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2 Introduction

The introduction will handle the background, purpose, goal, delimitations, and the disposition of the report. It will also give a brief presentation of B. Grimm Group and Polo as a sport. To facilitate the reading, words in *italic* throughout the report can be found in chapter 10 Glossary.

2.1 Background

Due to an increasing interest in the *equestrian sport* Polo in Thailand, a few country clubs have opened up in the area with the sole purpose of satisfying this growing demand. Thai Polo Club, 20 minutes outside Pattaya, was opened in 2005 by the German-Thai company B. Grimm Group with President Harald Link [28] in the lead. The club hosts 35 horses as of this moment but they are setting up new stables and will then be home to over 70. The facility also has one playing field and two more in planning [31]. Polo is a time consuming sport and since the club is located at quite a distance away from Bangkok, where most of the club members presumably will be living, the arena also requires accommodation.



Figure 1 Thai Polo Club
Reference: [15]

The high living standards of today demand an excessive use of energy and resources to keep the houses comfortable for the residents at all times. The exploitation has ignited an interest in ecological aspects of different trades and the building industry is no different. B. Grimm Group has for this project expressed a need for a more energy efficient type of building. Mr. Link has personally voiced an interest in keeping the designs of the houses classical. This will be done by merging the designs of the traditional Thai houses with the *ambience* of the Western-influenced houses of the late 19th century.

This report will examine the problems and possibilities of building a modern residence incorporating these building styles to an ecological house with a low demand for technology.

2.2 Purpose, goal and delimitations

The purpose of the project is to present a design proposal to the client, B. Grimm Group, by incorporating the knowledge we have gained during our years at the Department of Built Environment at the University of Jönköping with the research material we have gathered during our work on the thesis.

The goal is to hand over a complete set of layouts including a structure plan of the village area, perspectives, facades, building layouts and axonometric views of all house types, as well as garden plans. The underlying research will make the ground for the final presentation of both the layouts and the written report.

The delimitations of the project were set from the start through B. Grimm Group's specific request for a housing area, a village containing about 12 households, at the Thai Polo Club and the size was kept well suited for a bachelor thesis. The process of the other building- and landscape projects had already been set in motion at the club which meant it was natural for us to omit these parts from our project. The ecological view is described without any energy calculations and less thorough research into the different technological systems. Other delimitations are the specifications of appliances, building materials and glazing which is not included in the project in order to keep the designing as our major focus.

2.3 B. Grimm Group

B. Grimm and Company was initiated in 1878 by Mr. Bernhard Grimm, a pharmacist from Germany, who set up a very successful chemist store in Bangkok. Concurrently, the reigning king, H.M King Chulalongkorn, brought back many changes to the nation after studies abroad. These changes included, among other things, railroads to Malaysia and improved infrastructure in the capital. The new European ideals came at the right moment for B. Grimm and Company which took the opportunity to look into other business fields as well. The market seemed unlimited in these changing times. The company started by going into the armoury business, supplying the Siamese Armed Forces with uniforms and weapons imported from Europe.

In 1903 Mr. Adolf Link was brought into the company to manage the chemist store and was soon made Managing Partner for the whole company. B. Grimm and Company has stayed in the Link family ever since, with Mr. Harald Link managing the company in the present day.

B. Grimm Company has expanded steadily during the past 125 years, with the exception of during the World Wars, and has constantly incorporated more and more types of businesses. When Mr. Harald Link took over, the company had expanded to such an extent that he formed B. Grimm Group of Companies with several subordinate companies. Today the company consists of eight very different subsidiaries, from health care to transportation and real estate, as well as several joint venture companies. 2005 the company went further into the real estate business when they initiated the plans with the Thai Polo Club. [16]

2.4 Polo

There are quite a few versions of the origins of Polo, but all return to the same area: Persia. Over 2000 years ago the aristocracy and cavalry in this part of the world spent their leisure time in fast paced games and not much has changed since then. The fast ponies that can turn on a hairpin, the sticks, the balls, the show-factor, and the unlimited access for the upper class have all followed through the history of Polo. The sport has since then been passed on from nation to nation, from Turkey and China, through India where the English military and colonists picked up the sport and brought it back to the European nobility in the late 19th century. The Englishmen continued spreading the sport across the world through the United States to Argentina, today's leading polo nation of the world. Many Argentines play Polo professionally and work seasonally in different parts of the world, following the polo season [1].



Figure 2 Polo players at Thai Polo Club
Reference: private picture

2.5 Disposition

The report has five major chapters: Theoretical background, Implementation, Results, Our experiences working in a foreign country and Conclusions. The objective throughout the report is to find the optimal designs for the housing project at the Thai Polo Club.

The upcoming chapters, 3, 4, 5, 6 and 7 will address the following:

Chapter 3, Theoretical background

1. General background on Thailand includes culture, religion and climate.
2. Architectural background, introduces the traditional Thai house, the Western style house and the Jim Thompson house. It also discusses materials, modular building, religion and beliefs in architecture, and the Thai garden.
3. Classification of the representative residents, presents the three potential groups: the long time owners staying permanently, the long time owners staying during the weekends, and the short time tenants staying during weekends.
4. General ecological views, discusses the global ecological issues
5. Ecological views implemented in the project, handles the wind and ventilation, water, infrastructure and traffic, window glazing and materials best suited for the housing. It also brings up the landscaping issue.

Chapter 4, Implementation

1. Methods, describes the six methods used in the project: pre-studies, interviews research, study visits, sketching and designing.
2. Building technology goes into depth about both the construction and the construction process of a traditional Thai house.
3. Structure plan explains the layout of the housing area, including small roads, the community house and the playground.
4. Building design clarifies the different designs and layouts of all the buildings. It also includes the housing adapted for residents with reduced physical ability.
5. Garden design considers the layout of the garden with driveways and parking, the placement of houses and trees, water features and the security factor.

Chapter 5, Results shows the finished designs with layouts, facades etc. This includes:

1. Structure plan
2. Compound plan
3. Garden
4. Main house
5. Wing with master bedroom
6. Wing with single bedrooms
7. Guest bathroom and storage room
8. Maid quarters
9. Guesthouse
10. Teahouse

Chapter 6, Our experiences about working in a foreign country illustrates the gratification and difficulties one faces when working abroad.

Chapter 7, Conclusions brings the project together by discussing the final results and answers the question “What makes the proposed housing well suited for the clientele?”

3 Theoretical background

The theoretical background consists of five parts: general background, architectural background, classification of the representative resident, general ecological views and ecological views implemented in the project.

3.1 General background

Thailand, or what is known to many as Siam, is a very complex yet simple country in many aspects. It might sound paradoxical and yet this is exactly the core of the nation. Where on one hand the people are extremely proud of their colonial free history and at the same time adapt any traditions of their liking no matter what their heritage might be, celebrating New Years at least three times of the year e.g. The city of Bangkok is one of the largest and most polluted in the world, yet in the countryside the rice paddocks and pineapple farms can reach as far as the eyes can see. And no matter if you live in the slums and the walls around you are deteriorating, the TV-antenna or satellite dish will be ever present, more often than not covering half the façade, working as a reminder that you can never be too poor for a TV. When looking at the building techniques of the Thais it is very important to bring along a little bit of this knowledge to get a better understanding to what otherwise is quite puzzling to the Western set of mind.

When it comes to Thai architecture there is an incredible amount of thought put into details, but at the same time it does not matter if the walls are crooked, if there is a large hole in the ceiling or if your air-conditioning apparatus covers half of the window. In Thailand function follows form follows function, meaning if it does not work out the way it was originally planned creativity will find a way around it.

3.1.1 Population

The population of Thailand is increasing drastically every year. With numbers over 62 million people at the moment and a predicted population of over 75 million in 2050 [17], the problems of migration to the cities is becoming apparent. Bangkok with all its suburbs is covering more and more land and huge *mubahns* and skyscrapers are popping up everywhere. Quite often these building projects run out of funding and whole ghost communities can be found all over the larger cities of Thailand, especially in Bangkok. Even if entire families are forced to share a tiny room in the slums, an enormous building can stay abandoned for years right next-door. Contrasts such as these are very common in Thailand and the planning technique used is very often only short term especially in the building industry.

3.1.2 Religion

Religion plays a very large part in the life of the Thais with Buddhism being the main religion. According to statistics from 1991, 95% of the population is Buddhist followed by 3.8% Muslims, 0.5% Christians, 0.1 % Hindu and 0.6 % belonging to other religious groups. Further into the report the effects of religion in the building industry will be discussed. [17]

3.1.3 Climate

Thailand is located just north of the equator (17°-20°N) and has a tropical monsoon climate with three seasons; the wet, the cooler and the hot season. The periods depend on the monsoons making the winds blow from the south four months a year and from the north eight months. The rainy season starts normally in May and ends in October and it rains a few hours every day. Longer rainfalls are unusual. The temperature in the low level districts is about 30-35 °C in the day and some degrees colder during night time. Sometimes, in August and September, typhoons occur with heavy winds, rainfall, thunder and lightning that can continue for about three to four days. During the cooler season, which starts in November and finishes in February, the humid and damp winds from the Indian Ocean are swept away by dry northern winds from Central Asia. The sun however, is still shining strongly and the temperature reaches 30°C in the South, but in the North the temperature can fall down to 10°C after sunset. Rain occurs very sparsely. In December, the green vegetation starts to turn brown and drop their leaves to prepare for the approaching hot season. This warm time of year is short, from the middle of March until late May. The sun rises higher and higher and the temperature can reach 40 °C in the afternoon. The warmth and the increasing humidity make longer trips and physical activity straining. [18, 30 & 32]

Mean value	J	F	M	A	M	J	J	A	S	O	N	D
Sun hours/day	8	8	8	7	6	4	5	5	5	5	6	8
Temperature	26	27	28	29	29	29	28	28	28	27	26	25
Precipitation	19	14	52	67	177	79	77	90	202	249	134	4
Rain days	1	3	4	6	12	11	11	12	17	18	9	1

Figure 3 Climate table over Pattaya during a year

Reference: [19]

3.2 Architectural background

The Thai society has deep roots in the agricultural field and the people have for centuries been separated into owners and labourers. The defining moment of the abolition of slavery occurred as late as in the turning of the century from 1800 to 1900 but the old way of thinking still remains. The agricultural lifestyle of the majority of the people has produced a type of house which still fills the purpose of bringing the family together in a secure environment. In the report this type of house will be referred to as the **traditional Thai house**. In Thailand there are several different types of houses depending on where in the country they are situated. The houses in this report relates to the houses of the Central region mainly because this is the area where Pattaya is situated.

The traditional Thai house did not however fulfil the needs of the many foreigners who during the late 19th century immigrated to the kingdom. The great immigration of an upper class from the West brought a new way of constructing buildings for a different lifestyle, so far only exercised by the noblemen and the king. The new houses reinvented the skyline and exposed the Thai population to a wealth usually hidden behind high gates. In other parts of the world these houses are referred to as colonial style, but as Thailand was never under the control of another nation it is very important not to use this expression which conveys the association above. This type of house will therefore be called the **Western influenced house** in this report.

3.2.1 The traditional Thai house (the *ruen Thai derm*)

In the Thai culture, family is at the core of all values and this is also reflected in their architecture. The traditional Thai house is built and arranged around the family structure. The heart of the building is the parents' bedroom around which the other rooms branch off. The houses are arranged in a modular fashion with each room separated from the others but still connected through open roofed passage ways. The system allows easy modifications of the buildings as the family is growing. Since all walls are prefabricated it is easy to build and move the houses in case of an unforeseen event.

The modules are arranged around a square forming a natural centre where a tree or a small pond is the focal point. From every room the entrance is facing the veranda and this platform creates easy access from one room to the other. Each module is designed as a separate building with a large roof overhang to protect residents from sun, heat and rain. As the roof overhang of one building is connected to the next, a sheltered walkway is formed.



Figure 4 Model of a traditional Thai house

Reference: Private picture

A Thai house is very easily distinguished simply by looking at the roof. The saddle roof has an unusual height compared to other countries and the roof overhang ends with fine wooden carvings. The carvings have two common workmanships. The first one is the Naga style which is a reminder of the seven headed snake Naga who was a protector of Buddha and therefore also functions as a guardian for the inhabitants of the house. The second style is called the Fish tail style and the carving simply has the shape of a fish tail or fin. The slope of the roofs can reach very high figures and the choice of roof covering must follow in order to prevent leaking. The roof ridge is commonly decorated with a *finial* at the gable walls.

Thai houses are built so that all walls lean in towards the centre of the building making the floor area larger than the ceiling area. This construction has several advantages such as increased stability, more easily made attachments of the prefabricated walls, increased air circulation in the building and giving a lighter and more graceful appearance to the building. Further information can be found on §4.1 Building technology.

Because of the climate in the South East Asian region, windows and doors are arranged in a very different way from the Scandinavian standards. The windows are positioned in the direction of the wind and with minimal area facing the sun. This results in the traditional Thai houses being quite dark and the new generation Thais consider them too gloomy for their taste. During the day the windows are covered with wooden shutters in order for air to circulate while the heat stays outdoors. Another reason for these shutters is to keep the mosquitoes and other insects from getting into the living area.

To reach the living area, a staircase, usually with two branches, is mounted on one side of the building reaching a locked gate. Depending on the size and structure of the building more staircases and gates can be added. The staircases can have many different designs as long as the number of steps is kept at an uneven number or it brings bad luck to the household.

