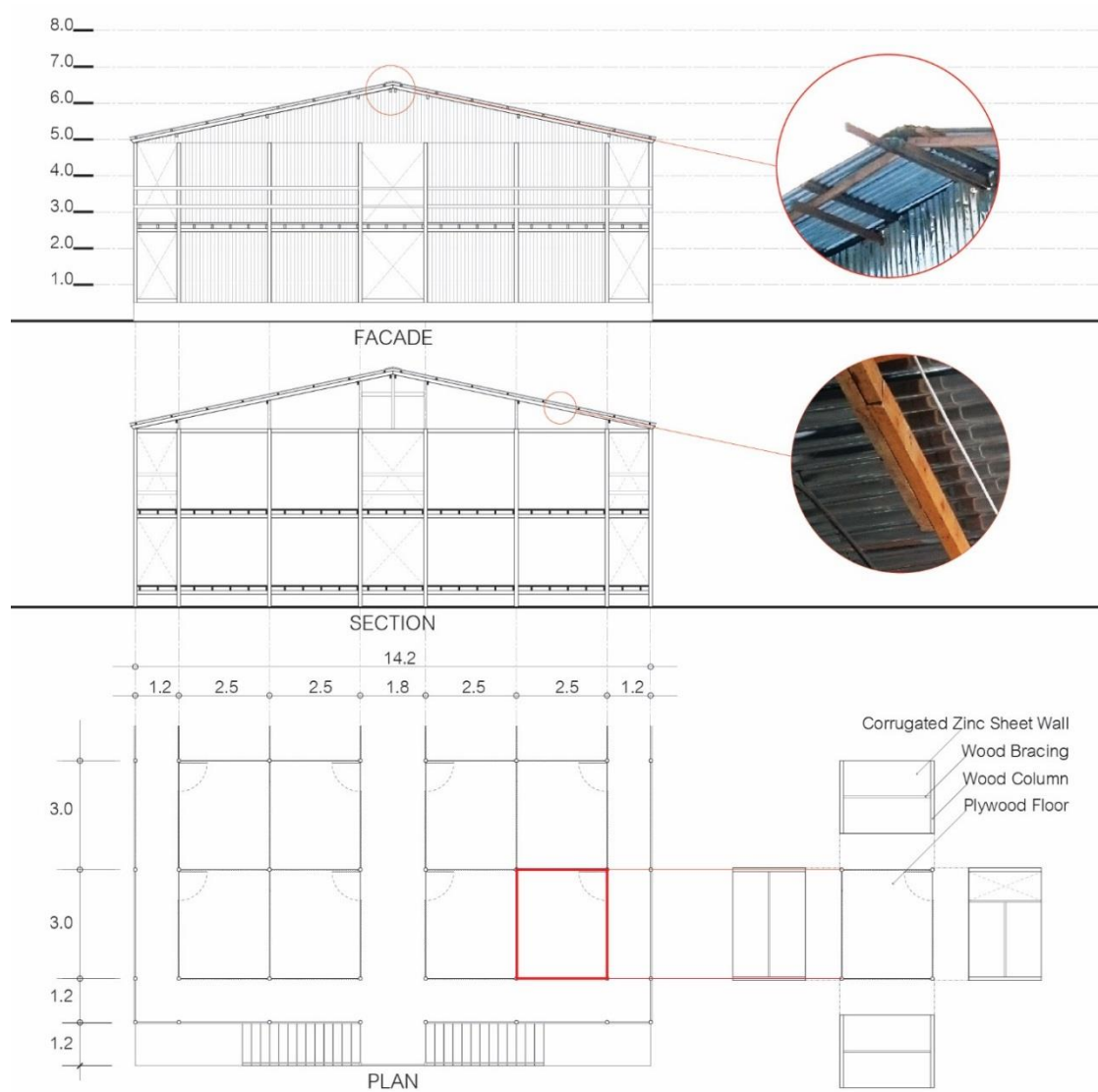


Figure 15. Residential building appearance and structure

The residence is constructed of wooden pieces and corrugated zinc sheets. The partitioning walls were installed from the floor to under the beam. The sheets on the top of the wall were cut to align with the roof inclination, resulting in a lack of ventilation (Figure 15: Facade). As Vanichprapa (1998) described, “Utilising corrugated zinc in a unit with no ventilation made the interior of residential unit hot.”

The beams and columns are wood. Wooden pieces are connected with nails in order to create the building’s frame. However, some of the wood pieces are not long enough to create a span, so workers were required to join several wood pieces together in order to create a beam that was the proper length (Figure 15: Section). With poor craftsmanship, this could cause structure distortion and lessen the building’s durability.

A residential unit is enough for two residents. The wall structure of a residential unit is illustrated in Figure 15: Plan. A wood bracing is provided in the centre to make the wall stand. It connects to the column by nails.

The campsite’s appearance has not significantly developed from the campsite described in literature reviews. It can be concluded that similar problems are continuing to exist, including heat, ventilation, insufficient space, mosquitos, and disturbing noises generated from the neighbouring units and the installed building materials’ looseness. However, workers still manage to live in these rather inadequate conditions.

Thailand’s climate heats up the indoor air. However, workers already have solutions to this issue. They open the door of their residential units at all times while they are inside to provide ventilation. Every worker has electrical fans, which can provide ventilation in the unit as a substitution for natural ventilation openings. Figure 16 points out the existing space utilisation solutions to the workers’ living conditions.



Figure 16. Space utilisation in the residential units

- (1) PVC pipe is hung from wall frame to hang clothes.
- (2) Workers need to work every day, so the clothes that are frequently used are hung inside the units. The clothes hung inside are dry clothes. These clothes are those not requiring frequent washing – jeans, for example.
- (3) Belongings are hung on the wall by nails. Nails were vertically placed on the wall structure in order to provide better holds and avoid injury from exposed nail scratches.
- (4) Rice sack for family eating. Workers can bring it from their agricultural hometown or bought it in a significant volume for a lower expense.
- (5) The residential unit has no window. Workers can instead open the door while they spend time inside and use an electrical fan to provide ventilation.
- (6) Workers can own a TV. A satellite receiver is placed on the roof in order to provide family entertainment.
- (7) Small utensils, such as body powder and a menthol inhaler, are placed on top of the wall frame.

- (8) A mosquito net is hung from column or wall frame. It can be folded or tied up when unused. Most of the time, it is used while workers sleep.
- (9) Used clothes are placed in the basket waiting to be washed.
- (10) Workers sleep on the floor. However, the floor is hard and not completely smooth. Mattresses, cushions and pillows are placed in the sleeping area. While unused, these items are folded and placed in the corner so as to transform the unit into a living or dining space.
- (11) A water bottle is required to contain drinking water for consumption in the residential unit.
- (12) The wooden floor can have gaps and holes, but workers can put plastic sheets to cover the floor. Plastic sheets also provide a cleaner floor for sleeping.

In a single residential unit, workers can live with their friends or families. However, space is limited inside the residential unit. Workers can only put selected pieces of belonging inside. Most belongings are placed on the floor or hung on the column or wall structure. Workers generally sit or lie down while resting in their unit. The wall is thin corrugated zinc sheets with a wood bracing in the middle. It is not rigid, so workers cannot even lean on the wall. Space utilisation mostly depends on the wall structure, and with the existing wall structure, workers cannot utilise the wall to its full potential (Figure 17).

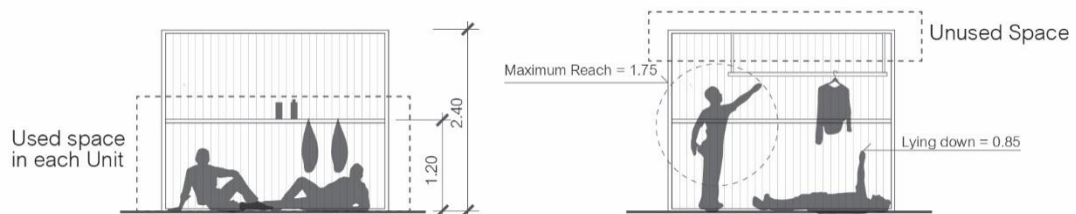


Figure 17. Wall structure utilisation diagram

According to the workers' daily routine in the previous topic (Figure 12), workers are not staying in their residence during the daytime. However, workers need to hang their clothes during the daytime in order for them to dry. Workers hung their clothes on the guardrail or created their own clothing hangers from scraps. Clothing hangers could be hung from the roof structure or stood on the ground. However, clothes hanging made the camp unorganised and made clothing easily lost, especially the company uniform, which everyone has almost identical versions of. The corridor in front of their unit is the best spot for workers to hang their clothes, as this spot can receive direct sunlight (Figure 18). However, doing so creates further obstructions on circulation.



Figure 18. Disorderly clothes hanging on guard rails in order to receive sunlight

Before entering their room, workers take their shoes off and place them in front of their room. Workers use part of the corridor in front of their room as storage. Belongings that workers place in front of their units include shoes, bathing equipment, clothes, rice cookers and cleaning equipment. Workers also make shelves from scraps in order to place their belongings in front of their units. Unfortunately, this narrows the circulation and becomes an obstruction during emergencies. Exterior space utilisation is described in Figure 19.

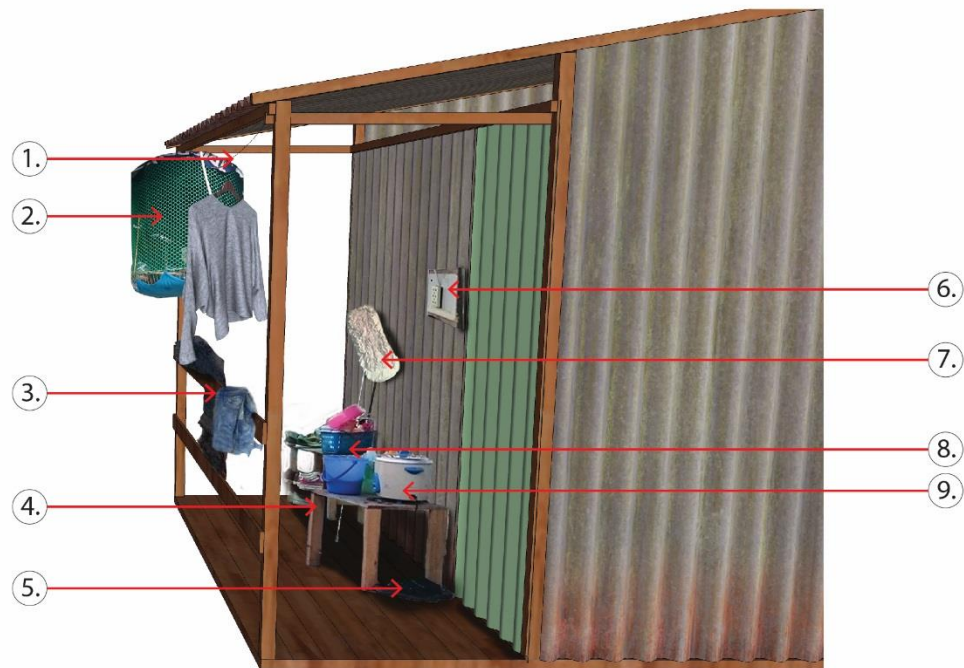


Figure 19. Space utilisation in front of the residential unit.

- (1) Workers tie ropes or cables in order to hang their belongings. These wires can hang from beams, columns or the roof structure.
- (2) A bird cage is hung on a wire. Workers raise birds in order to entertain themselves while living in the campsite. Workers need to cover the cage with fabric or newspaper in order to protect the bird from strong sunlight.
- (3) Workers hang their clothes on the guard rails. This spot received sunlight during the daytime. By hanging their clothes outdoors, workers are able to lock their unit in order to protect other valuable belongings during work time.
- (4) Wooden shelves are built from scraps in order to place more items in this limited space. Shoes are put on the bottom of the shelf.
- (5) Workers do not wear shoes inside their units. Shoes are placed in front of their units, mostly working shoes and slippers.
- (6) A light switch, power outlets and a breaker are placed in front of every unit to allow caretakers to check whether any workers left electrical devices on in their

units while they are working at the construction site, as this could increase the risk of fire.