To be protected from monsoon rain and reoccurring floods, the Thais build their houses on high posts. That way they can also take advantage of the wind circulation to cool and air them from beneath. In the rural areas they use the space underneath the houses to keep the animals and machinery. But where it is more populated the outdoor room is scarcely used and leave the substructure exposed for passers-by to admire the architectural details. [2]

3.2.2 European influences in early 20th century Thai architecture

Due to a mishap in late 17th century involving a foreign high official allowing French troops in the country, the king of Thailand banned foreign involvement in the country for 150 years. In 1851 the new king in power regained diplomatic relations with the West to avoid his country to become colonized. [3] This allowed new influences and ideas to cross the Thai borders and brought new aspects to the Thai architecture. Among these effects we can see buildings which display a blend of Baroque, Rococo, Renaissance and Art Nouveau. These styles grew in popularity as a consequence of a foreign-educated aristocracy arising in Thailand. These new designs required innovative materials such as bricks, concrete and plaster which until then had been sparsely used in residential buildings in the kingdom. These materials have however always been commonly used in temple buildings, large Buddha statues etc.

The houses that then were built are recognized by their grandiose chateau like appearance in large gardens. Everything seems to be built to impress the visitors, whether looking at the interior or exterior, the eye for detail is always apparent. When entering the large gates one is greeted by the pompous driveway with heavy foliage on both sides. A few large welcoming steps lead up to the entrance through which one is lead into a large hall.

The inhabitants of these houses were in the country for business and had a lifestyle surrounding representation through dinners and other leisure. This building is therefore organized in a much more segregated way with dining halls, specific tea rooms, library, and smoking rooms etc. in the representation part and bedrooms in a separate part of the building. The cooking and cleaning facilities were placed further away with a separate entrance for the servants and deliveries. [4]

3.2.3 The Jim Thompson house

On a small backstreet in the middle of Bangkok lies a wooden house created by a person who has made deep impact in Thai history. Jim Thompson was an American architect who during World War II had been scheduled to serve in Southeast Asia. Thankfully the war ended before he had to do any operations but his fascination of the Thai people and culture made him choose a life in Thailand over going back home. Primarily he worked as a restorer at the Oriental Hotel in Bangkok, but later he focused on the newly gained interest in the Thai silk handicraft. Due to the introduction of the inexpensive machine-made textiles this was about to become an extinct art. After a successful promotional trip to New York, Jim Thompson and a group of shareholders founded the Thai Silk Company, Ltd. in the mid 1950's. Through this lucrative business he managed to save the Thai silk industry and obtain the sufficient amount of funding for his later building project.

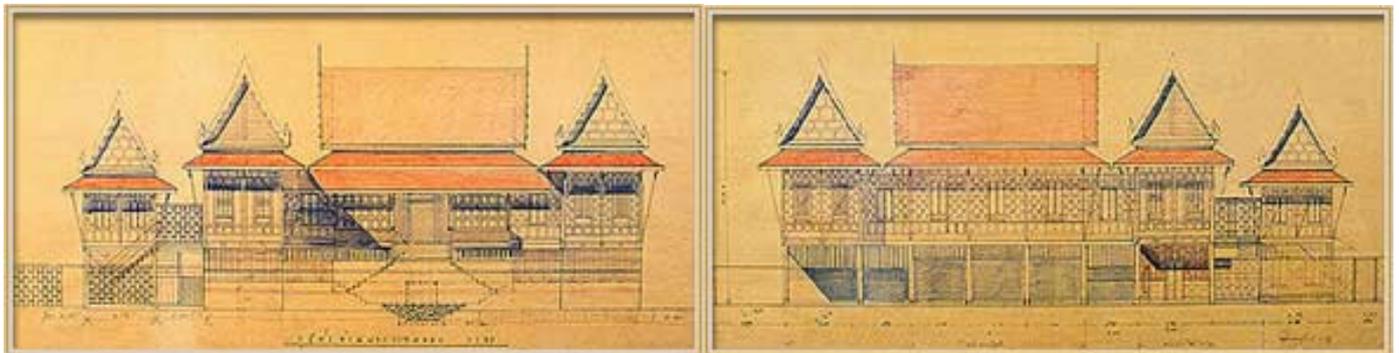


Figure 5 View of the front and back facades of the Jim Thompson house

Reference: [20]

During his years in Thailand, Thompson expanded his architectural curiosity by travelling through the countryside and taking in the building techniques of the agricultural villages. This combined with his American heritage and influences from his other travels, resulted in the building of his diverse residence in Bangkok. He joined together three separate houses found in the Ayutthaya area and where they were intersected he added extra material to make the constructions into one building. The shape of the house is at first sight traditionally Thai but after a second glance one can see the changes Thompson has made in both the exterior and interior designs. He wanted a home in Siamese style but with the western facilities he was used to. This included indoor bathroom, closets, narrow corridors and western furniture. East meets West in Jim Thompson's house. [5]

Theoretical background

A few parts of the building are worth taking a closer look at. Primarily, the staircase is located indoors in an impressive entrance hall with imported Italian floor tiles whereas the Thai entrances are always on the outside of the complex.

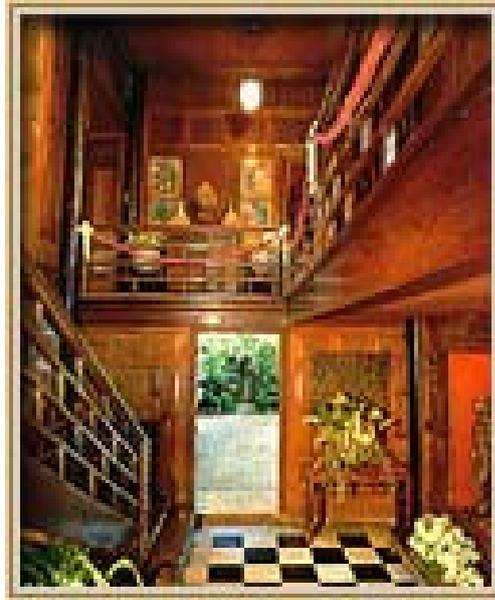


Figure 6 Hallway at Jim Thompson's house
Reference: [20]

Secondly, since the house consists of several buildings put together, each part has its unique set of windows with different shapes and forms. Furthermore, Thompson turned the curved wooden panels inside out in order for him and his guests to admire the floral patterns. In the living room the windows have been turned into niches for him to display part of his statue collection.

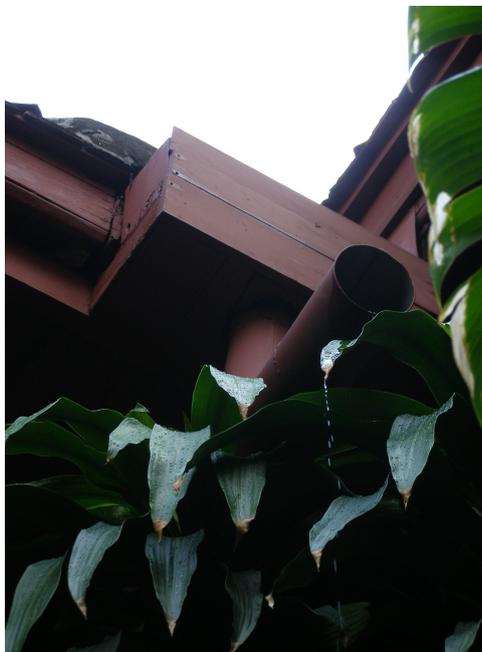


Figure 7 Gutters between the houses at Jim Thompson's house
Reference: private picture

Thirdly, where the roofs of two of the houses are joined together, Thompson had special *gutters* designed for drainage. This might be overlooked by the average visitor but is in fact a very creative solution to what could become a major problem.

3.2.4 Materials

Teak wood has been the most frequent building material in Thai houses, due to its durability, its repelling effect on parasites and Thailand's vast supply of the wood. In the late 19th century the British, French and Danish were allowed to start logging the forests in an attempt from the government to avoid colonization. These nations took advantage of the concessions to such a degree that the Royal Thai Forestry Department was initiated in 1896. Nowadays the forests are still trying to recover from the damage and several teak plantations have started in order to supply the furniture and building industries with the precious wood. Teak wood grows very high and straight, around 20 meters before the branches. This meaning that the wood can be bought without the knots which are all timbers' weak links. The inevitable increase in price for teak has made it impossible for the average citizen to use this material and the teak building has now become a sign of high status. The hard felling of the Thai teak forests increased the market of imported timber and made room for foreign wood as maple from Canada, elm from China and pine from Sweden and New Zealand. [6]

As roof covering, terracotta tiles and thatched roofs are most common. The terracotta tiles can be glazed or non-glazed and of different colours, red being the most frequent. The thatched roofs are made of grass or dried palm leaves sewn together.



Figure 8 Details of material use
Reference: private pictures

In both the traditional Thai houses and the Western influenced houses, the wooden details by the doors and windows are very important. The intricate designs, made of local woods, are as much for ventilation as it is for decoration. In the Thai houses they are kept in their original form but the European houses usually add some colour to further bring out the patterns. The doors in Thai houses have high thresholds for two reasons, firstly to avoid small children crawling out of the rooms and secondly to keep the bad spirits of the house from entering the sleeping areas as they are commonly thought to only travel through the floorboards. The use of stained window glass was also introduced during this era. These features were mostly used above the windows and doors where the gaps otherwise left room for ventilation. The use of fans decreased the need for self ventilation even though this was the still the most common way to air the buildings. [38]

As mentioned above the Western influenced houses introduced new materials to the residential buildings in Thailand. Up until this point the use of Teak wood had kept the houses at one storey, but the stability of the concrete introduced new heights to the secular buildings. The houses were placed directly on the ground and sometimes even with cellars, a new phenomenon in these parts of the world, and contained up to three floors. Instead of spreading out over ground the new houses acquired the same amount of area through height. The surfaces for both floors and walls were, up until the Europeans arrival in Thailand, solitary wooden boards. The newcomers brought in stone tiles and mosaics for the floors and painted and sometimes even wallpapered walls. Even though the Thai houses had wooden boards in different patterns as their interior wall decorations, they did not provide the lightness in the rooms that the Europeans were used to. [4]

3.2.5 Modular

“Modular design is a coordinated system that makes use of standardized material units without waste.” [7]

An old traditional Thai house compound consists of buildings assembled by light wooden prefabricated elements which are designed for the ability of a sudden and rapid need for alteration. Historically it could be necessary to move a house if the site had been damaged, for example during a flood and this building system simplified the process. It could also be necessary to simply add extra modules due to an increase in the number of family members. The prefabricated elements are lightweight and because of the slanting walls, hard nails are not needed to join the building. This makes the puzzle-like construction easy to change, add, remove and dismantle whenever required. The prefabricated units are of standardized dimensions which indicate a short construction time and an economical use of material.[2]

The modular system has been used in most parts of the world throughout history. The preferences of a quick assembly of the construction are illustrated in the following quote made in an advertisement for housing for English immigrants to Australia in 1827. “...a comfortable dwelling that can be erected in a few hours after landing, with windows, glazed doors, and locks, bolts and the whole painted in a good and secure manner.” [7]

3.2.6 Religion and beliefs

Religion plays a large part in the lives of the Thai people. Buddhism is the main religion and the spiritual elements are very apparent in the country. Selecting a suitable plot of land for the housing is more complex than “simply” making geological probes, checking wind and sun conditions etc. In Thailand one has to consider the spiritual factor as well and tradition says that this is done either with the help of crows or by sniffing lumps of earth. The crows are given three different types of beans, red, black and white, strewn on the site and only if the crows eat the white ones the site is free from bad spirits and the land may be used. Through sniffing the soil one can determine whether the grounds are usable and only if the soil smells of the lotus, pikun and matulee flowers the site will bring fortune to the habitants. [2]

The belief is that all land has its inhabitants of spirits and as a new building is raised these spirits are loosing their home. Therefore a *spirit house* is built in the garden as a new home for them. The houses are usually a smaller copy of the main house and are decorated with flowers, incense and small Buddha figurines.



Figure 9 Spirit house
Reference: private picture

After selecting the site one also has to consider the day of the week, the month of the year and the materials used to build the house in order for it to bring happiness to the occupants. The dimensions of the house are also important, as is the number of steps in the staircases as well as the direction it is facing. Even the name of the person who digs the first hole can make a difference to the future of the site. After the house is finished there are several ceremonies involving monks that conclude the building process. [2]

According to Western standards, after choosing the location for the building, one has to consider the conditions of the wind and the sun when positioning the building in the right direction. In Thailand other aspects play a bigger role. Since the traditional Thai houses provide the residents with sufficient natural air circulation and shade no matter how they are placed, it is more important instead to make sure that they build for easy access or to avoid neighbour clashes. In a village the first house to be built set the rules for the coming. The following houses will be placed in the exact same direction so that there are no misunderstandings regarding ownership of plots etc that could stir up a conflict. When building by the water the entrances are for obvious reasons towards the water which means the buildings could end up in any direction, but this does not seem to oppose a problem for the residents. [2]

3.2.7 The Thai Garden

Even the garden architects have to consider the different beliefs of the Thais. Certain plants are better than others and some are outright forbidden, though this is widely ignored nowadays. To make a traditional Thai garden there are several regulations one must follow for which plant should be planted in what area in the garden, all to give the inhabitants of the housing compound a rich, healthy and happy life guarded from bad luck, illness and evil spirits.

On the north side of the house, trees as acacia and lime together with a mixture of herbs and bushes will be growing to guard the buildings from black magic. To the northwest auspicious plants are yor and saraphi who will ward off misfortune. Citrus fruit trees like pomelo are also recommended in this quadrant. To the west tamarind, mayom and putsa are placed to protect the buildings and the people within from ill intentions and evil spirits. To the southwest jackfruit and cassia are to be chosen for their ability to ward off misfortune. To the south mango and ebony should be planted for their tasty fruits and their believed skill to convey good health. To the east bamboo and coconuts are recommended as these will bring happiness and good health according to the old traditional Thai beliefs.

For the middle of the terrace where it is common to plant a large growing tree, one should consider planting a chan, champa, champee, jackfruit or mango tree as these grow tall and get fragranced, coloured flowers or bear fruit. They also provide a pleasant and sought after shadow to the houses and its residents during sunny days. [2]

A regular Thai garden is far from what a Swede would label a garden. Function is what a garden designer has to think of in the first place with shadow as a main task. In Sweden we do not have to think about shadow in the same way as in these tropical countries. Because of our dark northern location we, the sun loving people, yearn for light all year round and want to see as much as possible of the sun. In Thailand what people need most of all is protection from the sun and therefore large trees in a mix with smaller shadowing plants are most favourable. This means that the vegetation in a characteristic Thai garden consists of a combination of trees and bushes with small and large, fat and thin, plain or patterned leaves. Among this foliage different kinds of creepers and climbing plants are added to increase the shade, as well as bringing colour and lightness to the green undergrowth by their beautiful flowers and slithering way of growth.

In this warm and humid climate the wind is an important issue to consider, even in the garden plan. In Sweden one would like to shelter from the wind, in Thailand people request the opposite. The breeze is desirable to keep cool and to ventilate the housing. One has to set the plants in the garden spaciouly to let the wind easily run through the vegetation and reach the openings in and around the building. This means that to get good airing inside the house and on the verandas one has to make sure that the plants do not impede the flow of air through these spaces.

Thai gardens usually have a web of tiny pathways of flat stones leading into and among all greenery. Here and there one can see ceramic pots, large and small, placed under the houses' eaves as well as under trees and bushes to collect rain water. In these containers, water plants like pink water lilies grow and sometimes fish swim around making the water urns a garden decoration. Near the staircase to the entrance it is also common that the Thais put a smaller pot of water with the intention of every visitor washing their feet before entering the house. [37 & 38]

3.3 Classification of the representative resident

Potential members of the Thai Polo Club will have to meet certain requirements set up by the board in order to be accepted [28]. Owning at least one horse will be the strongest condition resulting in that a very specific type of clientele will be admitted. Only those who fit the profile will then be able to apply for a residence within the compound. The housing at the Thai Polo Club must be well suited for the club members and the prospective residents can be put into the three following categories [29]:

1. Long time owning - seasonal /permanent stay
2. Long time owning - weekend stay
3. Short time rental – weekend stay

3.3.1 Long time owning – seasonal/ permanent stay

The long time owning category can be separated into two groups, the seasonal and the permanent residents. Both groups will involve foreign couples entering retirement and looking for a quiet retreat during their later years. The only difference between the subgroups is that while the permanent residents will stay all year around, the seasonal residents will only stay in their houses during the European winter. The other half of the year will be spent in their home countries when it is unsuitable for polo playing in Thailand. Winter houses in tropical nations are becoming very common for the European aristocracy.

3.3.2 Long time owning – weekend stay

The second category is based on the permanent residents of Thailand, both foreigners and Thai, wanting a weekend house where they can also keep their horses and practice polo. The house can be seen as a good investment and will stay in the family through generations.

3.3.3 Short time rental – weekend stay

Expatriates who are working and living in Thailand and have got an interest in polo is the third representative group. They are usually stationed in Bangkok and only stay a few years in the country. Many foreigners feel uprooted and miss the security of their everyday lives in their home countries. To continue with a familiar hobby is a comfortable way to meet new friends and escape a sense of displacement.

3.4 General ecological views

The energy usage has increased dramatically during the last 50 years making the quantity of fossil fuels such as oil, coal and natural gas shrinking fast. These resources are not refillable; it will be finished when the last drop is taken. Our western living habits are to a large part the causing factor.

Environmental issues are a growing concern for people around the globe and it has been shown through a rising demand for new alternative technologies. Supplementary energy reserves must continue to be developed so that “green energy” can be produced, used and eliminated without having devastating effects on the environment. Most of the techniques already exist but are hard to put into full-size manufacturing because the lack of interested investors and uncertain results. To improve the health of the world, we all must share the burden of protecting the ecosystem and a major social change has to come about if *sustainability* is to be achieved.

By studying different charts concerning consumption of primary energy sources, it is shown that all countries in one way or another is responsible for damaging the Earth. Oxygen producing forests are logged, drinking water is being contaminated, the ground were crops grow is polluted and it is time we start thinking about in what state we will pass over nature to the coming generations. [21]

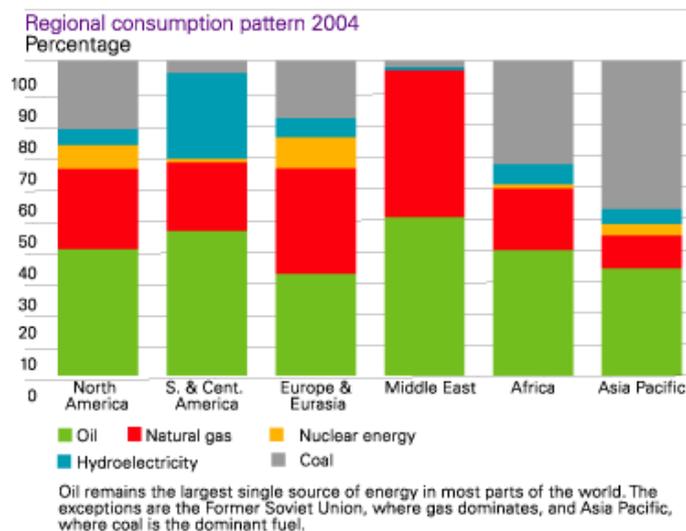


Figure 10 Chart of regional consumption patterns of primary energy 2004
Reference: [21]

3.5 Ecological views implemented in the project

For the final thesis Mr Link has expressed a wish for an ecological view for the housing project and he is especially interested in energy efficient buildings. We have found ecological angles of how to design “green buildings” by studying the course Building Ecology at Jönköping University in the autumn of 2005. Ecological “thinking” is spread worldwide, only customized to work in the environment of the specific country. By adjusting the facts we learned in Sweden to Thailand’s climate, we have created energy efficient houses adapted to their tropical location.

3.5.1 Solar panels

Thailand’s large amount of sun all year around makes solar panels extraordinarily well suited for the site. For this purpose we have placed solar panels on all houses to generate hot water and electricity to every housing compound. The solar panels are placed at a maximum of 20° due to the high *solar altitude angle* in Thailand using the solar beams to the limit [22]. The previous calculations have been made with comparisons to Australian research due to the lack of English language material on the subject in Thailand. In order to keep the bachelor thesis at a reasonable size, no calculations have been made regarding what percentage of the electricity usage can be extracted from the solar panels or the amount of area they need to cover. It is however of our greatest concern that as much as possible of the energy usage at the Thai Polo Club shall come from renewable energy sources.

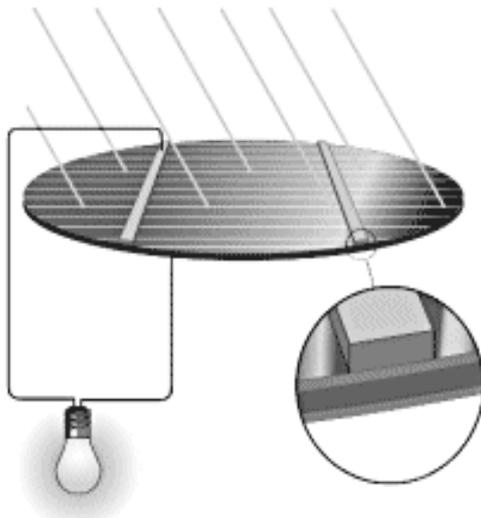


Figure 12 Electricity attached to solar photovoltaic cells
Reference: [24]

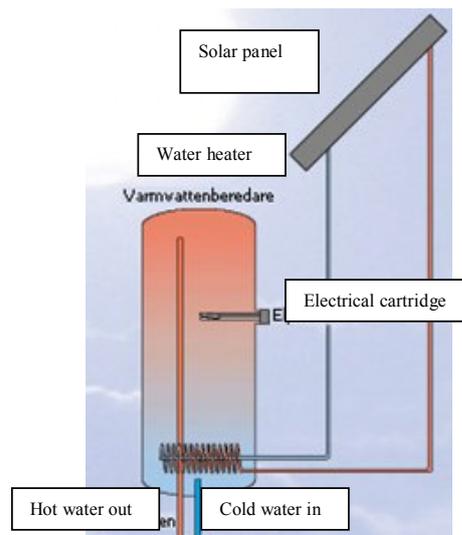


Figure 11 Solar panel attached to water boiler
Reference: [23]

3.5.2 Wind and ventilation

To reduce the heat naturally, one can increase the air circulation around the house by placing openings in the buildings in the wind direction. Planning the infrastructure to get as few wind stoppers as possible and to lead the roads in a north-south direction is another way of increasing the air flow. In the garden design coconut trees with leaves in the top and sparsely grown mango-, citrus fruit- and tamarind trees let the air through to reach the houses.

The houses are designed in favour of a self ventilation system which claims a minimum of energy [8]. Today however, air-conditioning is required from most people and to meet these demands the houses are easy to convert into a modern air-conditioning system. By only using the air-condition in the bedrooms, and there trying to keep it only to night time, the electricity use can still be kept low.

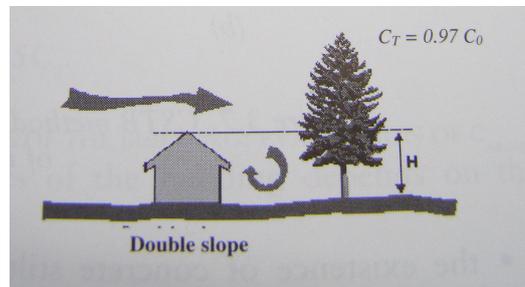


Figure 13 Vegetation placed for maximum airflow
Reference: [8]

3.5.3 Water

In Thailand one can not drink the tap water. The ground water is soiled and is not recommended to swallow. Instead there is bottled water to buy in every food store or mini market to use for thirst-quencher. Water is the source to life and therefore, all appliances in kitchens and bathrooms must be energy efficient, and reduced flush volume in toilettes and showers are to be used. A large container is placed at the back of the house for storage of rain water which is to be used for showering and also laundry. Taking care of rainwater makes an economical profit and is highly recommended.

In May the rainy season arrives to Thailand [18] and to be able to handle this massive increase in water, the area will use *Local Caretaking of Surface Water*. Most of the surface water will drain into the sandy ground and the rest will pour into subsurface pipelines leading to the nearby ponds (which are under construction in the writing moment) with local *purification* of water treatment.

3.5.4 Materials

There are many ecological aspects for using wood in buildings. Wood is one of the world's only renewable building materials and further advantages are the recycling and regenerating abilities. Trees also provide benefits to the environment while they grow, taking in carbon dioxide and releasing oxygen [26] which is a life necessity. No *preservatives* are needed in teak since the tree itself resists vermin and parasites which is a good quality for the process of green buildings. See §3.2.4 Material. Locally produced it would be optimal to our housing project, since the material that is brought up in this climate and region and must therefore be the best choice. To import other tree types instead of using teak, is defendable on one hand but on the other hand the pollution through the long journeys causes a problem. During the building procedure of the prefabricated elements, they are put together under roof which decreases the risk of rotting and mould fungus problems otherwise caused by penetration of rainwater. The idea of ecological building also contains the idea of as little waste and spillage as possible and this important part of the concept will be followed by accurate planning at the housing site. [10]

3.5.5 Window glazing

In a classic Thai house there is no glazing in the window openings to let the wind come inside, but as air-condition is required for this project, glass have to be put up [9]. The single-glazing of the windows will be covered by a special solar glazing that is reflecting the heat but letting the light in. The glass will be transparent even with the added reflecting layer. [25]

3.5.6 Infrastructure and traffic

Noisy, gas-using cars are not allowed within the village. All vehicles are to be parked in a separate area near the village entrance and from here all households will have their own electrical car to go further into the settlement. Visitors to the Polo Club will also be able to trade in their regular car with an electrical one at the Electrical Car Station situated on the parking area. Electrical charger stations will be placed underneath all residences for re-charging the electrical golf carts during night time. Bicycles are also a recommended as transportation in the quarters. Asphalt is chosen to make the roads more resistant to heavy rainfall as gravel easily is washed away in the floods. The *serene* driving routine will lead to minimum wear down of the asphalted roads as well as no *malodorous* exhaust gases will linger inside the area. People can safely walk around in a quiet and peaceful community.

3.5.7 Landscaping

By having the houses on high stilts there will be very little ground work for the house foundations. The digging for the poles, ditches, subsurface pipelines and ponds will be carefully handled to interfere as little as possible with the existing environment.