- (7) Equipment for cleaning their units and the surrounding area.
- (8) Bathing equipment, such as soap, shampoo, a small water bucket and sponges were placed inside of a plastic basket to conveniently carry to the bathing area.
- (9) Rice cooker placed on the shelf for conveniently connecting to the power outlet.

In conclusion, workers have methods for dealing with the campsite's inadequate conditions. For example, the lack of ventilation can be solved simply with electric fans. Floor gaps can be covered with plastic sheets. Thus, the most critical problem is the lack of space, as this cannot be solved with devices or equipment. While their belongings almost entirely occupy the floor space, workers need to place their belongings on the vertical axis. Since the wall is weak and corrugated, workers can only hang belongings on the wall frame. The residential unit does not support vertical storage.

3.3.2 Kitchen

The kitchen is a common area provided for workers to cook in. This decrease the chances of fire by preventing cooking in workers' private residences. However, this camp rule must be applied strictly. The Lumpini Township Campsite insists that workers cook only in the kitchen and use only electrical pans.

The kitchen has a wooden structure. This is a combustible material and can increase the risk of fire in such a facility. The kitchen has minimum walls, which provides decent ventilation and allows cooking smoke to flow out of the facility. A washing machine is also provided in this facility.

Workers cook on the provided counter (Figure 20). They carry their own electrical pan from their residence. Stands are provided for more stable cooking (Figure 21). However, workers have electrical pans from various manufacturers, so the stand might not fit all of them.

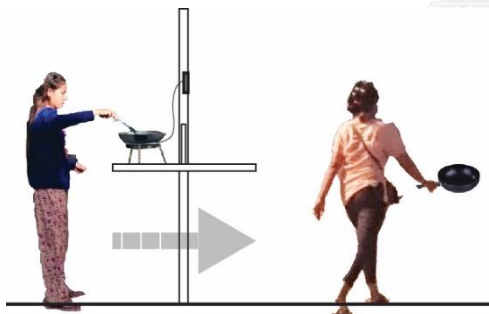


Figure 20. Workers' cooking position



Figure 21. Stands for electrical pans

After the cooking is finished, workers then immediately carry the pan back to their residence to distribute the food and dine with their families. Rice cooking is done at their residence. For workers that live on the second floor, it is dangerous to carry hot electrical pans upstairs. However, the kitchen is not always fully occupied. It has the potential for making a dining area, which decreases the necessity of carrying food to dine elsewhere (Figure 22).

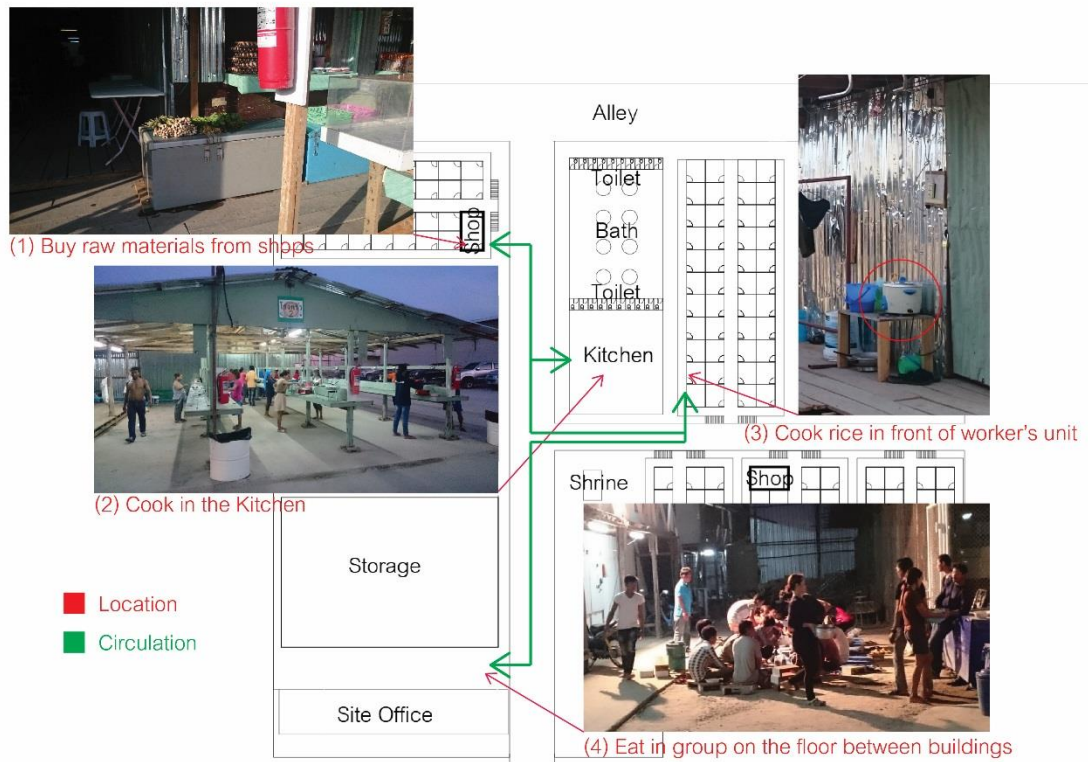
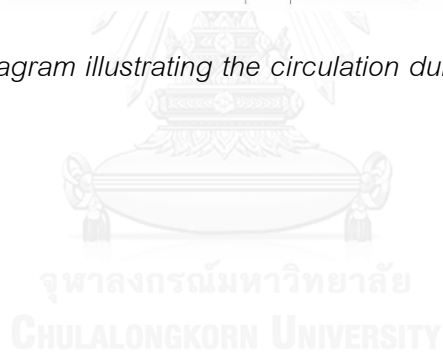


Figure 22. Diagram illustrating the circulation during cooking activities



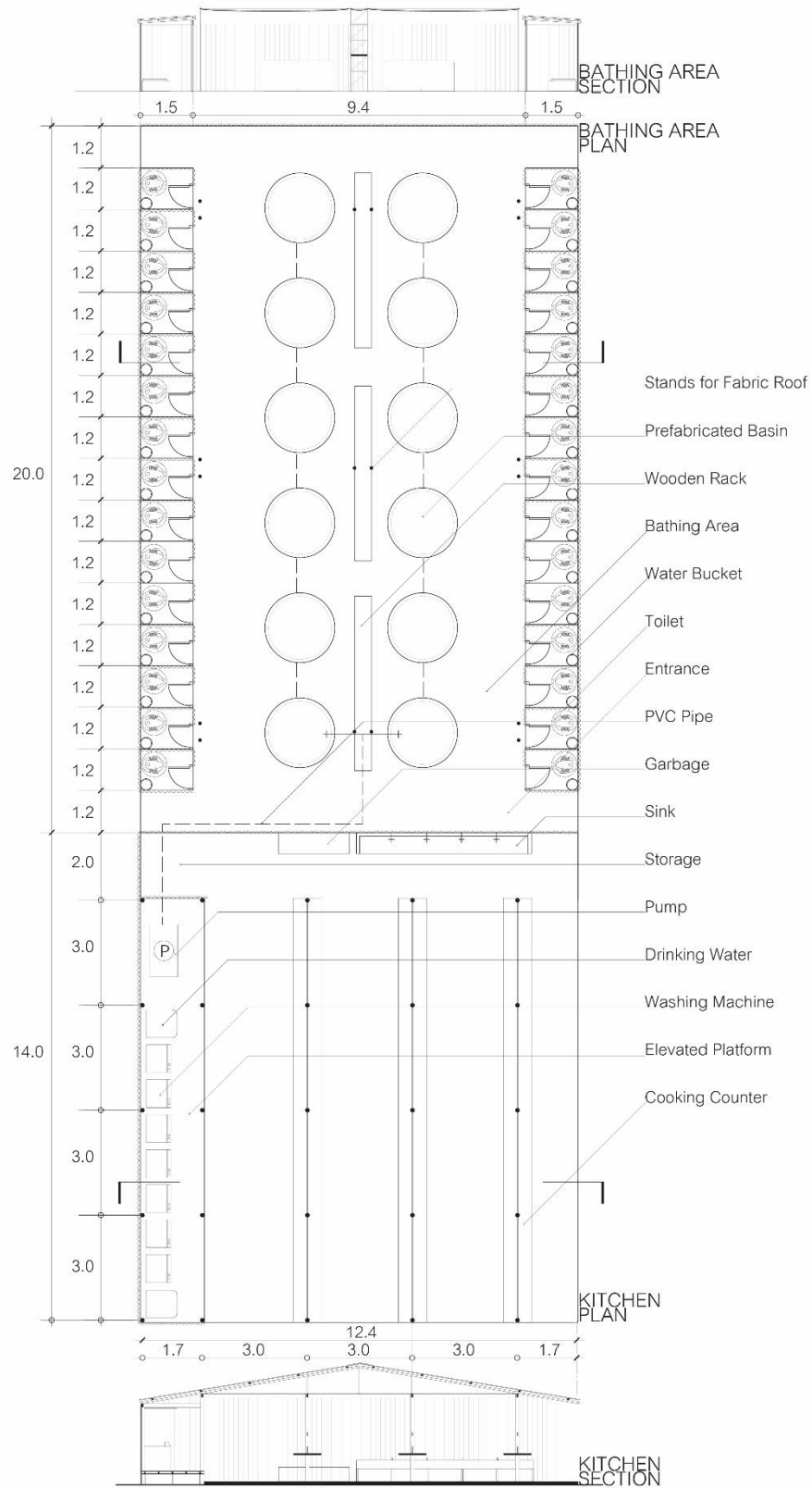


Figure 23. Plans and sections of kitchen and bathing area, Scale 1:200

3.3.3 Toilet and Bathing Area

Prefabricated water basins are used in this campsite, which decreases construction time because it does not require structural construction.



Figure 24. Worker prepare to take a bath

Every worker that walking to the bathing area wears a towel and carry their own bathing equipment in a basket (Figure 24). They required a space to place the basket and hang their towels. Workers have to build a stand from scraps for this purpose. It became obstacles in the bathing area.

Since Bathing Area located apart from the residence, workers need to wear slippers. There isn't any dry space to place their slippers. Some workers are wearing slippers while taking a bath.

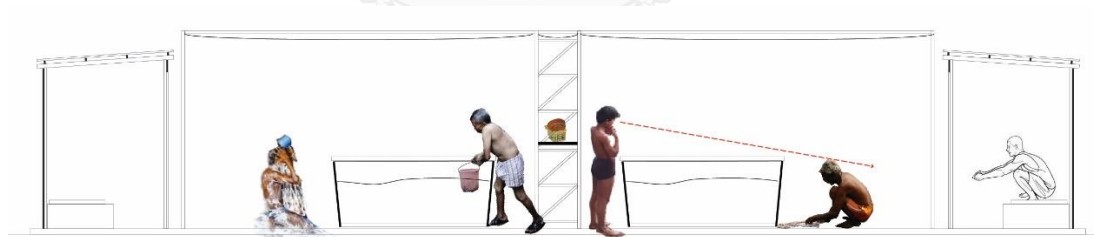


Figure 25. Diagram illustrating workers' bathing activities

Some workers sit down while taking a bath. This is not only relaxing, but the water basin also creates a visual barrier between the workers, providing a small sense of privacy during the bath (Figure 25). For more convenient, workers can use a bucket to dip portion of water to use during sit down bath.

Thin fabric roof is provided on steel truss stands. Workers place a wood plank on these truss to create a shelf for their bathing equipment (Figure 25).

Even though the contractor provided coin washing machines, workers could lower their expenses by hand washing their clothes on the floor during the bath. Since the basins are placed in a straight line along with circulation, sitting workers become obstacles. The space does not support sitting activities.



3.4 Conclusion

From the observations, the Lumpini Township Campsite appears to be similar to the campsite described in the literature reviews. It also possesses similar problems. However, workers do not consider these issues as problems and instead manage to live with them. Workers already have solutions to those typical residence problems, as described in Figure 26.

Issues	Causes	Workers' existing solution
Hot and uncomfortable interior space	<ol style="list-style-type: none"> 1. Lack of ventilation 2. Utilisation of corrugated zinc sheets that absorb heat 	<ol style="list-style-type: none"> 1. Use electrical fan 2. Open the door while staying inside
The campsite is congested and lacks space	<ol style="list-style-type: none"> 1. Limited site area 2. Not enough space in the residential units for workers' belongings 	<ol style="list-style-type: none"> 1. Hang their belongings 2. Build their own shelf or stand
Insufficient activities space	<ol style="list-style-type: none"> 1. Limited site area 2. Campsite is fully built as residences 	<ol style="list-style-type: none"> 1. Play sports outside of the camp area
Mosquitos	<ol style="list-style-type: none"> 1. Public ditch nearby incubates mosquitos 2. Inappropriate drainage system incubates mosquitos 	<ol style="list-style-type: none"> 1. Sleep in mosquito net 2. Use mosquito repellent
Disturbing neighbours	<ol style="list-style-type: none"> 1. Weak building materials create sound when hit 2. Wall partitions are thin and have large openings on top 	<ol style="list-style-type: none"> 1. Add extra corrugated zinc sheet on top of the wall to cover openings

Figure 26. Table summarised workers' solution to existing issues in the campsite

Even though workers have found solutions to most of the problems, lack of space is the most critical issue, as it cannot be solved with such devices. Workers can build a shelf, but the shelf itself takes up floor space and could obstruct other activities, such as dining or sleeping. Workers also hang their belongings. However, since the wall is weak, they can only hang belongings on the wall structure. The unit design does not support hanging.

Workers are required to cook in the kitchen, but there is no dining space nearby. It is inappropriate for them to carry their cooked food around the site. There should be dining space provided close or within the kitchen. The bathing area does not support workers' bathing activities, as there is insufficient space for bathing equipment. The bathing space also does not support sit down baths.

This thesis will tackle the issues of residential unit hanging space, as well as proper dining space and space to support bathing activities, which should be redesigned.

Chapter 4

Programming

4.1 Case Studies

This thesis provided 3 case studies which separated into two existing campsites and one design proposal to related issues.

4.1.1 Existing Campsite: Univance Campsite, 2015



Figure 27. Univance New Factory Campsite, Pintong Industrial Park, Thai Kajima, 2015

Univance New Factory campsite is located at Pintong Industrial Park. The site covers 5,600 square metres (Figure 28) and contains 240 residential units. The campsite located 4 kilometres apart from the building construction site. The residences are single-story buildings constructed of corrugated zinc sheets and wood (Figure 27). Each unit is 3x3 square metres and allowed the maximum of 2 residents. The building materials are a combination of new and reused corrugated zinc sheets. New sheets are used for the roof to prevent leakage. The reused sheets are for wall construction.

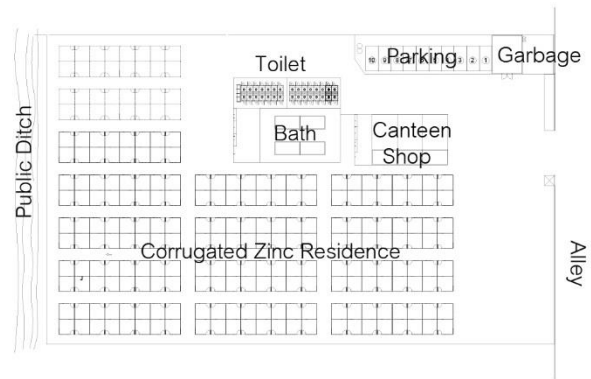


Figure 28. Univance New Factory Campsite, Thai Kajima, 2015

Scale 1:1000

This campsite appears similar to others in term of material and utilisation. Univance Campsite is not prohibit workers from cooking in their residence. It provided a canteen, rather than kitchen (Figure 29). Shops are located in this facility. It also provided tables and seats for dining and socialising.

At the bathing area, this campsite has concrete water basins (Figure 30). A stand for bathing equipment is unnecessary in this campsite. By utilising concrete water basins, workers can place their bathing equipment on the edge of the basins.



Figure 29. Canteen, Univance Campsite



Figure 30. Bathing area, Univance Campsite

4.1.2 Existing Campsite: Lumpini Mixx Campsite, 2016



Figure 31. Lumpini Mixx Theparak Campsite, Srinakarin, Tri Group Ratchada, 2016

Lumpini Mixx Theparak-Srinakarin Campsite is located on Srinakarin Road. It covers 12,800 square metres. It contains 808 worker residences and 10 chief residences (Figure 32). The campsite is located 1.2 kilometres from the construction site. The worker residences in this campsite are a combination of two-story corrugated zinc buildings and two-story metal sheet buildings. This case study focuses on the metal sheet building in order to explore different construction system.

The metal sheet building has 40 residential units with a corridor in the middle (Figure 31, 33). A window is installed in every unit. The floor is constructed of fibre cement which is smooth and can provide gapless connection.

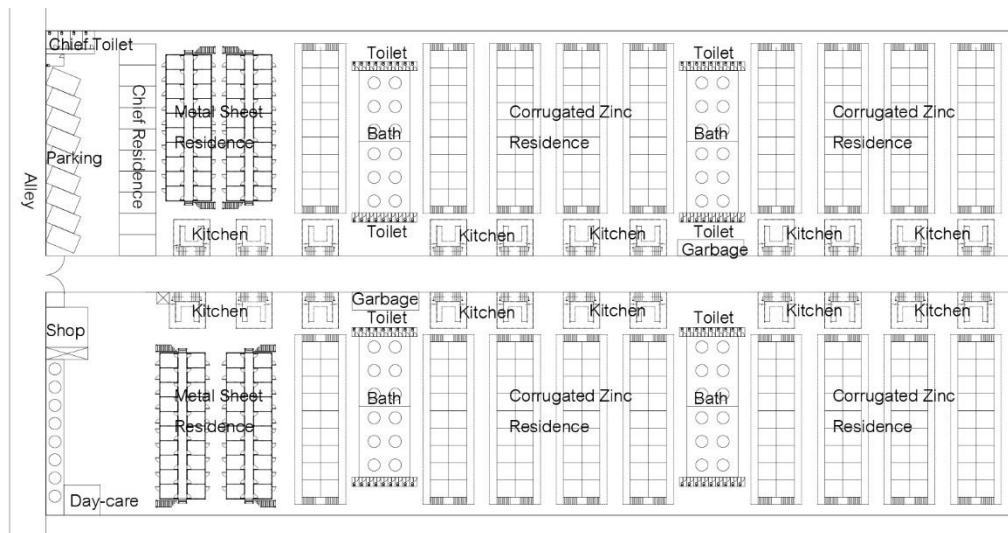


Figure 32. Lumpini Mixx Teparak-Srinakarin Campsite, Tri Group Ratchada, 2016,

Scale 1:1250

Lumpini Mixx Campsite has two-story steel structured kitchen (Figure 34). It has better fire tolerance compared to wood. However, it is difficult for workers to use stairs while carrying their dishes. It increases risks of accidents such as falling and dish dropping. This campsite locate kitchen in front of every residential building. Even though it is easier for residents to use, it would be more difficult to control in case of fire due to the multiple locations. Bathing area in this campsite (Figure 35) is similar to Lumpini Township Campsite with prefabricated water basins. Workers required to build stands for bathing equipment. Bathing area in this campsite is open without any wall or roof. Toilets perform as visual barrier between bathing area and the road.



*Figure 33. Residential unit
Lumpini Mixx Campsite*



Figure 34. Kitchen



Figure 35. Bathing area

At the front of the campsite, the fence is setback from the road allowed street vendors to set up their temporary stores. It became a small market place later on (Figure 36). Workers conveniently purchase food in this area.



Figure 36. A group of street vendors set their store in front of the campsite

4.1.2 Proposal: Housing for Construction Workers in Ahmabad, India, 2015

Housing for Construction Workers in Ahmabad, India is a research and design project by Hannah Broatch. It aims to provide an architectural solution to complicate social issues that are in desperate need of attention including:

1. No toilet provided, workers are forced to defecate in open
2. No water drainage, during monsoon it is flooded throughout the place
3. No drainage at the drinking water outlet and water pools which attracts mosquitoes.
4. No facility for children
5. Poor quality of construction material
6. No shaded area provided, except for some trees at the site perimeter.
7. Poor smoke ventilation for an indoor cooking.

These issues are similar to worker campsite in Thailand. Broatch's research has studied entire campsite and came up with four design criteria as follows:

1. Flexible: various height and width, joints with many potentials
2. Reuse: using recycle elements, easily to dismantle and same elements can be utilise on other site.
3. Organisation: a platform with activity space and gaps for natural light.
4. Portable: abilities to move building elements.

The design proposed in this project was taken from how things were already done in the campsite. It uses materials found on the site to compose a residential unit. Figure 37 illustrated a design concept of this project.



Figure 37. Design concept proposed for Ahmabad, Hannah Broatch, 2015

Broatch provided an outdoor space for the unit and claimed that the outdoor space is defined by inclining poles to make it more difficult to attach steel sheets makes the space remain external (Broatch 2015).



Figure 38. Section of the design concept presenting the shadings and double roofs

This design also proposed a double roof of corrugated steel and Hessian clothes coated with lime plaster (Figure 38). Broatch stated that layers of the roof would act as a mezzanine level to store the workers' belongings while providing some insulation from both heat and cold.

This design proposal tackled the issues of ventilation, storage, and socialising. However, this design proposes a unit for 7–8 residents. Different from the context in Thailand where workers prefer to stay with their family members (2–3 residents). Utilising fabric as partition and providing large openings decrease privacy of the unit.

4.2 Programming

This chapter provides the requirements for three main facilities in the campsite. The requirements are based on the space utilisation that derived from the observation in Chapter 3.

Meanwhile, the size of each facility is also provided to ensure that the facility space is sufficient for everyone in the campsite. Everyone in the campsite should be able to have access to the main facilities equally.

4.2.1 Residential Buildings

The residential unit is a single room but contains four different spaces (Figure 39). These spaces are determined by workers' activities including sleeping, storage, dining and living. The circulation which consists of stairs and corridor are considered as a common area.

Space	Utilisation	User	Charac- teristics	Area (Sqm)	Number of Units	Number of User per Unit	Gross Area (Sqm)
Sleeping Area	Sleep overnight	Workers and their family	Private	4	500	2	5,000
Storage	Keep belongings			4		2	
Dining Area	Having breakfast and dinner	Workers , their family and friends	Semi- Private	2		2-5	
Living Area	Living, Relaxing, Watching TV and Socialising					2-5	
Common Area	Circulation and Socialising		Public	3 /Unit	500	2-10	1,500

Figure 39. Table specify area requirement for each space in the residence

Though, the size of each space is uncertain. The lifestyle of construction workers required dynamic space. The space is adaptable and can be shared between different activities (Figure 40).

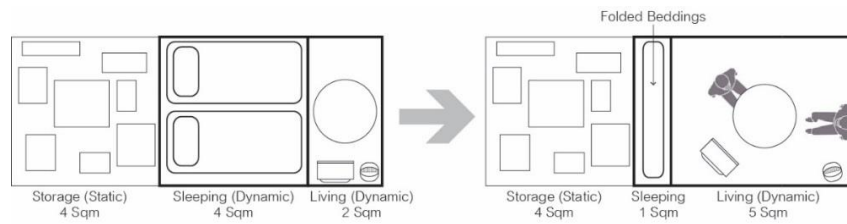


Figure 40. Diagram illustrating adaptable spaces in the residential unit

The requirements for each space in the residence is stated separately according to the space utilisation. The requirements are specified in Figure 41.

Area	Requirement
Sleeping Area	<ul style="list-style-type: none"> ▶ Flat and rigid floor to place at least two sleeping mats ▶ Flat and rigid wall to support floor-sitting, lying and leaning ▶ Openings shall remain the privacy of the unit ▶ Construct with low-combustible materials ▶ Residence door is rigid and lightweight with lock provided
Storage	<ul style="list-style-type: none"> ▶ Provide storage space apart from corridor ▶ Provide multiple hanging methods to support vertical storage ▶ Provide cloth hangers on both interior and exterior. ▶ Exterior cloth hanger receive sufficient sunlight. ▶ Provide space to support plantings or self-made shelves. ▶ Provide spaces for hand-held fire extinguisher
Dining Area	<ul style="list-style-type: none"> ▶ Multipurpose space. Adaptable for Living and Dining
Living Area	<ul style="list-style-type: none"> ▶ Flat and rigid floor to support floor-sitting lifestyle
Common Area	<ul style="list-style-type: none"> ▶ Corridor is covered from rain and allows safe egress ▶ Provide guard rail at the corridor end ▶ Electrical outlet, breaker and switches located on the exterior wall of the residential unit on corridor side, allowed caretakers to check.