In the garden there will be space left open for vegetable gardens for the inhabitants with green fingers and a plant interest to fulfill the thought of an ecological village. The garden design will make use of the existing surroundings, preserving the trees already in the area. To keep with a traditional Thai garden several local species of trees will be planted but this will not affect the geology of the site. [2 & 39]

4 Implementation

The implementation examines the methods used for the project as well as goes into depth about the building technology, the building design and the building layouts of the project.

4.1 Methods

The methods used for this project have been from the qualitative approach meaning the research methodology starts with a problem and after thorough research about the topic one can narrow down the subject through delimitations to reach the final theme. The methods are put into six chronological categories: pre-studies, interviews, research, study visits, sketching and designing.

4.1.1 Pre-studies

The project was initiated with thorough preparations and methodical studies of the theme. To get started with the final thesis contact was made with one of the few Polo Clubs in Sweden to set up a meeting with people active in the sport. In February 2006, Johan and Caroline Seth held a guided tour of Almare Stäkets Polo Country Club outside Stockholm. The newly built stables, the riding house, the paddocks, the large field among other things were shown. The Argentinean polo horses were on a winter retreat during off season and were outside 24-hours a day in one of the large paddocks. Very important information was obtained from talking to Johan and Caroline Seth in their role as active polo players and these views have been considered throughout the project. [36]

The first weeks after the project was accepted, information about Thailand was collected from the internet and correspondence was initiated with many persons, both in Sweden and in Thailand, who were educated in the field of building techniques in a tropical climate. Contact was also held with Harald Link, President at B. Grimm Group [28], who was to be our tutor abroad. Later, however, this responsibility was passed over to *Khun* Hattaya Angkhavinitvong [29], Deputy Director of Link Real Estate Co., Ltd.

4.1.2 Interviews

The interviews that have been carried out through this project have been made with an informal approach. It has also been quite difficult at times to hold interviews with people in Thailand as their English skills have been minimal, sometimes nonexistent, making it very hard to rely on some information. The information used from interviews has been checked with several sources making sure it is correct, explaining the lack of interview material in the appendices, and the extensive reference list. Since the paper is written within an area very different from previous building assignments, many of these informal interviews have been carried out to get a good understanding of the project. Everyone from the groomsmen at the Polo Club to the professors at Silpakorn University have helped put in a piece of the puzzle, but once again due to the lack of communicative skills it has been impossible to hold proper interviews even if this sometimes would have been desirable.

4.1.3 Research

The main research has been done at Silpakorn University in Bangkok where an impromptu meeting was set up with Ph.D. Kitchai Jithkajornwanich [33] at the architecture institution, who not only answered all questions but also gave full access to the library of the faculty and the library at the school. Here, many useful sources were found to enable the proceeding of the project and two days were spent exploring books regarding Thai architecture, building ecology etc. Mr. Harald Link also provided with several good books upon arrival in Thailand, some for inspiration and others focusing more on the building techniques.

Internet cafés have been another natural source of useful information to fill in the gaps regarding up to date technology etc. The literature at Silpakorn University was very good but somewhat outdated, especially regarding building ecology.

4.1.4 Study visits

To gain superior knowledge of the local building techniques and other areas vital to the project, several visits around the Pattaya and Bangkok area were made.

In Bangkok the National Museum was visited to study Thai history and culture. Here one could follow Thailand's history from the beginning until today and enjoy the many treasured artefacts from past to present. The museum visit made it easier to understand Thailand today. [37]

The Jim Thompson House also received a visit in order to see and enter a traditional Thai house with interior modifications to suit a western lifestyle. The possibility of having a private guided tour made it possible to ask architectural questions and the visit enlarged the research file enormously. Jim Thompson's elegant way of mixing the traditional Thai with his American lifestyle has shown that careful changes in old tradition can lead to very pleasant results. This visit has been one of the most inspiring in the quest to gather facts about Thai houses and it has often been referred to during the whole project. [38]

In order to gain more knowledge about the rules of designing a Thai garden a trip was scheduled to Nong Nooch Tropical Garden, located south of Pattaya. Many *auspicious* and *inauspicious* plants make up the rules and the main goal of the visit was to find and photograph these plants. The green park area is used as a very large showroom for tropical flora and the grounds are also used for scientific plant research and a database categorizes and keeps record of all species on the site. Nong Nooch Tropical Garden houses one of the nation's *prominent* plant nurseries where mixing takes place to evolve new species. There are also a few traditional Thai houses on the premises which are excellent study objects. The gardens surrounding these houses are also traditionally Thai in their layout and choice of plants. [39]

Many trips were also made around the Pattaya surroundings and the countryside. These trips have been a great source for studying typical housings of the late 20th century for Thai families as well as a hands-on experience of the infrastructure in the country. Erosion caused by heavy monsoon rain has made the verges weak at some points and has sometimes reduced the carriageway to half. The roads are also full of large holes which can damage a vehicle or worse, be the reason for an accident. The maintenance is not comparable to Swedish standards but the Swedish sense of safety will be incorporated into the project when designing the roads for the housing area.

4.1.5 Sketching

As soon as the project was approved by the department at Jönköping University, several sketches were made of a house that would match a polo playing family. Since the necessary background material, including maps and survey protocols, was delayed, the sketching process was started without these. The only information received was an e-mail from Harald Link explaining the surroundings of the Polo Club. “To the left by the entrance there is a small hill and behind that one to the right, there is another hill and to left of the second hill there will be a pond...” All sketches had to be redrawn upon arrival in Thailand. The sketching work began with drawing with pencil and paper and continued on computers with SketchUp and AutoCAD.

4.1.6 Designing

From the beginning the project was supposed to be a housing area with European influences, with the feeling of a “European village”, but as time went by the assignment changed to one made of traditional Thai houses. Traditional meaning that the external design follows the rules of an old Thai housing and that the modular system is applied. As mentioned above, great effort has been put into the underlying research about Thai houses, with visits to buildings such as the Jim Thompson’s House and different Thai homes in the surroundings of Pattaya, to collect references. A great deal of time has been put into learning about the architecture of the central region in Thailand, which the classic Thai house is very much associated to. Since the Thai Polo Club is situated in this area, it is natural that these province traditions are adapted in the construction as well as in wall patterns and details. With all these aspects to lean on, the buildings have then been designed for the present living habits and architectural parts have therefore been added and removed to make a home of today in the character of an old Thai building. Designing has at times been quite difficult as the client has changed his mind several times during the project making it unavoidable to return to the drawing board each time. The wishes of the client can sometimes be quite *contradicting* to what technology requires.

There has also been a lot of thought put into the designs of the garden, concerning wind direction, religious aspects etc. [2] since this is an important part of the impression of the compound as whole.

4.2 Building Technology

The building technology for a traditional Thai house is quite simple, relying on knowledge passed on through generations. When incorporating the demands for modern living standards there are certain aspects of the old styles that need to be reconsidered. Building technology deals with the building construction and the construction process of the houses at the Thai Polo Club.

4.2.1 Thai houses – the construction

The construction of a traditional Thai house is made of wooden components all way through - from the load carrying posts and beams to the wall elements and the decorative carvings on top.

Only the roof is not made out of wood. In the old days it was mostly covered with elephant grass, palm leaves etc to prevent outside heat from reaching down into the room and it rested upon wooden *battens*. Tiles were only used as roofing on temples and royal buildings earlier,

but today tiles have been more and more common as roof covering. Because of their sustainability and good looks tiles in different colors (green, red and white) can now be seen on many houses. Tiles bring more weight to the roof construction and require therefore battens in larger dimensions. Stone material keeps the hot air low down, but the heat flow is blocked by insulated ceilings because of air-condition usage. [11]

The old tradition of a high roof construction is founded in the natural occurrence that hot air rises. The building structure forces the heated air up and out through a gap in the ridge and keeps the room cool. By this appliance stuffy air is prevented, air flow increases and the inside is kept cooler than the outside. Today air-condition is required to give a pleasant interior climate and this system provides another roofing. One has to add ceilings and insulate the walls in every room where air-conditioning is wanted. This is necessary to get a satisfying air-flow in the room and it is a fact that a smaller space will cool down faster than a larger room with a high ceiling. In the rooms ventilated by wind and breezes, fans are installed to operate when needed. [12]

In order to block out the sun and heat during the day as well as the heavy rains brought by the monsoons, the roofs are constructed with a very large roof overhang. Over the verandas and passageways the overhang is 2200mm while at the *gables* it is restricted to 700mm. Because of the large dimensions, the roofs need to be supported by either diagonal braces or vertical stakes, depending on whether the space underneath is to be used for walking. The roofs will all have a very well dimensioned set of gutters to collect the rainwater from the roof and transfer it to the Local Caretaking of Surface Water. Many of the Thai houses visited during this trip have had insufficient dimensions on the gutters resulting in overflowing and, in the worst cases, mouldy beams and poles *jeopardising* the entire structure.



Figure 14 Mouldy beam

Reference: private picture

The major posts that carry the buildings are about 5-6 m high and have the dimensions 250mm in diameter at the bottom and 200 mm in diameter at the top. These are establishing the slanting for the walls and onto these the floor beams are attached and hold the whole structure. The prefabricated wall elements are, because of the slanting, fixed to the posts by their own weight and with one *dowel* in each corner. The wall elements are joined on the outside of the pole and cover it to just be shown on the inside. The slanting construction gives the building improved firmness and easily nails the prefabricated walls. This project will have its own standard dimensions and this procedure is working even if the walls are insulated. [2]

In Thailand one does not have to take into account the thermal bridges like in Sweden. Since the temperature difference is not that great between indoors and outdoors it is not of equal importance to make sure the windows are insulated and that there are no gaps in the walls. In Sweden this difference can reach up to 40° C in the winters, but in Thailand it will never exceed 15-20° C in the hottest season, presuming the desirable indoor temperature in both

cases is 20° C. This however does not mean it can be discarded completely especially when dealing with the modules using air conditioning. The wall panels e.g. work both as decorative designs and to cover the joints between the timber boards. [38]

All the houses in the traditional Thai house complex are individually supported by their own poles, making the veranda a building part of its own, only connecting the different houses. The floor structure is made up of 150mm beams going through the poles, supporting another set of 150mm beams crossing the bottom ones. This gives the floor structure a 300mm height. The terrace is sometimes set at a lower height than the surrounding houses, giving the floor structure a more complex construction with the added steps. The verandas connected to the main house are raised 1000mm above the terrace and are supported, just like the houses, on their own stilts, in order for the wood to move freely and to avoid fractures in the construction. [2]

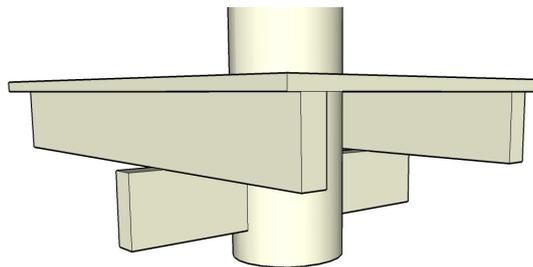


Figure 15 Floor structure
Reference: own design

The larger windows and the front doors are constructed in the same way as the walls leaning in towards the middle of the building and the bottom part being larger than the top. This is done mostly to help stabilize the building but also for the esthetical aspect. [2] Openings should be oriented to the South and North to avoid direct sunlight. This has been done to as large an extent as possible, but since the wings are at a 90° angle to the main house, it is impossible to take this into effect in all the houses. Since air conditioning is required in the bedrooms, the focus has instead been put on placing the main house in a north-south direction, giving it the natural ventilation wan. All windows and doors are also equipped with mosquito nets for being able to leave the windows open, as the insects in this part of the world can be the cause of both malaria and dengue fever. In tropical regions there are different natural occurrences to take into account from what we are used to in Sweden. All openings will be closable in case of typhoons and although Pattaya is not in the earthquake zone, they have occurred, and across all openings lintels and beams will be placed to even out the load. [13]

The staircase has been constructed with two platforms to facilitate the climb for the residents and visitors. The platforms are of the same construction as the floor structure and each is supported by four posts. The staircase leads up to the entrance in the terrace wall. The top plank of the terrace wall is placed at a 45° angle to enable run off of water.

The foundation is also made up solely of wooden components. There are several variations depending on what type of geological properties the site contains but figure 14 shows the fundamental structure. The houses at the Thai Polo Club will have this type of foundation due to the ground conditions being sandy and wet. As mentioned above, the Sao Ruens are the round, inclining posts supporting the buildings and the terrace, and gives the compound its impressive height. The Kongpat is the 150x50 mm plank penetrating the Sao Ruen and the

Ngua, the Ø150mm and 500-700 mm long round log, is placed underneath to prevent the compound from sinking. [2]

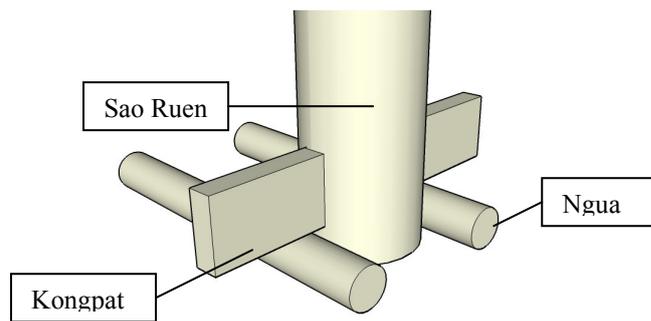


Figure 16 Foundation
Reference: own design

In order for the buildings to be used with air conditioning, insulation needs to be added in most components. According to Australian research about housing with air-conditioning in hot and humid climates, it is very important to “reduce the heat gain and keep the cooled air inside (...) through a well sealed building.” [27] The research also shows that even if most of the “cool loss” occurs in the roofs, it is also very important to also insulate the walls, the floors, especially suspended ones such as in this project, and the inner ceiling. The modular system has been adapted for this project of Thai buildings with just a few changes to adopt the idea to the living habits of today. To meet the demands of houses with air-conditioning, the elements have a different construction and therefore they will be heavier than usual. The units also have a smaller assembly tolerance than in the old days, to avoid springs and leaks that would decrease the effectiveness of an air-conditioner.