Figure 41. Table specify the requirements of each space in the residence

4.2.3 Kitchen

This facility is required to be able to contain many workers at the same time. Space requirements of this facility separated into cooking, dining, and multipurpose area. However, all of these area can be shared and considered as one space in the facility (Figure 42).

Facility	Utilisation	User	Charac- teristics	Area (Sqm)	Number of Units	Number of User per Unit	Gross Area (Sqm)
Kitchen	Cooking, Dining and Social Gathering	Workers	Public	300	2	1-500	600

Figure 42. Table specify area requirement of the kitchen

Area	Requirements
Cooking Area	<ul style="list-style-type: none"> ▶ Construct of non-combustible materials ▶ Provide cooking counters supporting electrical pan ▶ Provide material preparation space ▶ Provide power outlet for electrical pan ▶ Well-ventilated and able to release cooking smoke ▶ Located apart from residential units to avoid fire spread ▶ Equip with hand-held fire extinguisher
Dining Area	<ul style="list-style-type: none"> ▶ Conveniently accessible from every residential unit ▶ Provide dishwashing sink ▶ Provide drinking water ▶ Locate adjacent to the Cooking Area
Multipurpose Area	<ul style="list-style-type: none"> ▶ Adaptable space can be use as community centre for social gathering and community events

Figure 43. Table specify the requirements of each space in the Kitchen

4.2.2 Toilet and Bathing Area

Bathing area also required to be able to contain many workers at the same time. Area in this facility determine by the utilisation which separated into three spaces: toilets, bathing, and washing.

Number of the toilet is according to “Standard and construction drawings of a temporary building for construction workers and pre-school children” published by the Engineering Institute of Thailand which requires 1 unit for every 20 workers. Area of the bathing and washing is also follows the same standard which requires 7 square metres for every 20 workers (Figure 44).

Facility	Utilisation	User	Charac- teristics	Area (Sqm)	Number of Units	Number of User per Unit	Gross Area (Sqm)
Toilets	Toilet	Workers	Private	1.5	50	1	75
Bathing Area	Take a bath	Workers, Water Truck	Semi- Private	100	4	1-100	400
Washing Area	Washing hands and face, Provide water for additional use in the campsite	Workers	Public	10	4	1-10	40

Figure 44. Table specify area requirement for each space in the bathing area

Area	Requirements
Toilets	<ul style="list-style-type: none"> ▶ Separated by gender ▶ Allow convenient piping and plumbing system ▶ Underground Septic tanks ▶ Provide drainage gutter with decent flow rate ▶ Locate within 30 metres from any residential unit
Bathing Area	<ul style="list-style-type: none"> ▶ Separated by gender ▶ Provide drainage gutter with decent flow ▶ Paved floor, convenient to clean ▶ Separate dry-zone and wet-zone for cloth changing ▶ Provide towel hanger ▶ Provide space to support sitting bath activities ▶ Provide space for placing bathing equipment during bath ▶ No gaps and holes on the partition
Washing Area	<ul style="list-style-type: none"> ▶ Provide coin washing machines ▶ Provide space to allow hand-washing clothes ▶ Provide sink for additional use apart from bathing

Figure 45. Table specify the requirements of each space in the bathing area

Chapter 5

Design Proposal

5.1 Master Plan

The design proposal in this thesis focuses on main facilities, including the residence, kitchen and bathing area, though other facilities shall remain in the campsite with minor changes or relocations.

The site occupies 10,150 square metres on the west of the construction site with a public ditch in between. Rangsit-Nakornnayok 30 Alley is located along the east perimeter. The main road is T-shaped to connect the construction site and the public road. The main road is six metres wide to allow fire and water trucks to enter. Subordinate roads are divided from the main road to provide circulation throughout the campsite (Figure 46). The main purpose of the subordinate road is for workers to walk conveniently.

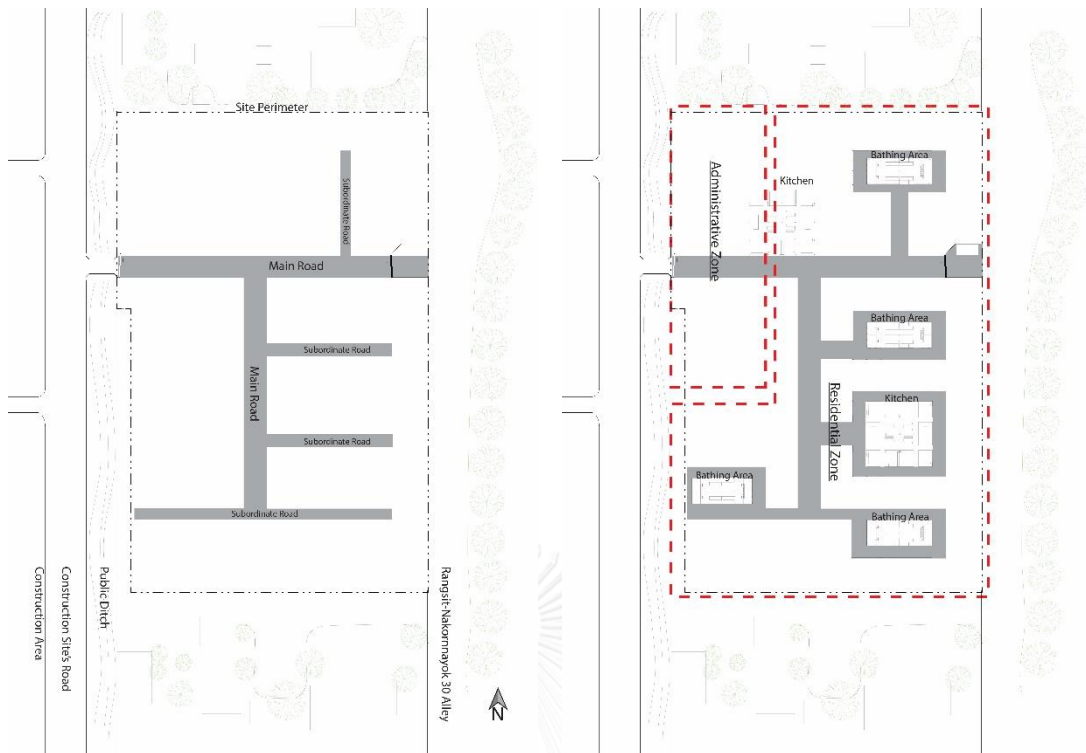


Figure 46. Site perimeter and road layout Figure 47. Zoning and activity nodes

This master plan is separated into two zones (Figure 47). One is an administrative zone located near the exit to the construction site. Workers are required to pass by for daily registration at the site's office before and after work. There are open space and a kitchen nearby for workers to wait for the registration. The kitchen is located at the T-intersection of the main road; it acts as a main gathering space. Service facilities are located at every subordinate road for convenient access; they are activity nodes for construction workers. Another zone is a residential zone, which surrounds the service facilities.



Figure 48. Plan and Location of Main Facilities

This master plan provides 504 residential units and can contain 1,008 workers (Figure 48). Available space in the campsite is limited, so residences must be located close together. A deck is provided within the residential buildings near activity nodes for socialising. The roof of the residential building connects, forming a long shaded area (Figures 49).

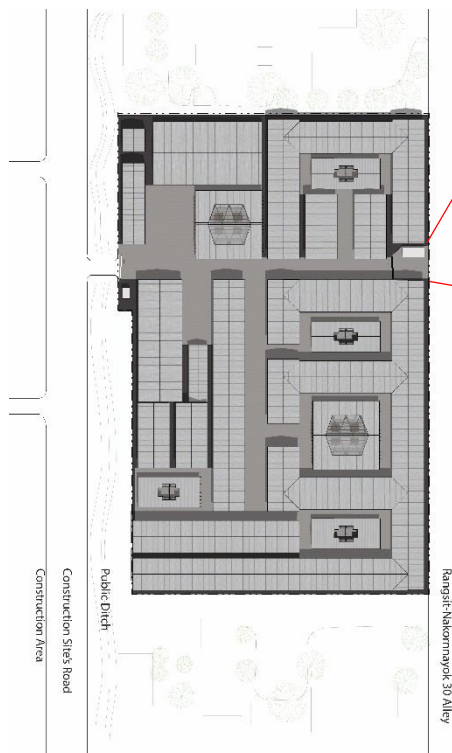


Figure 49. The connecting roof of residential buildings



Figure 50. Marketplace of street vendors

Even though the construction workers' campsite is not required by law to provide any setback on the site perimeter, this campsite provides at least a one-metre setback. The entrance at Rangsit-Nakornnayok 30 Alley is also set back 10 metres to provide space for a garbage house and temporary parking and for street vendors to set their stalls. Figure 50's photo was taken in front of Lumpini Mixx Campsite. Such a large campsite with many workers would attract street vendors; with the small space provided, vendors can set their stalls in front of the campsite, which would perform as a small marketplace.

5.2 Residence



Figure 51. Perspective image of residential zone

The residential building design is based on a two-story steel-structure buildings formed by rows of replicated residential units with a connecting circulation corridor. According to Khantiwong (2006), a building with a steel structure can be reused over 4 times, meaning it has a longer lifespan than a wooden structure and will be more efficient when reused after 2.86 times. The number of residential units to be combined into a residential building is changeable, as it depends on the site. Structural elements are constructed of steel tubes. Floors and lower parts of wall partitions are fibre cement. The upper parts of wall partitions and roofs are metal sheets.

This design proposal tackles the issue of insufficient storage space by enhancing vertical storage through architectural elements such as walls and columns.

Residential buildings located adjacent to the kitchen are main residential buildings. A deck is provided in front of them for social gatherings and dining (Figure 52).



Figure 52. Perspective image of residential building façade

The bottom part of front wall partition is extended, and the top part leans inward, which increases storage space on the floor level. The inclining partition top allows ventilation and creates hanging spots at a reachable height. The form allows multiple locations for workers to hang their belongings, including wall structures, the tilted wall, corridor poles, the edge of the wall and the Y column (Figure 56). The form of the Y column and corridor poles also allow workers to easily tie a wire to increase hanging spaces. Drawings of the residential building are illustrated in Figure 53–57.

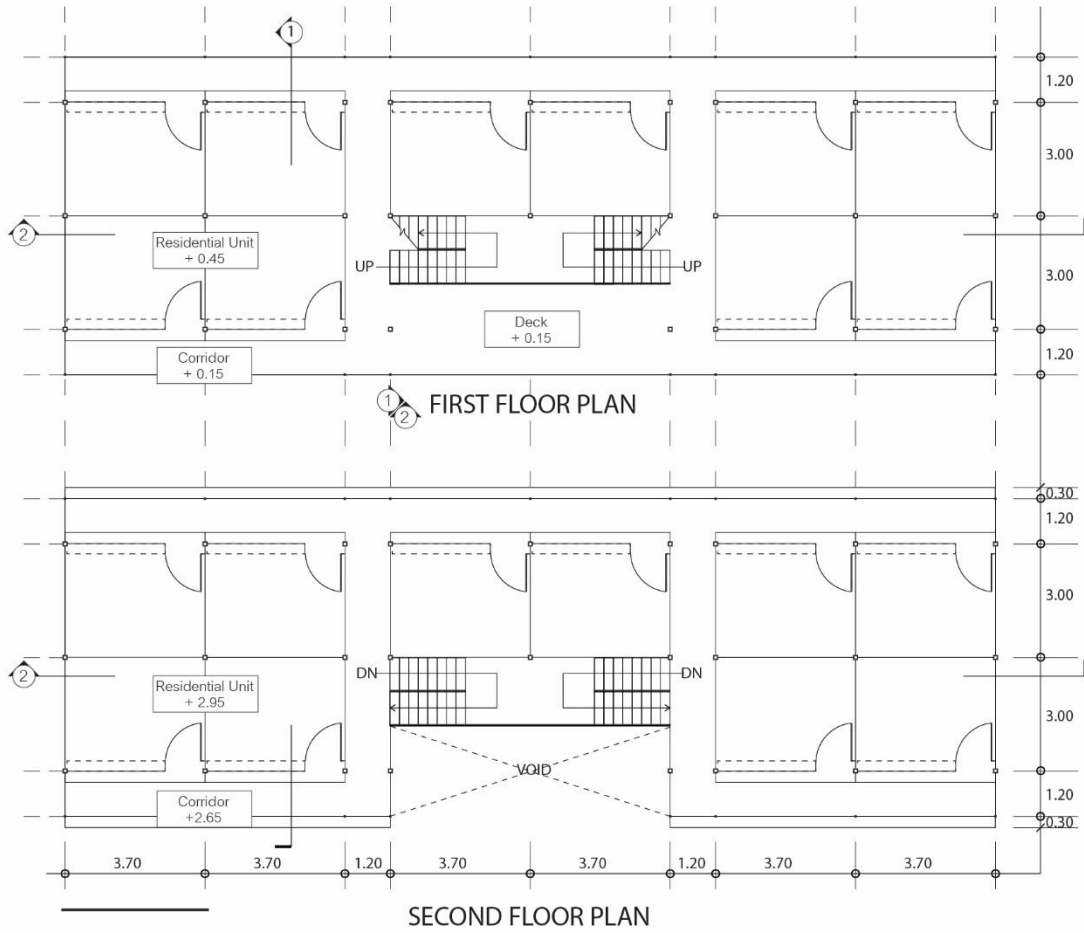


Figure 53. Residential building: Plan

Scale 1:200

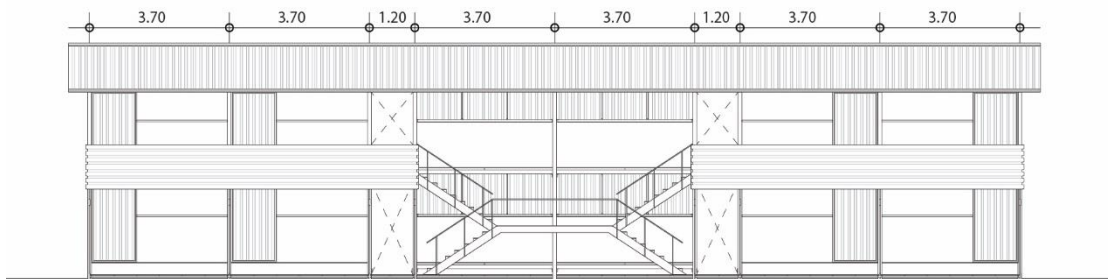


Figure 54. Residential building: Elevation 1

Scale 1:200

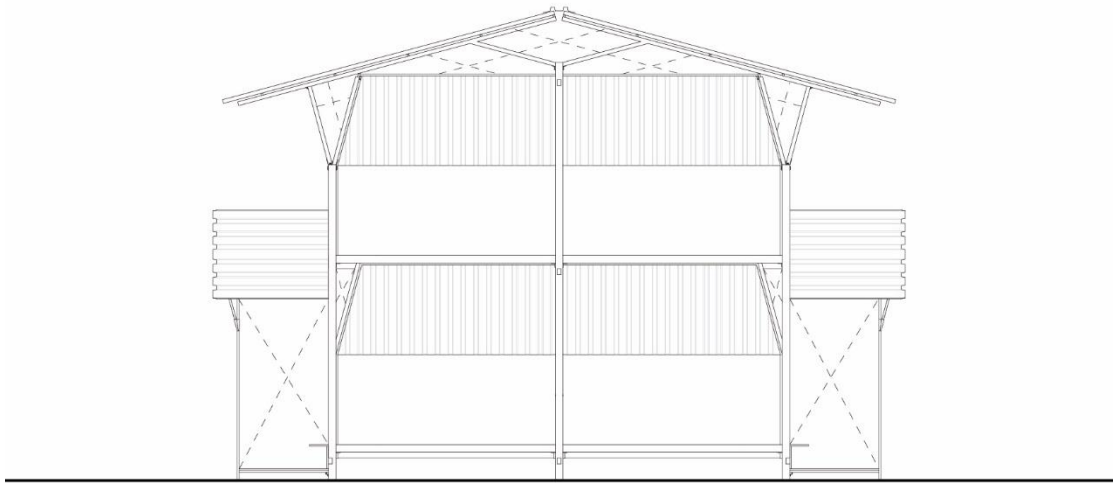


Figure 55. Residential building: Elevation 2

Scale 1:100

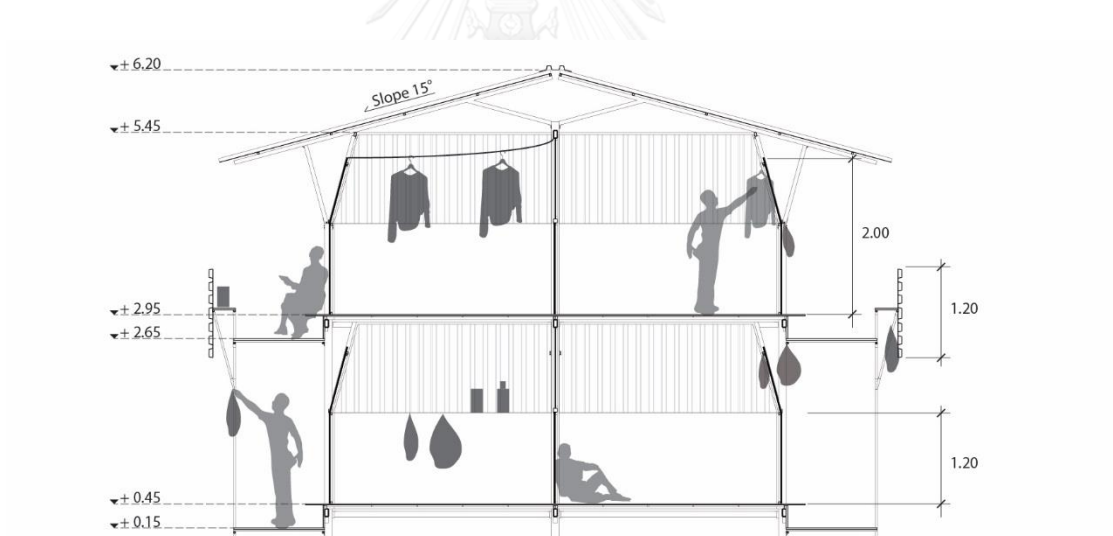


Figure 56. Residential building: Section 1

Scale 1: 100

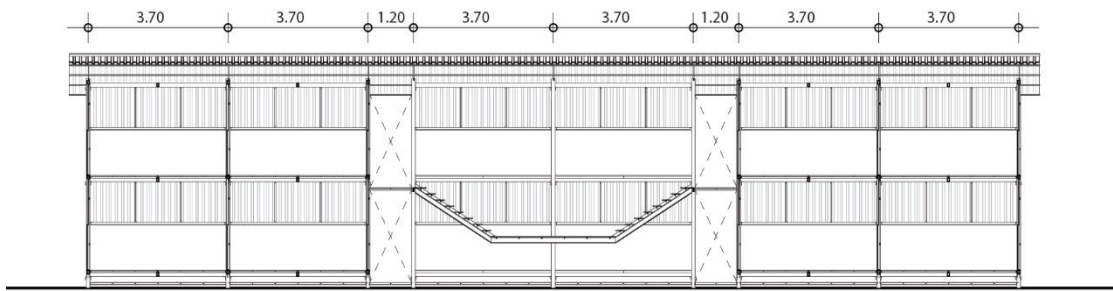


Figure 57. Residential building: Section 2

Scale 1:200

The interior space in a residential unit is 3.7x3 metres. The front part and along the wall of the unit is programmed as storage (Figure 58).

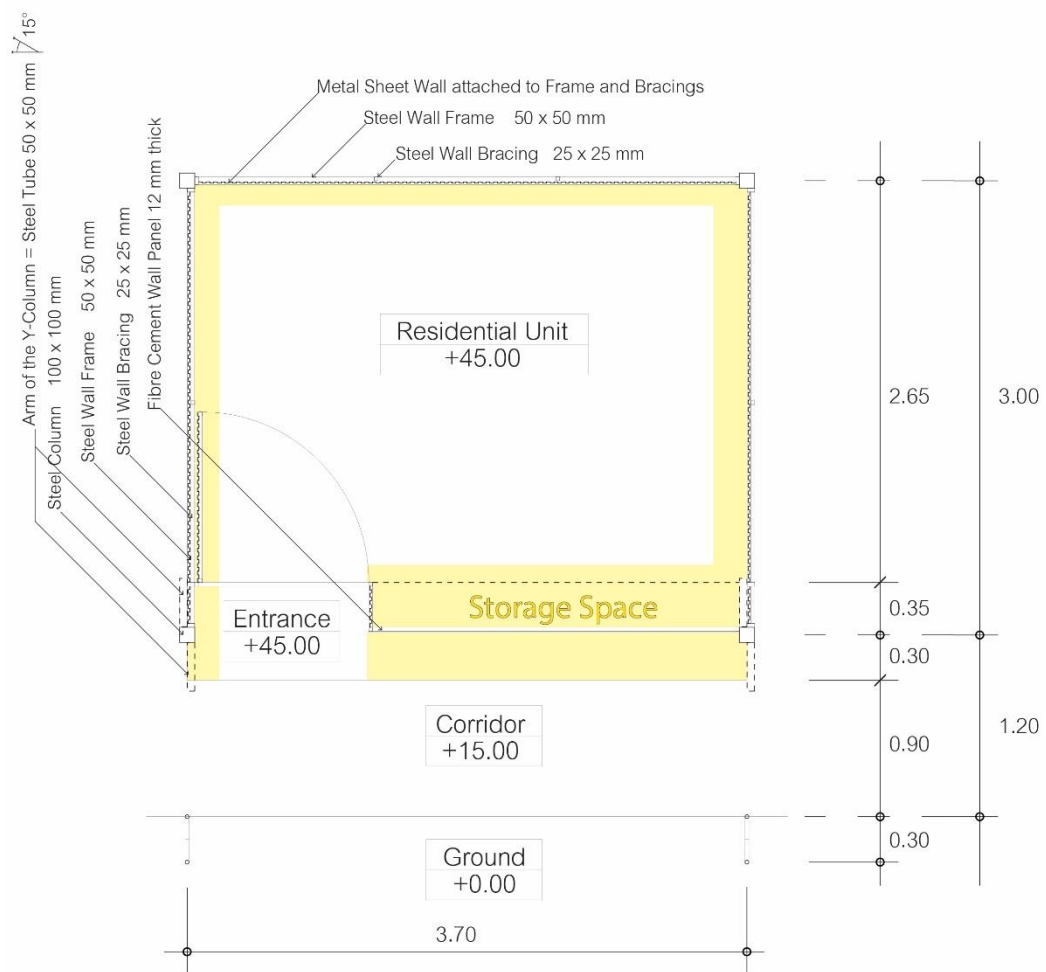


Figure 58. Plan drawing of a residential unit

Scale 1:50

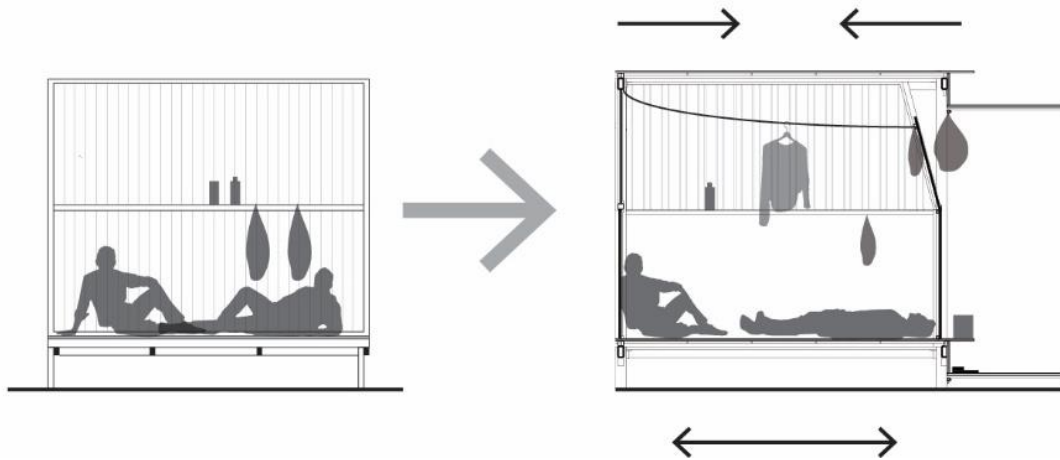


Figure 59. Diagram comparing typical unit with the new unit

The form of the residential unit was inspired by the floor-sitting lifestyle of workers, which occupies the lower space of the unit. The lower space of the unit is increased while the upper space tilts down to a reachable height (Figure 59). The material for the lower part of the unit is also changed to fibre cement. It is more rigid and allows residents to lean against it, which provides more comfortable sitting. Another advantage of using fibre cement is that it does not generate loud noise when impacted, which provides a quiet environment.