The supplementary buildings such as the maid quarters and the exterior guest bathroom are of the same construction as the remaining houses with very small alterations. The exterior of the guest bathroom is simply a smaller scale of the guest house but with ordinary walls without insulation. The dimensions of the maid quarters is replica of the main house brought down one floor, which means the house can take advantage of the existing poles from the building above. The semi-outdoor kitchen is added to the left side of the house and a *slat* is put up as one of the four walls to get the airy feeling. The roof is a low angled roof of corrugated sheets. This is done to protect the building from unforeseen rainwater from the gaps above since the two buildings are not connected.

4.2.2 The construction process

Without cranes of today, the process to raise a wooden Thai house in the old days was heavy and the owner had to call in several special builders and craftsmen to carry out the project. It claimed a lot of helpers to fix the poles when everything was dragged and pushed into place with ropes, braces and muscle strength and the procedure took about three weeks. Nowadays the same procedure is applied but with modern tools as different lifting appliances. Since the prefabricated wall elements for the housing at the Thai Polo Club will contain insulation, the parts will be too heavy to lift without the help of machines.

The first thing the settlers have to do is to dig the postholes with the right depth. Step two is to prepare the first pole, *sao ek*, to lift into place. In the old days there was a ceremony before the first pole was in vertical position. Monks chanted prayers and sprinkled the *sao ek* with auspicious water before the rise. They also tied leaves from the banana tree, sugar cane and colored cloth round the top. Today these habits are less common but it still occurs that monks bless new buildings. By securing ropes and braces the raising of the stilt can be done. The second pole, *sao tho*, will be raised with the same procedure, and then the other poles will follow in a clockwise route. Now that the poles are set the roof structure is made. Next to be put into place are the prefabricated gable ends, the walls and the *barge boards*. The work with the roof structure is now proceeding and tiles are hooked onto the battens. The floor is the last building part to be completed and this is done secured from rain and bad weather. [2]

4.3 Structure plan

The triangle shaped building site is about $240 \text{ m} \times 300 \text{ m} / 2 = 36\,000 \text{ m}^2$ and there will be space enough for about 12 housing compounds each on a plot of 2000 m^2 . The ground is very flat but has a fall of $3\text{m} / 240 \text{ m}$. [15]

The village is situated to the right when passing the first gate to the club. Turning right again one passes the village-gate and inside, again to the right, the parking area will be placed. Here the inhabitants leave their regular cars and change to an electrical one.

Adjacent to the housing compound in the north, is the entrance way to the Club house and the Polo field. Therefore, the borders of the garden are placed 4 m away since nobody wants to be disturbed by passing traffic. The traffic will not be disturbing like in the cities, but the distance is a safety factor to avoid any complaints from the tenants. The 4 m-border is a norm around the village which is encircled by small gravel “streets”. When this is written, the eastern street is used for transporting sand from the future pond and the western one which is more of a path, is not drivable.

The eastern supply street and the two streets leading into the heart of the village, are 6 m wide including the carriageway and spaces on the sides. The electric cars and narrow streets (*soi*) will reduce the speed in the area which makes the area more secure. The first *soi* will connect to most entrances, about nine driveways, and the second will hold only three. This is the result of the building sites triangular shape; to place more houses in the north section is to exceed the limits of the site. Another advantage of this decision is that the group of different trees in the peak can be left naturally growing.

The main house in the northern housings is facing south, meaning that the terrace major area is to the south. Across the *soi* the complexes will be placed with the terrace facing the north and in the second *soi* the compounds are facing south. The north-south placement of the housing is made to take advantage of the winds blowing in these directions for cooling and ventilation and the built area will, with its elevated construction and the varied vegetation, increase the breezes.

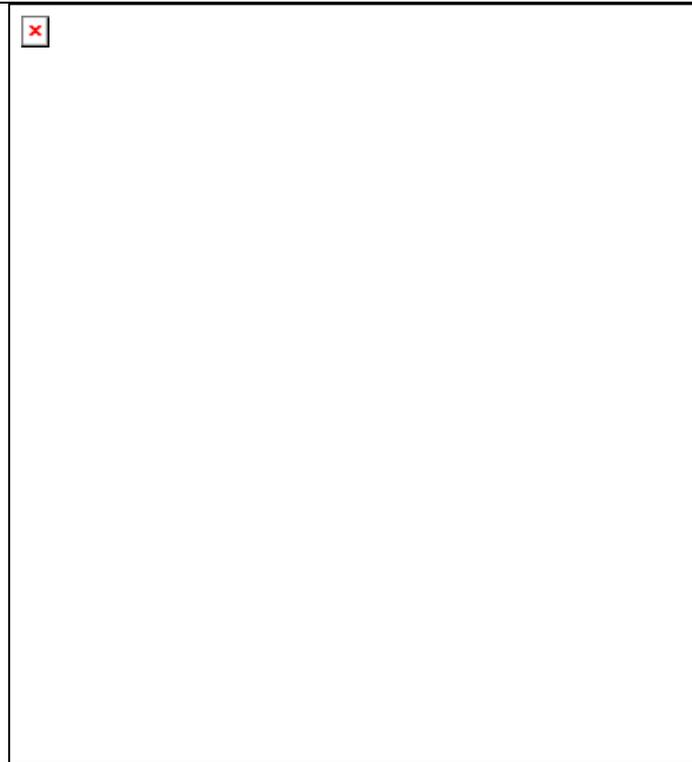


Figure 17 Structure plan
Reference: own design

The housing with the terrace turned to the south will have a great deal of sun, but the veranda roofs will cover the seating places during the hottest hours and the sun will only reach the façade at five in the afternoon. The dwellings with the terrace to the north will be sheltered from the sun by the main house in the mornings, but later they will also be reached by the sunbeams. The verandas however will always be a place offering cool shade.

Quite a few palm trees and bushes will be flanking the “streets” around the village and will be maintained to keep the area green and thriving. The cluster of trees in the peak are to be remained untouched, only a gentle reduce of sub vegetation of bushes and high grass will be done, to minimize the risk of unwanted meetings with the animal wild life. Large mango- and eucalyptus trees are providing the south corner with sweet fruits and cool shade which makes the site an enjoyable and delightful meeting point. Since this area is far from the busy roads it is suitable for a community house and a playground. A swimming pool nearby would be an appreciated establishment since the village is located 30 minutes from the beach.

4.4 Building design

To be able to adapt a traditional Thai house into the use of a modern western lifestyle, one has to change several parts of the long-established design. Today’s requirement of air-condition and indoor kitchens and bathrooms are making a number of changes in the interior, while the exterior more easily can have the familiar look of a classic Thai house.

The housing groups are designed to meet the representational living habits of the potential members of the Thai Polo Club. Their lifestyle with homecoming dinners and other gatherings will be adaptable to these houses and the spacious outdoor room is well suited for these events. We have planned two different alternatives of the housing: the first one uses standard design and the second one is adapted for the needs of people with reduced physical ability. The standard housing is described from § 4.4.1 General design until § 4.4.3 The wings.

4.4.1 General design

The houses have been clustered around the terrace according to tradition, with the main house in the central view point and the two smaller houses placed to its right and left, facing each other. The large terrace in between, is meant for different activities and here small trees will be placed, to provide shade, together with smaller pots with floral greenery. The terrace has different levels, steps and stairways to improve air flow and to connect the levels. The different heights between the wings verandas and the terrace are also to improve air flow and a step has been added to reduce the raise for the inhabitants.

The external house design is traditionally Thai. The wall patterns, the gables and the roofing are designed after already existing examples [2] and we have only adjusted them to fit our dimensions.

The roof covering on all houses and verandas is terracotta tiles which go well with the brown colour of all wooden parts. The roof over the verandas and walkways are following our chosen measurement to form secure connections at the corner meetings. These under roof walkways are traditionally Thai and create paths where one can walk from the left wing via the main house to the right wing without getting soaking wet during rainfall.

Sunlight is also well taken into account. By using the SketchUp shadow-function, the solar altitude angle has been studied in the model at different times of the day. The design of the veranda roof has been carefully considered when analyzing these facts as well as the placement of the solar panels. The water heating- and electricity generating solar panels will by their low angle not intrude or interfere with the architecture. The high solar angle in Thailand provides a very flat position of the solar panels and the veranda roofs are therefore a very accurate place for this equipment.

On the roof we have created the detail in the corners of the plaster framing. This form is done after looking carefully at several roof decorations and other embellishments for roofing. The carvings at the gables are made in Naga style (§ 3.2.1 The traditional Thai house (the ruen Thai derm)) because we find this style more characteristic of the classic Thai house and more suitable for the buildings in the project.

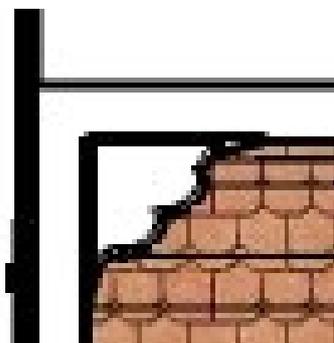


Figure 18 Detail on roof
Reference: own design

The fence around the housing and at the stairs has been drawn after studying a number of different existing fences. The design fits the housing and harmonizes well with the wall pattern and by using the same fence around the terrace as well as the guesthouse and the *sala* (§ 4.3.5 Housing adapted for residents with reduced physical ability) the dwelling comes together into one.

We have not followed the old dimension instructions religiously in order to obey the interior design-wishes of a modern family. One example of this rearrangement is the wings where the bedrooms have their own bathrooms and closets within the rooms. Bathrooms never occurred indoors in the old days when people cleaned and washed in a nearby *klong*.

4.4.2 Main house

The main house has been put on higher stilts to increase the ventilation through these different levels that are created and to make the terrace view more interesting.

In the main house we have placed a kitchen, a dining room and a living room. This is nothing they had in the earlier years. Back then one prepared, cooked and ate outdoors or in a separate house located near the main house. Dining rooms and living rooms did not exist like they do today. A dining room was never needed as a Thai family sits on the floor having their meals. The main house was only a large bedroom for the owner, his wife and their children. [2]

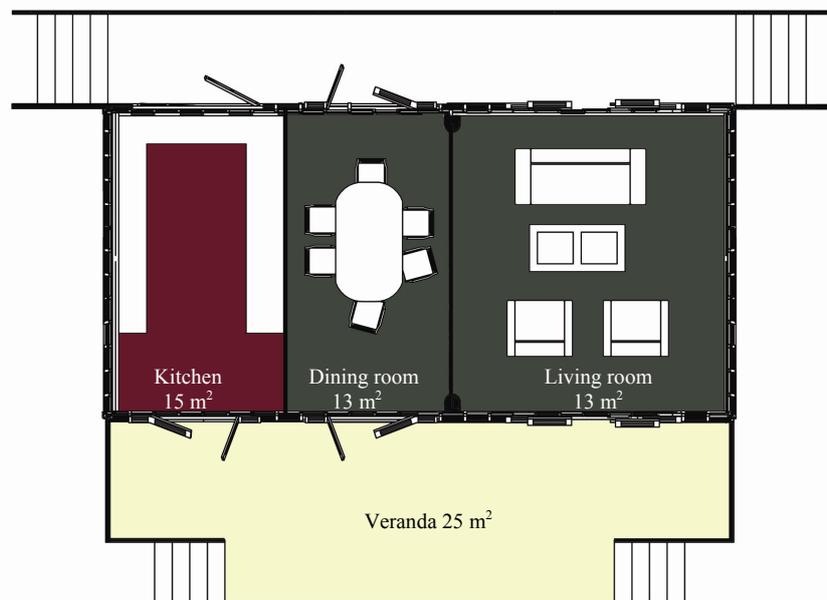


Figure 19 Layout main house
Reference: own design

The ceiling height inside is 6,5 m and when looking up one can see the roof beams and higher up the roof structure. This interior view is special for Thai houses, where you can actually see every construction part. The posts, that carry the house, are also shown inside and they are a decoration to the room. They also have the function of space dividers. The wall between the living room and the dining room has partially been taken away to open up the room. This generates one large social room.



Figure 20 Interior view of the dining room and living room
Reference: own design

Above 2100mm the ventilation-panel has been kept only as a wall decoration. We have seen the ventilation carvings in several books about tropical design and also experienced them in Mr Link's house in Bangkok and we found them pleasing to the eye. In this project they have only been used for their design not for their original function of ventilation passages. In air - conditioned rooms these panels have to be covered by see-through glass because if not, the function of electric air-flow will go *astray*. In this room, however, fans will circulate the air and they are attached to the roof beams which are placed here solely for this purpose.