Figure 60. Perspective image presenting entrance of the residential unit

The Y part of the residential building is painted with colourful hues, not only to brighten the mood in the campsite but different colours also represent a building number or the ownership of the building.

The corridor and unit's floor are at different elevations. The floor is extended 30 centimetres to create multifunctional space. It can perform as a seat, storage space and space for planters. Space under this element is for shoe storage. Workers can quickly take off their slippers while stepping into their units (Figure 60).



Figure 61. Lighting fixtures in the residential unit

A Fluorescent bulb is provided in every unit. Lighting fixtures for the corridor are installed at the gap under the second floor corridor. With this location, they can provide light for the corridor on both first and second floor (Figure 61).

The Y column is utilised in this design not only to support the structure but also to create hanging spots for workers. The Y columns support the roof structure on one arm and wall partition on another. Connection details of a single residential unit is illustrated in figure 62–63.

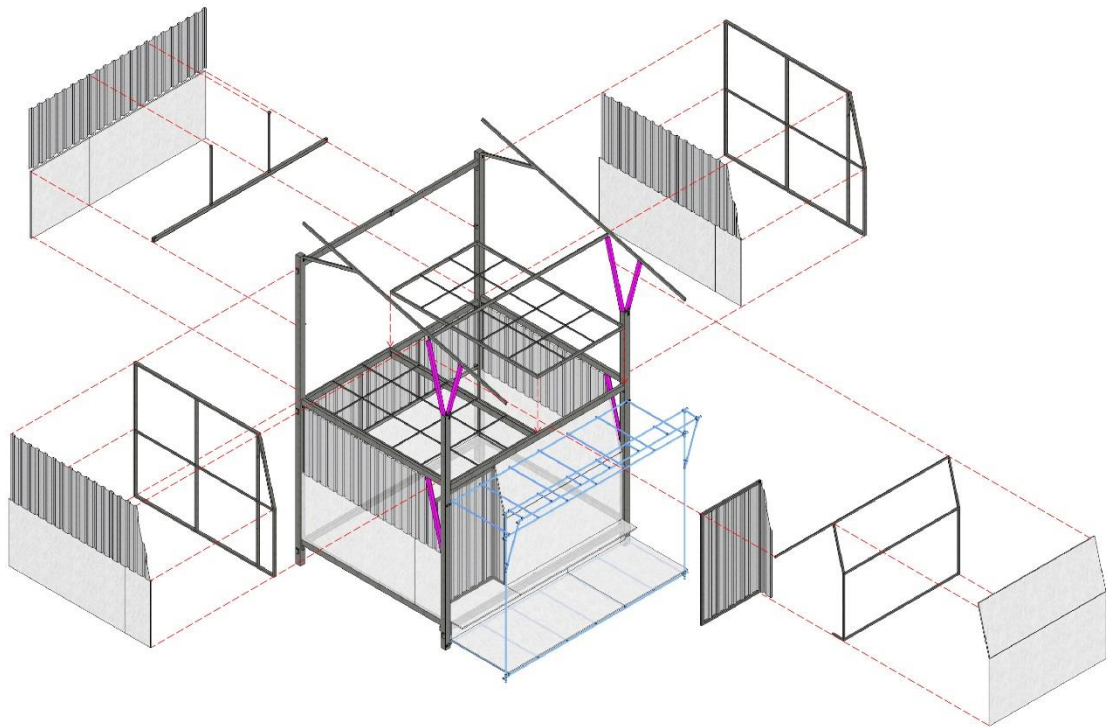


Figure 62. Diagram illustrating elements of the residential unit

All of the connections in the residential unit are connected with either interlocking joints or bolt which allows the unit to be able to erect and dismantled without damaging any building element.

The corridor receives less load; smaller steel poles are used for supporting the corridor. It also uses interlocking joints to connect with the column.

Structural elements connect with interlocking joints created with L-steel and C-steel welded to the elements. L-steel is welded to the beam while C-steel is welded to the columns (Figure 63). These interlocking joints provide the ability to dismantle the building without damaging structural elements in order to reassemble it on another site. This interlocking system is currently used at the Lumpini Mixx Campsite.

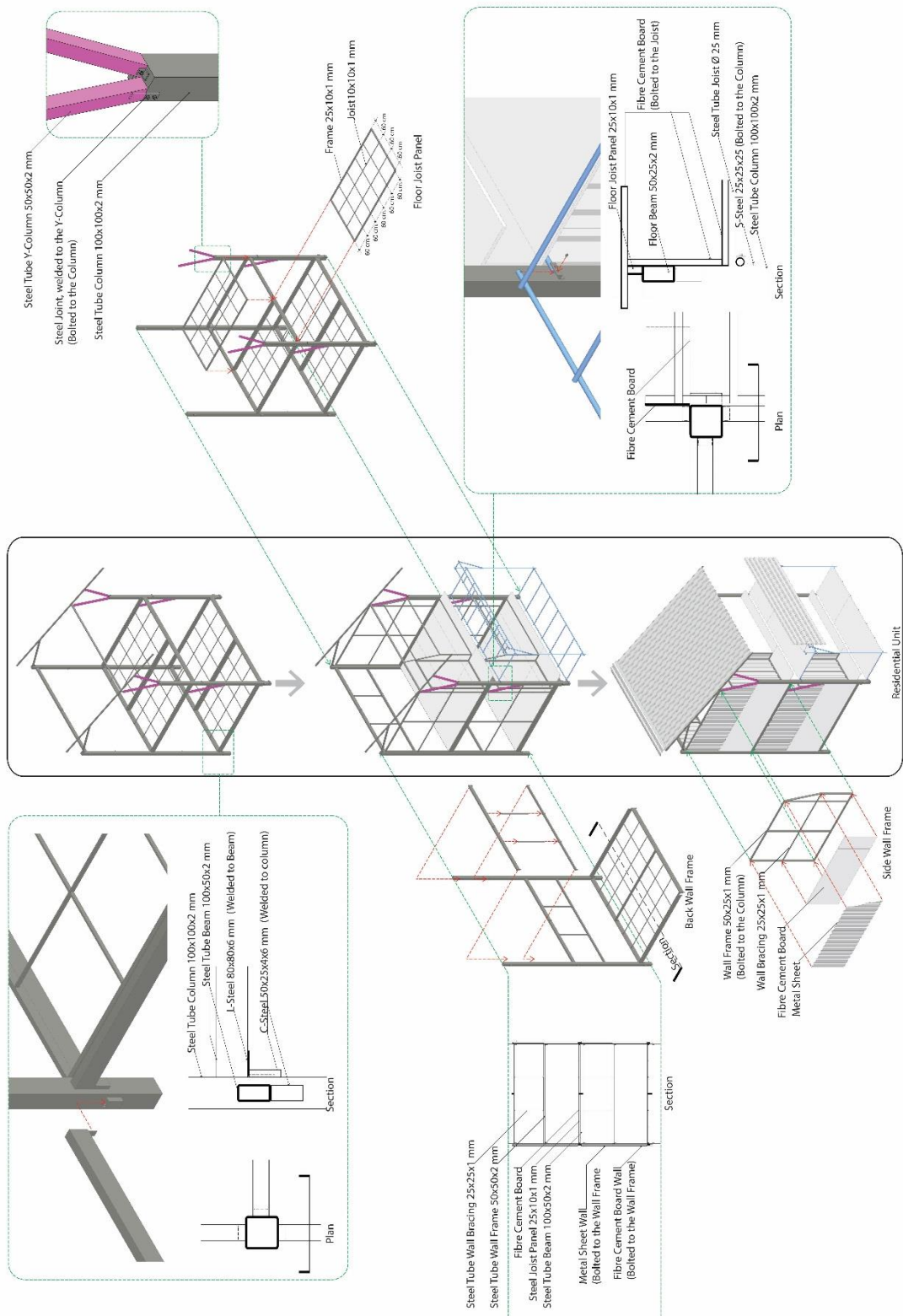


Figure 63. Diagram illustrating connections of the residential unit

5.3 Kitchen



Figure 64. Perspective image of the kitchen

The kitchen is located in the centre of the residential zone (Figure 64). It also performs as a community gathering space. This kitchen provides cooking space, dining space, a drinking water machine and a washing sink. The kitchen was planned symmetrically, allowing a straight path for circulation to nearby residences (Figure 65). Since dining space in the kitchen is limited, workers can carry their dishes to dine on the deck in the residential building. Drawings of the kitchen are illustrated in Figure 66-70.

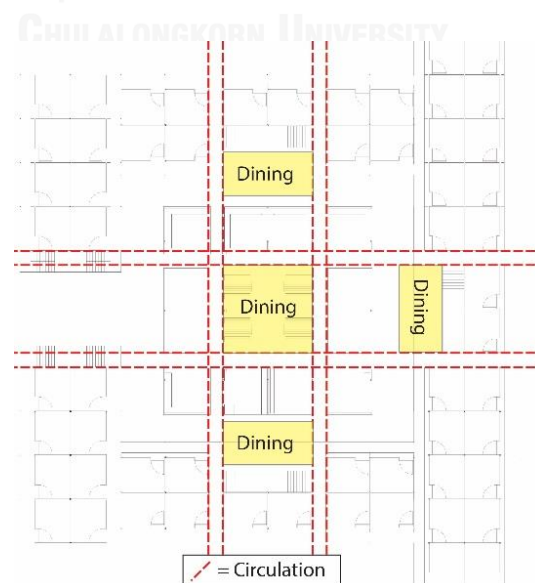


Figure 65. Circulation path from residential building through kitchen

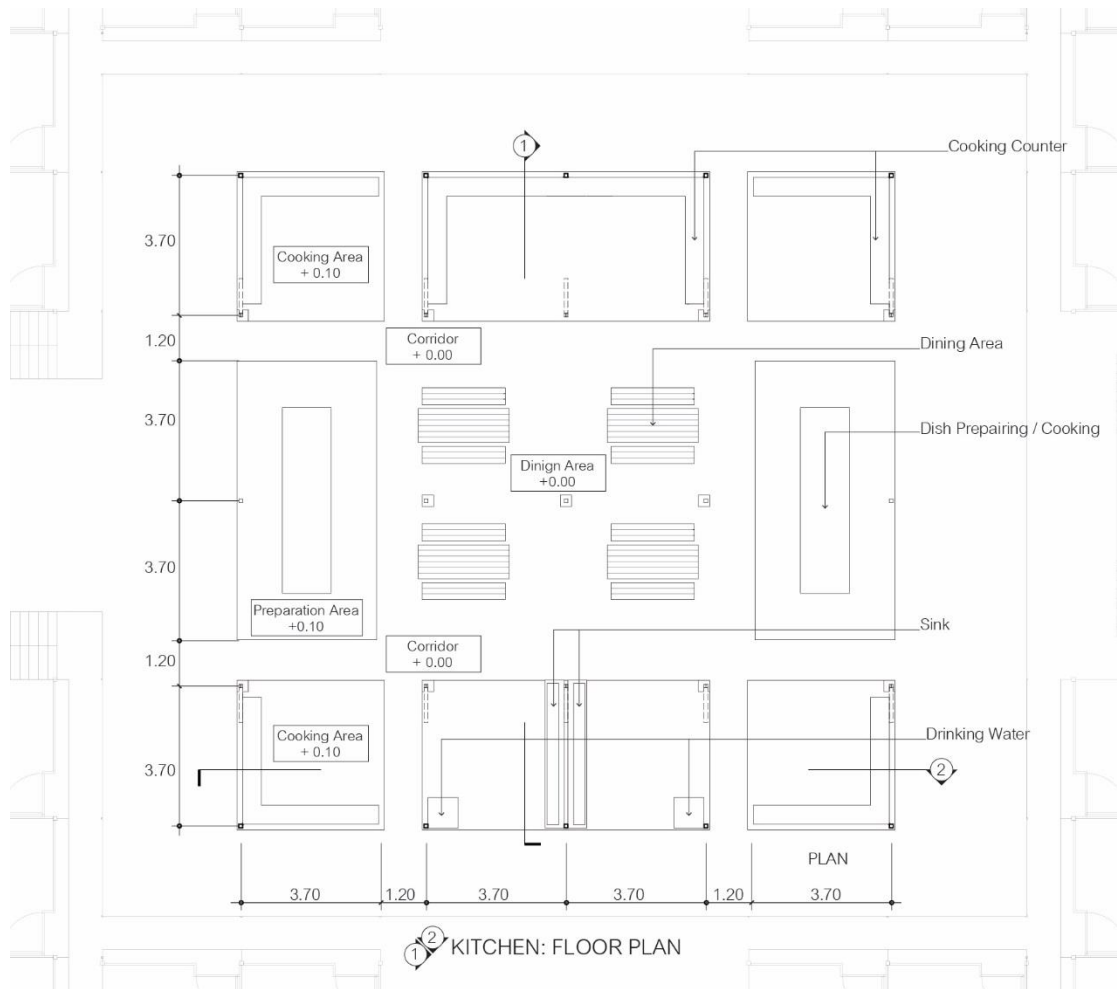


Figure 66. Kitchen: Plan

Scale 1:200

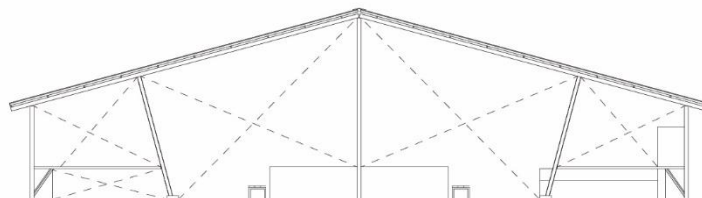


Figure 67. Kitchen: Elevation 1

Scale 1:200

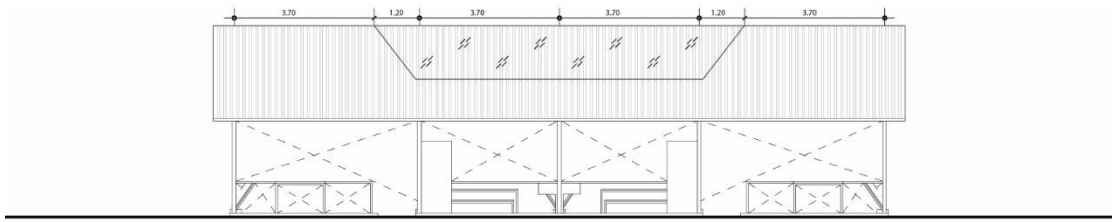


Figure 68. Kitchen: Elevation 2

Scale 1:200

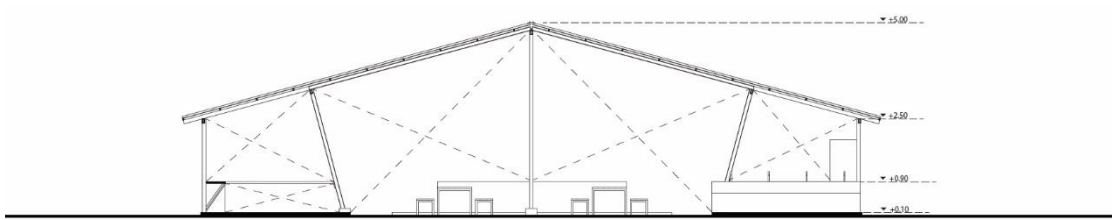


Figure 69. Kitchen: Section 1

Scale 1:200

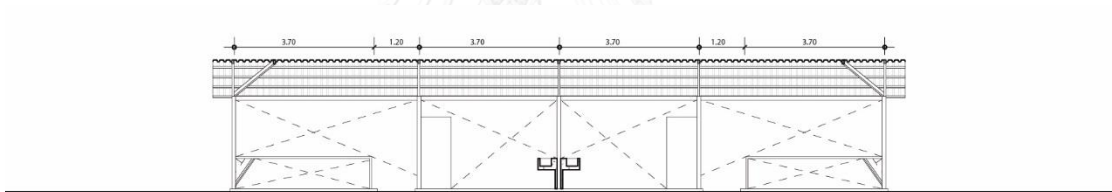


Figure 70. Kitchen: Section 2

Scale 1:200

The centre of the kitchen is for dining and a social gathering space. Since the facility is located in a dense residential community, the columns in the middle lean outward to make the gathering space in the centre open.

Raw material preparations can take more time than cooking. To avoid the crowd, a material preparation space is provided apart from the cooking space. Cooking counters are provided at the cooking space, and power outlets for the electrical pan are located at the column.

The translucent fibreglass tiles of the roof above this area allow natural light into this area. Without any solid wall, smoke from cooking can ventilate away from this facility (Figure 71).



Figure 71. Perspective image inside kitchen facility

At times for meal preparation, workers come to the kitchen with raw materials purchased from shops or street vendors. The raw material will be placed on the preparation area waiting to be cooked. A worker may walk to his residence to pick up more materials or equipment. His materials left in the kitchen will not obstruct other workers that are currently cooking because the space is separated.

After raw material preparation, workers will bring their materials to cook at the adjacent area. After cooking, workers can select their dining space around the facility. They can dine with their friends and family at the centre of this facility or carry their dish

to dine at their residence. After dining, workers must bring their dishes to wash at the sink provided.

The kitchen allows workers to walk freely around the facility. All of the necessary space for cooking and dining is located close together. The steps of space utilisation in this facility is presented in Figure 72.

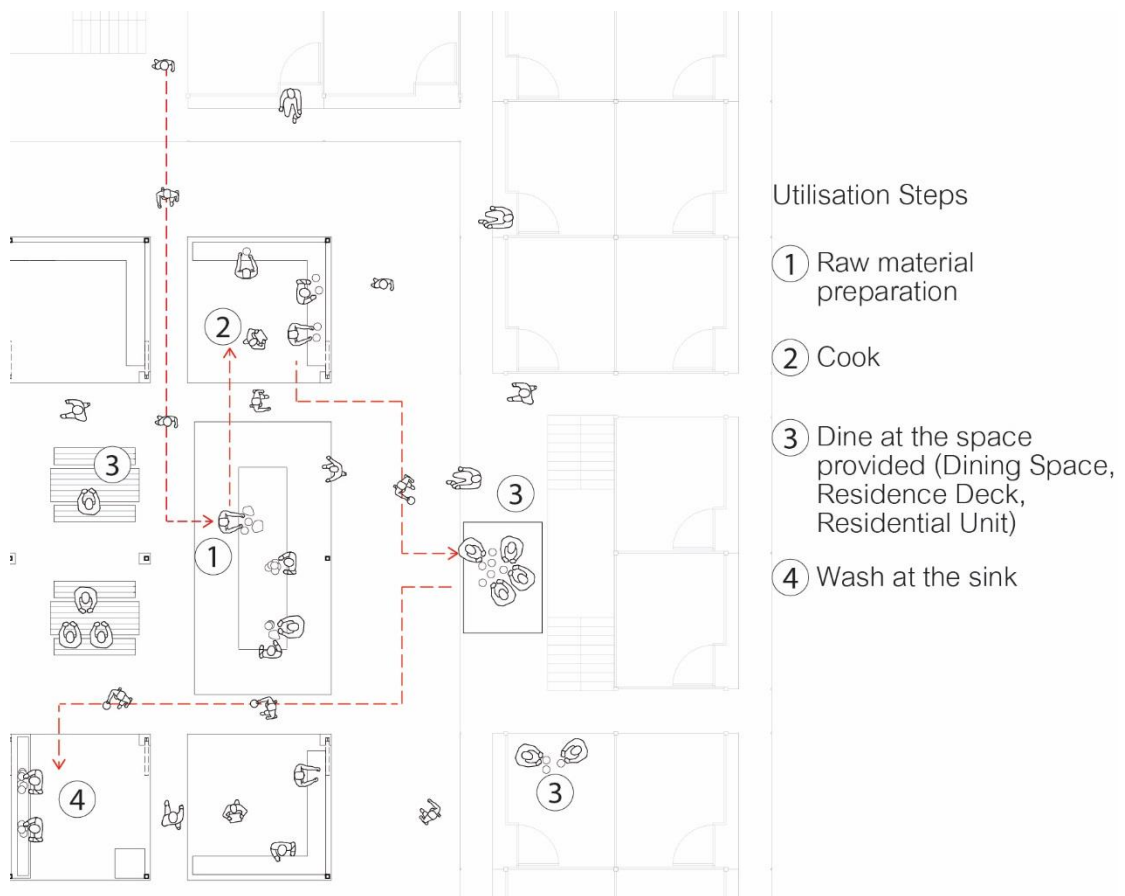


Figure 72. Diagram illustrating space utilisation in the kitchen

5.4 Toilet and Bathing Area



Figure 73. Perspective image of bathing area

Like the kitchen, this facility is located in the centre of the residential area. Its entrance is aligned with the circulation of the residence (Figure 73–74). The bathing area is separated into two bathing zones, a standing bath and a sitting bath, with a dry zone in between.