To get the light and breezes into the relatively dark inside, window doors are placed towards the terrace and on the opposite side. When the doors are opened the inhabitants can take benefit from the winds blowing through and also in the dining room the same doors are added in both the exterior facing walls. In the kitchen there are window doors to the terrace and European windows over the bench on the opposite side. Through these window doors the entry to the house is easily done.

At the back of main house there is a veranda from which one can overlook the garden and by a staircase in both ends of the balcony one can stroll down to the terrace. At the front of the main house the major veranda is present to be used as an outdoor dining room, with room for several dinner guests. Stairs are leading down to the terrace and to the right and left wings.

4.4.3 The wings

In the left wing there are two alternative building layouts. One consists of two mirrored single bedrooms with a bathroom and a closet each. The other alternative includes a large main bedroom, a small extra room, which can be used as a study, a large bathroom and a walk-in-closet. The right wing will be a mirrored copy of one of the two alternatives described above.

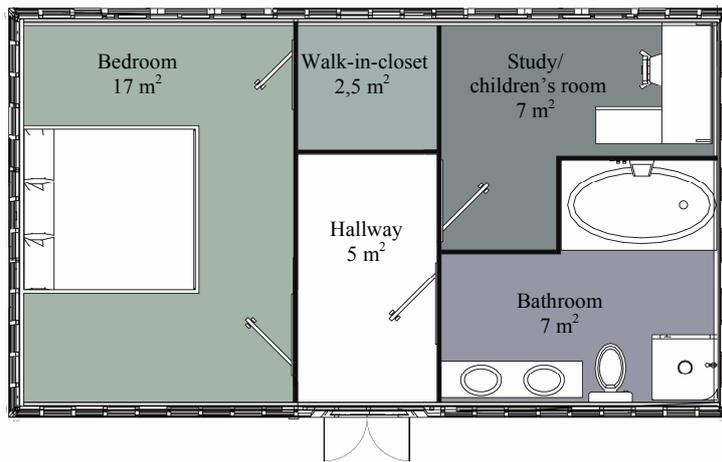


Figure 21 Layout wing with master bedroom
Reference: own design

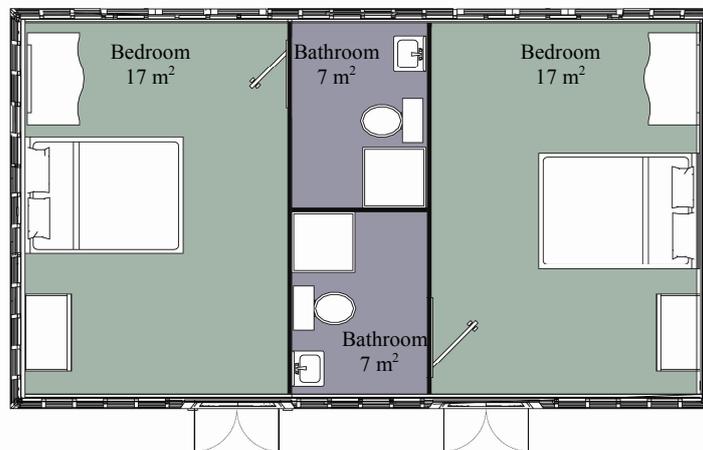


Figure 22 Layout wing with twin bedrooms
Reference: own design

The ceiling height indoor is 2.40 m because of the air-condition instalment. The roof has got a *levelled ceiling* and above the water-and electrical installations are placed together with the air conditioning-system. All walls will be insulated to make the air-condition work and stop unwanted airborne sound and noise. There are no ventilation carvings in this house because of the requirement of sound between the rooms.

The poles supporting the walls are shown inside and to let the light in, window doors, a smaller bathroom window and a window to the closet are placed towards the garden. A smaller bathroom window is also placed at the terrace side. All windows have elegant grids for security and the placements of openings are symmetric to get stabile and well arranged facades.

The outer double doors are designed with inspiration from our accommodation in Thailand and decorated with the same ornament shown on the roof (see §4.4.1 General design), only this time carved in wood. The doors are also used at the entrance gate which welcomes residents and visitors.

4.4.4 The guest bathroom and storage room

To the right of main house there is a small house comprising a guest toilette and a small storage room. The placement was natural because the living room is at this side of main house. To have a toilet inside the main house was not ideal and to get privacy this little house was created. Roofs cover the way to the house so the passage is rain free during bad weather.

A storage room is in the other half of the house and can for example keep extra chairs and tables, gardening tools for the plants on the terrace etc.

4.4.5 Ground floor

Within the housing, there will be a maid's quarter for the housekeepers. This will be placed directly under the main house, but the two buildings are separated because the space left open will increase the air flow.

The quarter will contain an outdoor kitchen and a private bedroom for the maid as well as washing and storage rooms. This facility will also include a changing room, showers and hold polo sticks, riding clothes and other equipment connected to the sport.

The kitchen has got three real walls and an airy slat as the fourth building part forming the room.

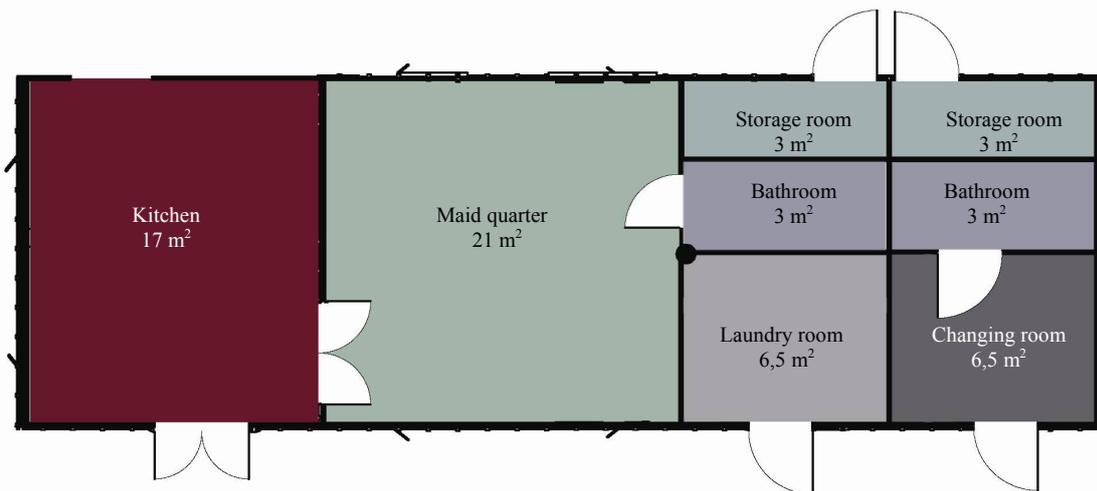


Figure 23 Layout ground floor
Reference: own design

The external design follows the other houses relating to the wall patterns, design of doors and windows but changed to be more secured as this building is placed on the ground. The roof is not a Thai roof in classical order, but a corrugated sheeted roof with low gradient to fit under the *terrace slab*. The roof will protect the “semi-basement” from dripping water from the terrace above when raining.

Under the housing there will also be parking spaces for the electrical cars and storage for related equipment.

4.4.6 Housing adapted for residents with reduced physical ability.

People who join the club are expected to have an active lifestyle but while ageing the body's physical state weakens, even if the polo interest might still be active. The equestrian sport requires people to be fit and live an active life; this means the housing will not have all the handicap requirements that Scandinavian buildings demand. In Thailand there are no set standards regarding building for disabled people, but at the Thai Polo Club the buildings will be designed so that there will be room for ageing and in case of accidents the residents will still live a comfortable life.

With this in mind we have designed the housing with provision for reduced physical ability.

This means that all modules in the Thai Polo Club have easier access by more spacey rooms and inside the wings the bathrooms will be equipped with larger areas for the showers as well as for the toilet and sink. The master bathroom will have a bathtub added and there will be no narrow passages. The doors will be wider than usual and additional space will be added around furniture. The kitchen will be planned with a maximum of reachable cupboards and with washing and cooking areas at adjustable height.

Thresholds will be of minimum height and where they can not be taken away they will be as low as possible. There will also be the possibility of installing a handicap lift to the entrance staircase.

Externally the main house will be lowered down and the staircases will be transformed into ramps for easy access. The terrace is put into the same height as the verandas to prevent fall and to reduce the amount of steps outside. The guest house and the tea house (§ 4.4.7 The guest house and the tea house) will be lowered to the same level as the pathways of wooden planks (see § 4.5.3 Trees, bushes and pathways) for easy access even with wheelchair. There will also be ramps added at several other spots for the possibility of entering onto the driveway.



Figure 24 Exterior illustration of ramps outside main house
Reference: own design

4.4.7 The Guesthouse and the teahouse

The guest house and the tea house are buildings that can be added to the compound by the future owners, if wanted. The placement of these complementary buildings is in front of the raised main buildings, on either side of the driveway.

The raised guesthouse to the left is easy to reach for visitors and is set at the side to give the guests a little privacy. The house contains a bedroom, a bathroom and a walk-in-closet and is perfect for two persons staying over for the weekend. A veranda is added to shelter the large window doors, with the function of an entrance door, from sun and rain and also to create a place for relaxing moments.

The external design is mentioned above (See §4.4.1 General design).

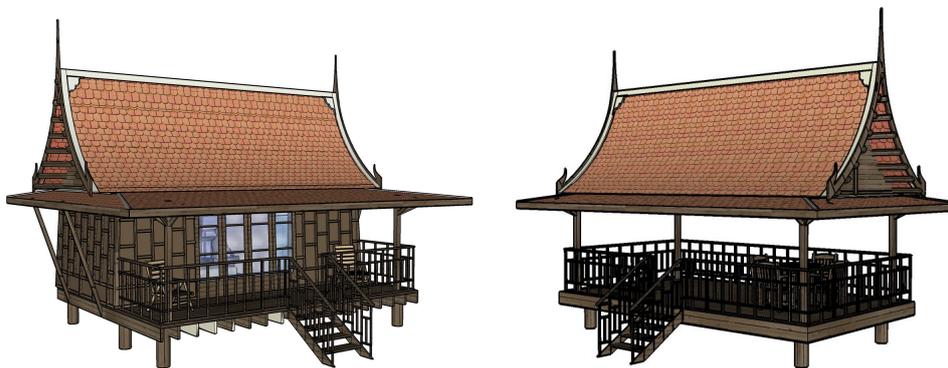


Figure 25 Perspectives of guesthouse, left, and the teahouse, right.
Reference: own design

The tea house is a small pavilion placed to the right of the driveway of the proposal housing. It is raised and therefore a fence has been added to hindrance falling. This additional garden jewellery is called sala in Thai and has for ages been used as a breezy place to sit and chat under, shielded from the sun during the hottest hours of the day. Since the Polo sport is far and wide associated to the Brits and their tea habits, our sala can be used as a place where the inhabitants can drink their afternoon tea and discuss the latest *chukka*.

4.5 Garden design

The garden belonging to the traditional Thai house has to follow very strict rules (see §3.2.7 The Thai Garden), just as the rest of the compound. At the Thai Polo Club each residence will have their own private garden surrounding the houses. It will have enough density in all directions to give the residents the much wanted sense of privacy, which might be very hard to come across in their other home in Bangkok. The garden design has been remodelled to best fit the conditions of the site, including the wind in a north- south direction, the mix between the very strict rules of the Thai “jungle-style” and the grandiose Western influences.

4.5.1 Driveway and parking

The visitors to the homes at the Thai Polo Club will go with their electrical cars on the narrow soi, turn into one of the driveways and be greeted by a great mango tree in centre of the garden. The driveway will go straight towards the tree and then continue in a loop around it for easy access to the staircase. The buildings spreading out behind the tree will be a welcoming picture for the newcomers to the area. The electrical cars will be able to park and recharge underneath the main complex and a small tiled lane guides them into the correct spaces. The whole area underneath the complex will also be tiled.

4.5.2 Placement of houses

Depending on what side of the soi the house is placed the gardens will be mirrored in order for the Thai rules of the direction of trees and bushes to be followed. This however does not cause a problem since the buildings are symmetrical and can be turned in a north-south direction without interfering with the wind and sun conditions too much. The trees at the entrance to the south facing house will be placed so that the wind is being forced to accelerate towards the buildings. The four south facing houses will instead be able to enjoy a nice shaded terrace facing the north.

4.5.3 Trees, bushes and pathways

The north of the buildings will be thriving with lime trees; this will be the central tree for the houses facing north, continuing on with pomelo trees to the northwest and tamarind in the west. Southwest will have jackfruit trees and mango growing in the south. All the trees mentioned above provide the owners and tenants with tasty fruits and well deserved shade. The east provides the jungle feeling to the garden. Bamboo bushes will be fighting for the space in between the trunks of the tall coconut trees hovering above. Smaller bushes and flowers will be planted in different parts of the garden, but as there are no set rules for this, we leave it up to the families to pick a selection of their preferences.