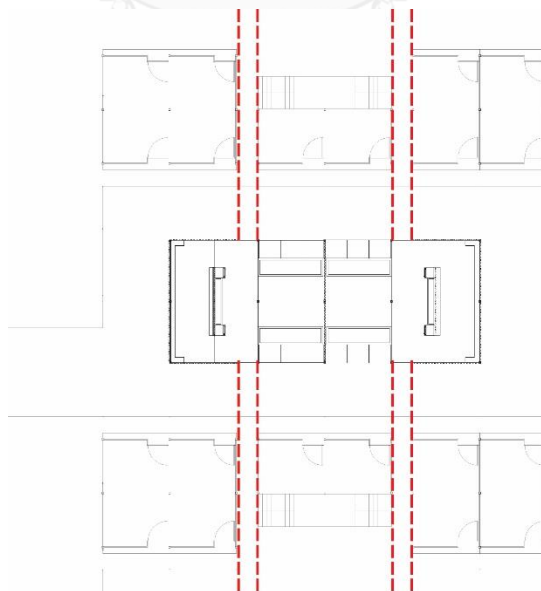


Figure 74. Circulation from residential buildings through bathing facility

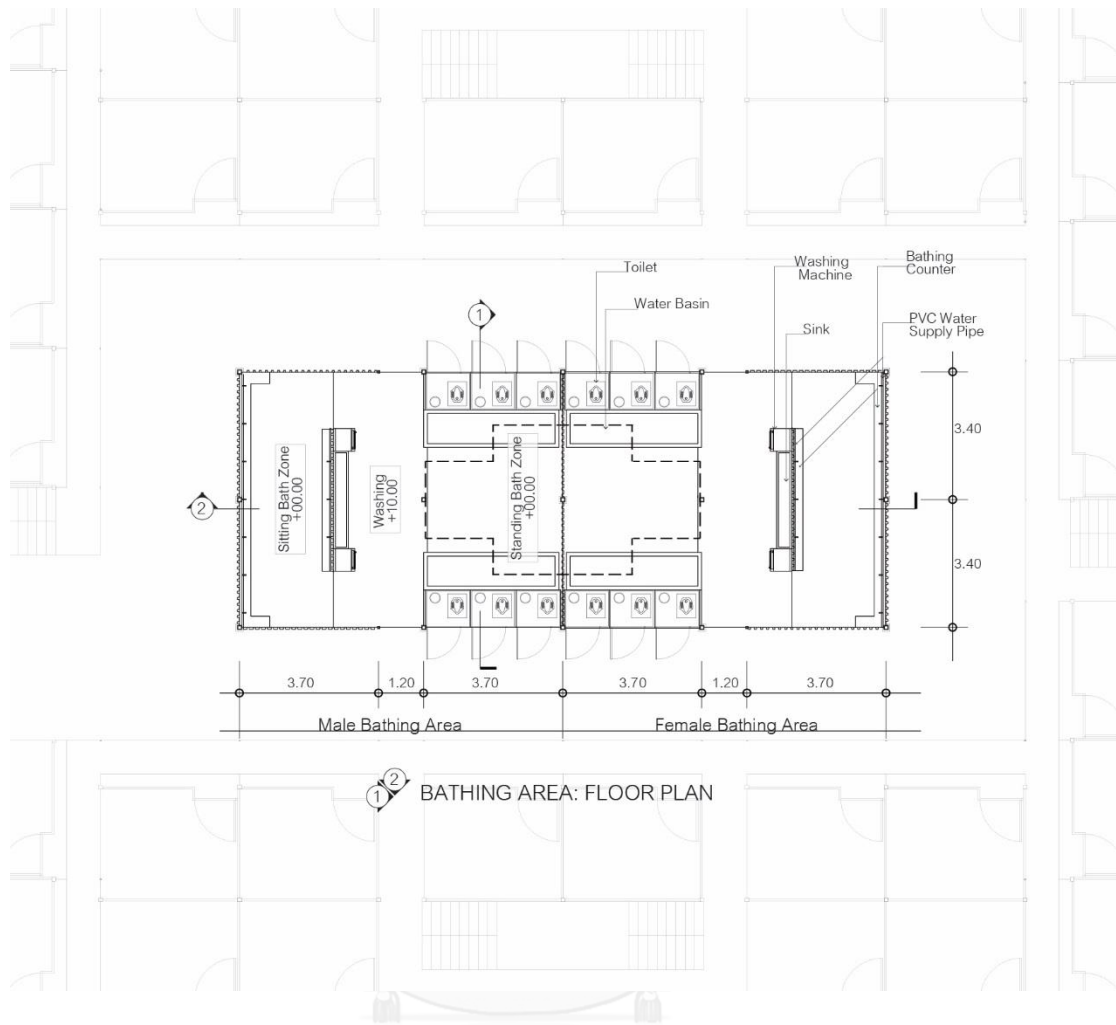


Figure 75. Bathing Area: Plan

Scale 1:200

Male and female bathing area have the similar design (Figure 75). Concrete water basins are used in the standing bath zone. They are the main water reservoir for the campsite. While taking a bath, workers can place their bathing equipment on the edge of the water basin for convenience. On the other side, the sitting bath area utilises water from hoses connected from a PVC pipe. There are counters provided for placing bathing equipment or sitting and socialising while taking a bath. Washing machines and a sink are provided in the dry zone. Workers can either wash their clothes with washing machines or hand wash them at the sitting bath zone.

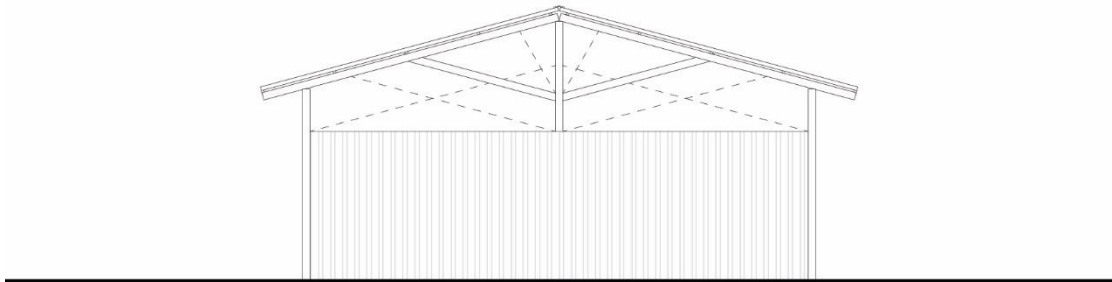


Figure 76. Bathing Area: Elevation 1

Scale 1:100

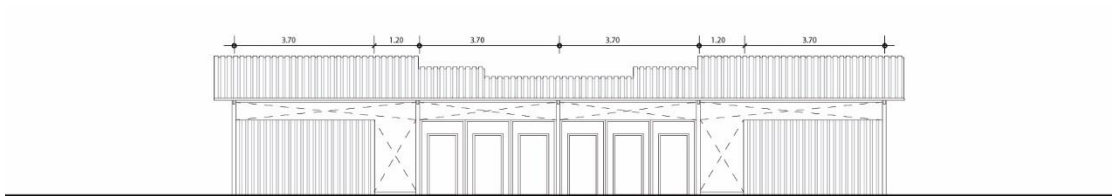


Figure 77. Bathing Area: Elevation 2

Scale 1:200

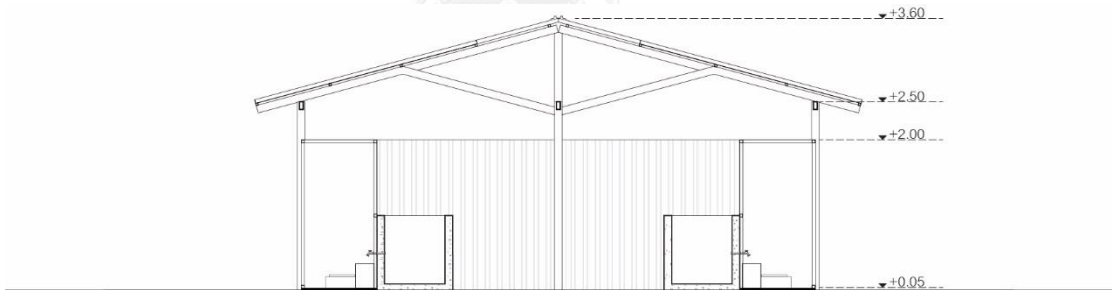


Figure 78. Bathing Area: Section 1

Scale 1:100

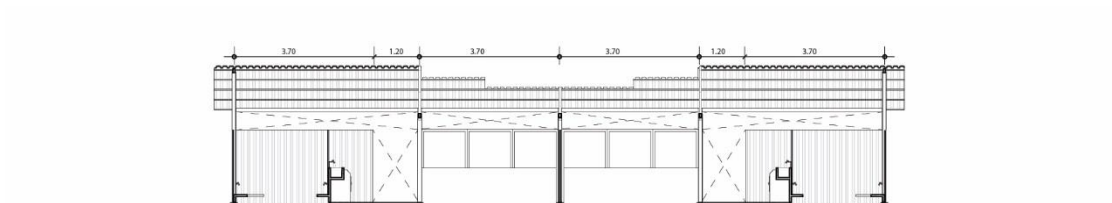


Figure 79. Bathing Area: Section 2

Scale 1:200

The toilets in this facility are prefabricated. According to research by Amnuay Thungmas, prefabricated toilets provide more security. Female workers have concerns about peeking harassment while using corrugated zinc toilets due to sheet gaps and nail holes. The prefabricated toilet is also more cost efficient in the long term. Even though the material of prefabricated toilets costs more, reusing a prefabricated toilet does not require as much cost for a worker's wage as a corrugated zinc toilet (Thungmas 2005).

Water buckets are provided in each toilet room for flushing. Water in these buckets comes from the main water basin (Figure 78). Hose bibs are attached at the water basins to control the flow from the bathing area to the toilets.



Figure 80. Perspective image of inside bathing facility

Although the roof covers toilets and the dry zone, the roof above the bathing area is open to allow surface runoff to rapidly evaporate (Figure 80).

Workers enter this facility through the dry zone, which separates the wet zone into two sides. Workers that want to have a quick bath can use the standing bath zone. Workers that want to spend time cleaning themselves can use the sitting bath zone. They can spend time in this zone without obstructing the main circulation of other workers. This zone is also provided for workers that want to hand wash their clothes. The utilisation of this facility is concluded into Figure 81.

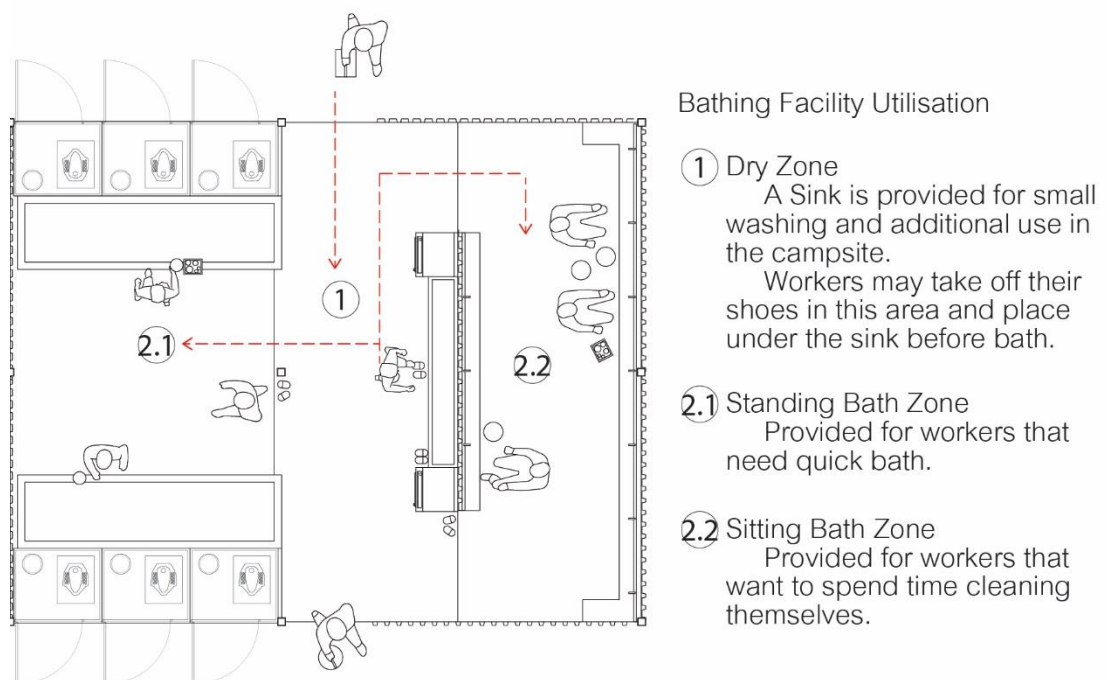


Figure 81. Diagram illustrating the space utilisation of the bathing area

Chapter 6

Summary

6.1 Thesis Summary

The problems identified in this thesis started off as supplementary from the multiple literature reviews presented in Chapter 2.1. Such problems include heat, ventilation, lack of space, smell, mosquitoes and disturbing neighbours. Most research also recommends providing ventilation openings.

However, while performing the site observation, the results expressed that similar problems continue to occur in the existing context, but workers do not consider them critical and manage to live in these conditions. This thesis considers the lack of space to be the most critical issue. Different from the heat or ventilation issue, which can simply be solved with an electric fan, the storage issue cannot simply be solved by adding a cabinet because the cabinet itself takes up floor space. Such storage is also difficult to move and may obstruct activities in the residential unit.

Through observation, the author focused on workers' space utilisation. The author has concluded that the most efficient solution would be to provide vertical storage space. The existing residence design does not support wiring and hanging, but through redesign, the architecture itself can enhance vertical storage.

The design proposed in this thesis is focused on space utilisation, based on the observation of three main campsite facilities. First, the residence design focuses on architectural elements that would function as vertical storage. Second, the kitchen design focuses on space for dining and gathering. Lastly, the bathing area design focuses on the zoning of different activities within the facility.

6.2 Future development

6.2.1 Fire Protection is one of the significant issues for the campsite, primary focus can be on safety and protection from fire with active approaches such as fire alarm system, pumping system or evacuation planning

6.2.2 The cost of construction is a major consideration for contractor while building the campsite. In order to estimate cost efficiently, a specification of each structural elements has to be identified. This topic can also be done by construction approach.

6.2.3 Joints and other specific construction methods of temporary building that provide easier and faster erection can be explore further.

6.2.4 Transportation and logistics management for construction materials is an issue for a temporary structure. Methods of moving the building elements without damage is also challenging.

6.2.5 Self-sufficient community can be another approach to provide for workers. Workers are known to have poor accommodations which force them to be humble. Appropriate planting and animal rising within the campsite can support workers' life.

6.3 Limitations

A campsite is a private property. In order to access appropriately, a permission from the contractor is required. During the site visit, a kind chief officer may escort researcher around the campsite. Visited by their leader, workers become stressful and may not fully express the problematic conditions of the campsite.

Some workers are also avoiding to have a conversation with an outsider. Most workers are immigrants. Language is another issue that limited the research.

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APPENDIX

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