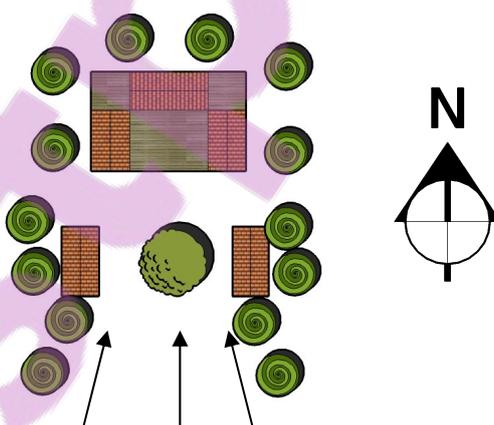


Figure 26 Wind flow to the south facing houses at Thai Polo Club
Reference: own construction

Through the entire garden stone laden pathways will take the people to the different sections. In the gardens for the people with reduced physical ability the pathways will instead be made of wooden planks and all the plantations will be put in wooden garden boxes with a height of about 650mm. The pathways also connect the guesthouse and the teahouse with the main house, with added access ramps when needed.

5 Results

The goal of the project was to hand over a complete set of layouts to the client B. Grimm Group. After several changes along the way we have come up with a proposal which is designed to satisfy the wishes of the client and the results will be shown below under the following categories: structure plan, compound plan, garden, main house, wing with master bedroom, wing with single bedrooms, guest bathroom and storage room, maid quarters, guesthouse, teahouse.

5.1 Structure plan

After calculations regarding the number of households in the village, the number of houses was set to 12. There are several other areas on the premises that still have not been planned and can be put into use as more housing areas for future expansion. See appendix 1.

5.2 Compound plan

The compound has been set up in such a way that it should suit the preferences of the three representative resident groups. This has been done with the housing being combined in a modular system where the residents are being able to choose freely which houses they want and need for their luxury retreat. Furthermore the possibility of adaptation to the residents with reduced physical ability has been taken into account which means all possible requirements of the client can be met. See appendix 2.

5.3 Garden

The garden has been designed in such a way that it is pleasing to the eye and creates a tranquil oasis for the residents. See appendix 3.

5.4 Main house

The main house has been planned to accommodate the many occasions of representation that is common within this social class. The kitchen has been placed adjacent to the combined dining and living room and the guest bathroom has been moved outdoors in order for the guests to feel comfortable. See appendix 4.

5.5 Wing with master bedroom

The wing with the master bedroom is ideal for the working couple wanting the peace and quiet during the weekend but unable to leave the work at home. The office can also work as a studio or a children's room close to the parents. See appendix 5.

5.6 Wing with single bedrooms

The wing with the single bedroom is well suited for the teenage family or for couples continuously entertaining many guests. See appendix 6.

5.7 Guest bathroom and storage room

The outdoor guest bathroom also has a storage room attached to the right. This has been created in order for the residents to store items without decreasing their living space in the other houses and to maintain the proportions of the house without making the guest bathroom unnecessarily large. See appendix 7.

5.8 Maid quarters

The maid quarters are dimensioned for a comfortable life style for the house keepers and the changing rooms are placed bordering the washing room for easy access. See appendix 8.

5.9 Guesthouse

The guesthouse is a complementary building when the standard buildings are not sufficient for housing the family members and expected guests. See appendix 9.

5.10 Teahouse

The teahouse is a complementary building added for the pleasure of relaxing in the breezy shade of the garden. The teahouse is a very nice counterpart to the guesthouse if one is chosen. See appendix 10.

6 Conclusions

To turn a traditional Thai house into use of a 21st century lifestyle, makes one struggle with the dilemma of how to unite this long-established construction to today's living habits. On one hand is the traditional Thai building with its special design and construction, the religious thoughts and simple living habits and on the other hand is the present demand for comfort and effortlessness from the modern man who is used to electricity, internet and everyday showers. This challenge has not only been stimulating but has also given us new knowledge and a better understanding of the difficulties in the building process.

To design and produce a house anywhere in the world one has to be informed about the right conditions from the start to be able to prevent damages and difficulties. In tropical humid countries there are other damage risks to consider than Swedish occurrences. The humidity and heavy rainfall e.g. is not optimal for building material, but if one is prepared and knows about these problems, they can be avoided from start. What the client asks and wishes for must be reasonable and possible to execute in reality. The following quote was found in one of our reference books and summarises this quite well:

“New building failure is a function of unrealistic owner expectations, complexity of the design and construction process, and contradiction among project drivers (cost, schedule, and quality).” [14]

The designs shown in § 5 Results have gone through several detours to reach the final result. We would never have been able to carry out the same project in Sweden as neither the great interest for polo nor the clientele exists. From start to finish the information provided by the company has been close to non-existent and their constant change in plans has made the work very problematic at times. The project started out as a European village at the Thai Polo Club with modern houses blended with traditional styles. Later it evolved into an ecological building project with traditional Thai houses ventilated completely without air conditioning. This in turn changed into the project presented in this report: a modern residence incorporating the traditional Thai and the western influenced styles to an ecological house with a low demand for technology.

The western influenced style has had to give way in most cases to the strict rules of the traditional Thai houses. Rather than incorporating the visual style of the Western influenced buildings we have tried to convey the atmosphere of this era in the layouts of the buildings and the garden. The luxury of the complexes does not lie in grandiose buildings or overstated gardens, but rather in the simplicity of the elegant wooden structures, the high ceilings, the jungle like gardens and the serenity of the place. Not to mention the closeness to the horses and the beautiful surroundings overlooking the Bay of Pattaya. We feel that the results of this project have reached the very core of what the clientele most needs in the hectic lives of today.

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9 Glossary

9.1 English-Swedish

Adjacent...	Angränsande
Ambience...	Känsla
Astray...	Förlorad
Auspicious...	Lyckosam
Barge board...	Vindskiva
Battens...	Läkt
Contradicting...	motsägelsefullt
Dowel...	Träplugg
Eave...	Takfot
Equestrian sport...	Hästsport
Expatriate...	Tjänsteman stationerad i utlandet
Finial...	Utsmyckning vid taknocksändarna
Gables...	Gavlar
Gutters...	Hängränna
Jeopardizing...	Sätta i fara/ äventyra
Levelled ceiling...	Slätt innertak
Local Caretaking of Surface Water...	LOD – Lokalt omhändertagande av vatten
Malodorous.....	Illaluktande
Precipitation...	Nederbörd
Preservatives...	Impregneringsmedel
Prominent...	Främsta/ ledande
Purification...	Vattenrening
Serene...	Lugn
Slat...	Spaljé
Solar altitude angle...	Solhöjd
Spirit house...	Andehus
Sustainability...	Beständighet
Terrace slab...	Terassbjälklag

9.2 Thai-English-Swedish

Khun...	Mr. /Mrs. / Ms. Herr/ Fru/ Fröken
Klong...	Small river, ditch, waterway Mindre å, vattendrag, bäck, dike
Mubahn...	Housing compound surrounded by a high wall with a guarded gate Bostadsområde omgärdat av mur med vaktkur
Ruen Thai derm...	Traditional Thai house Traditionell thaibyggnad
Sala...	Teahouse, pavilion Paviljong, lusthus, tehus
Soi...	Small side street Smal sidogata

9.3 Polo-English-Swedish

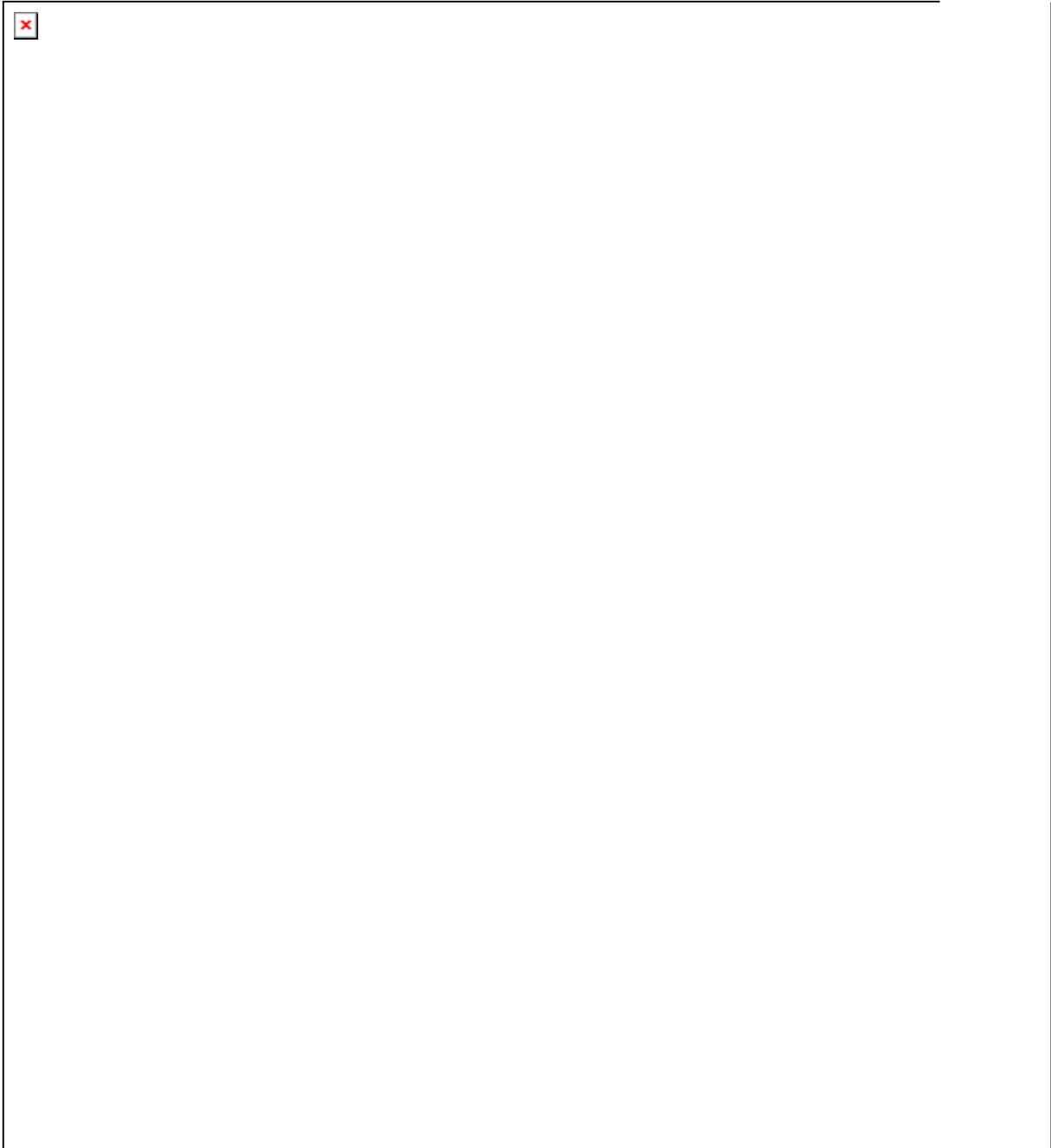
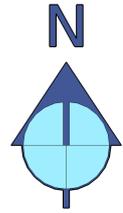
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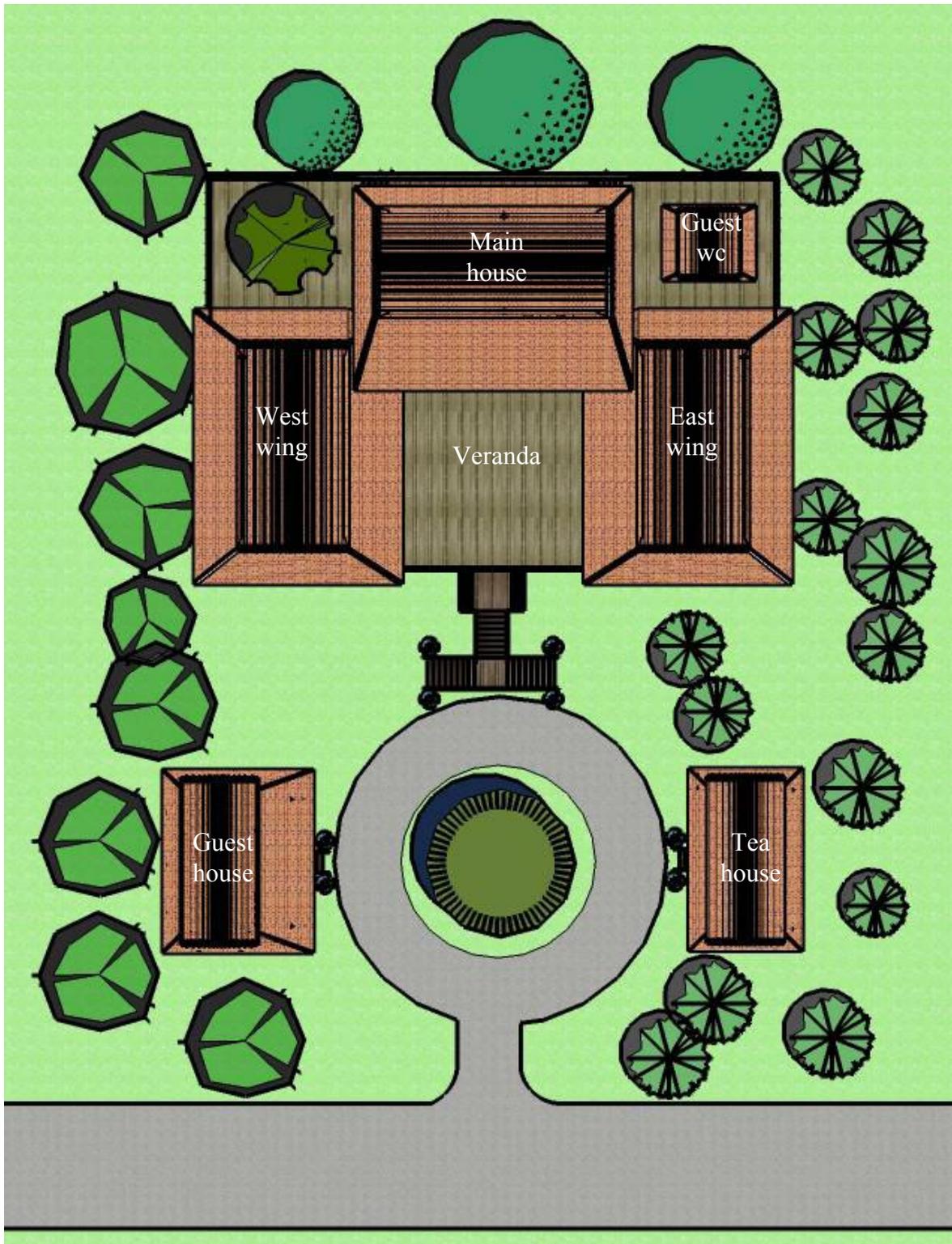
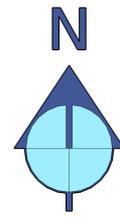
10 Appendices

All house types in the appendices are shown from the south-facing housing compound.

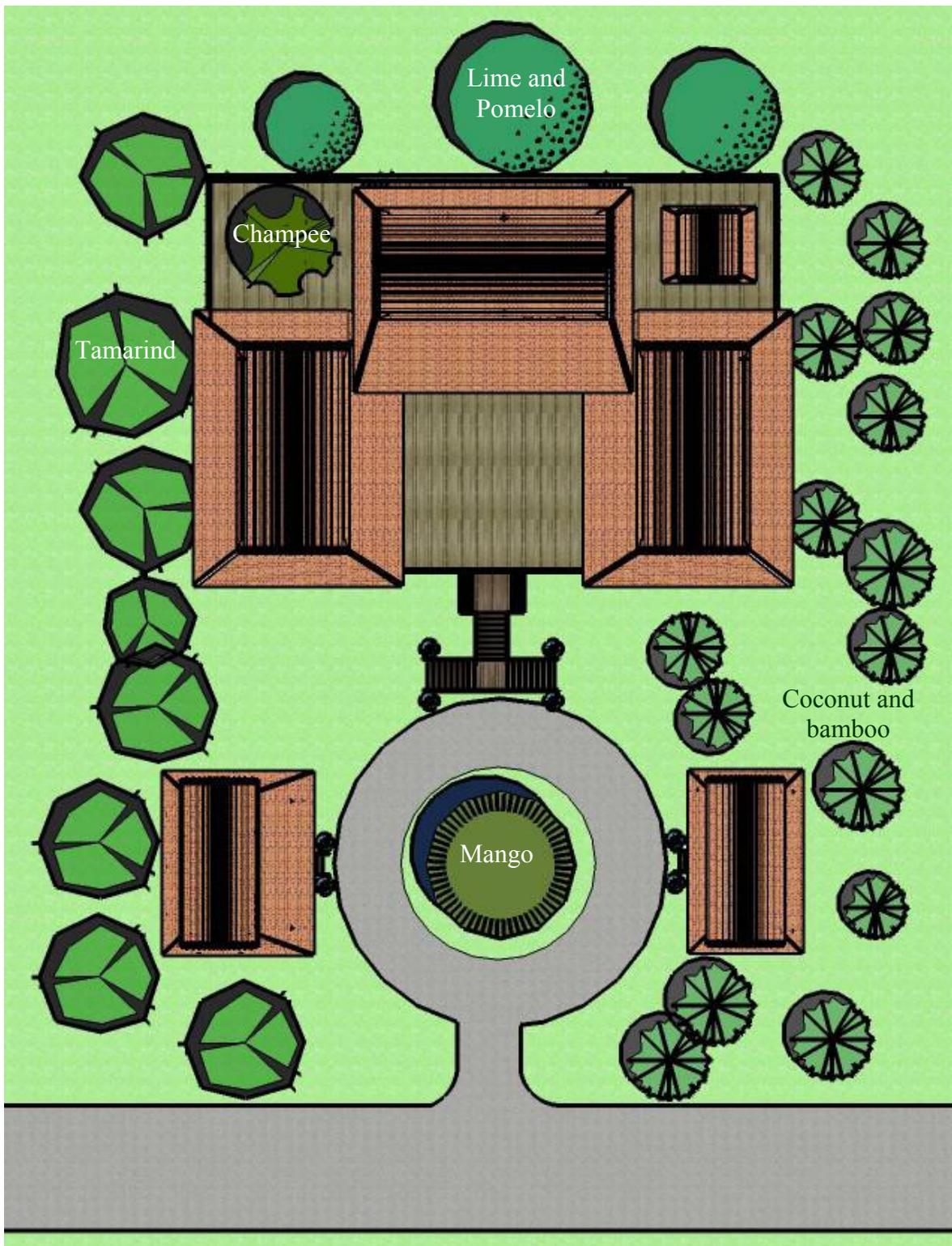
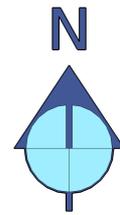
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Appendix 4	Main house
Appendix 5	Wing with master bedroom
Appendix 6	Wing with single bedrooms
Appendix 7	Guest bathroom and storage room
Appendix 8	Maid quarter
Appendix 9	Guesthouse
Appendix 10	Teahouse

Appendix 1 Structure plan





Appendix 3 Garden plan



Appendix 4 Main house



Perspective



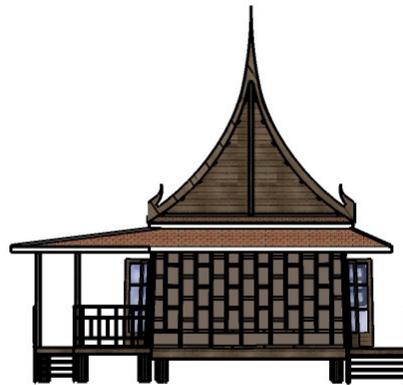
Façade South



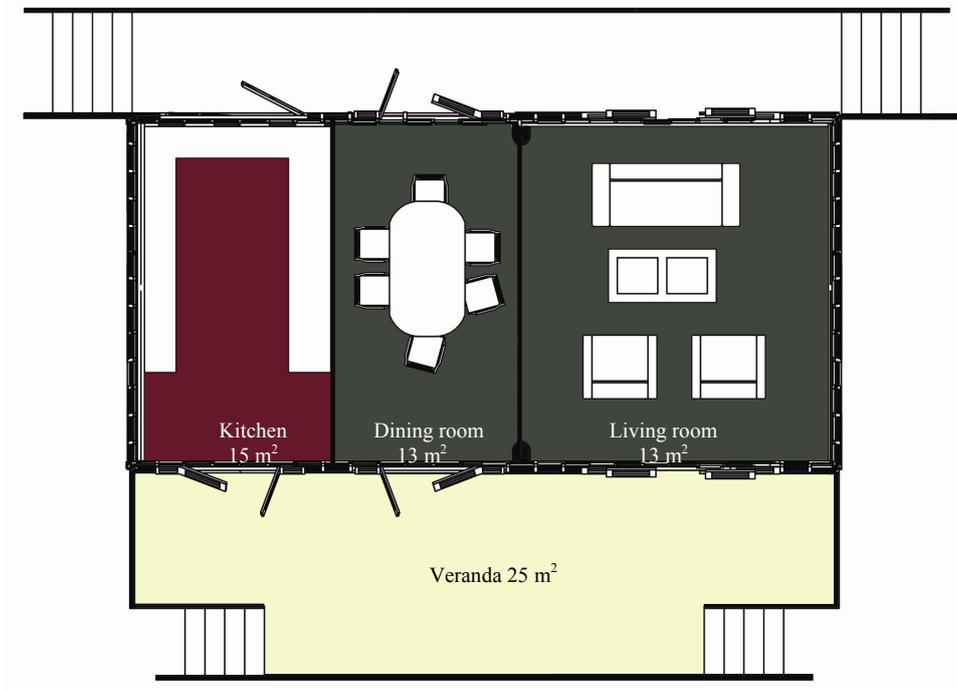
Façade West



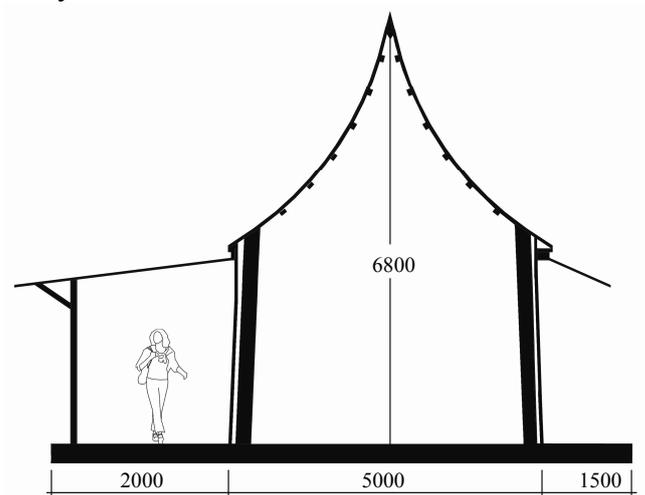
Façade North



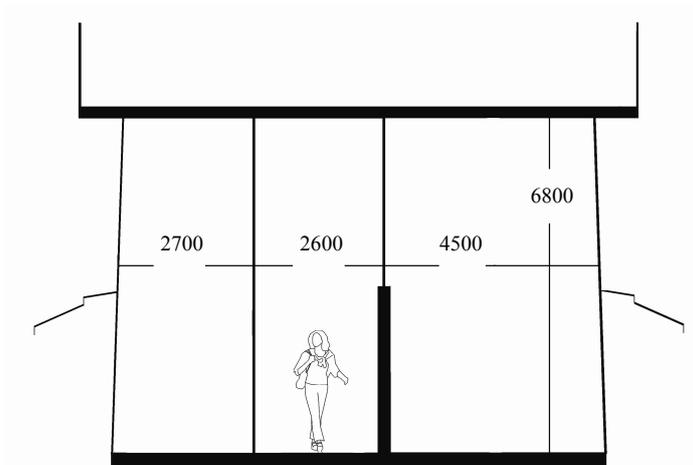
Façade East



Layout

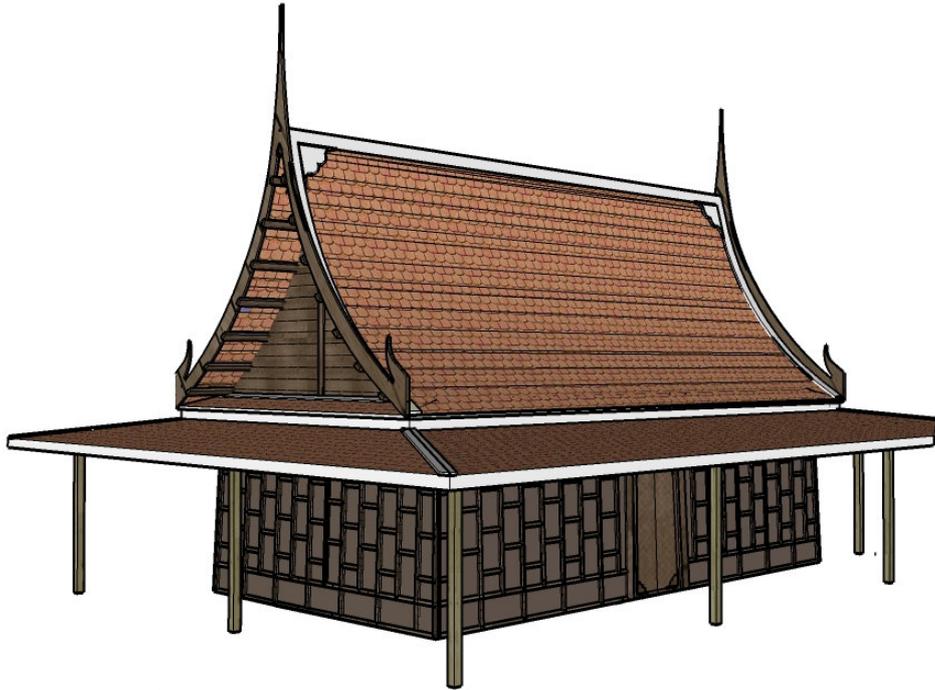


Section gable side

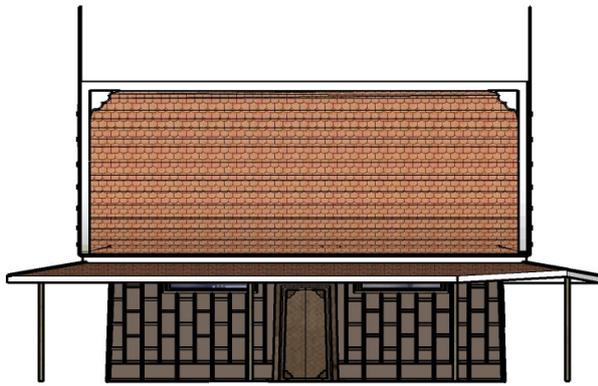


Section long side

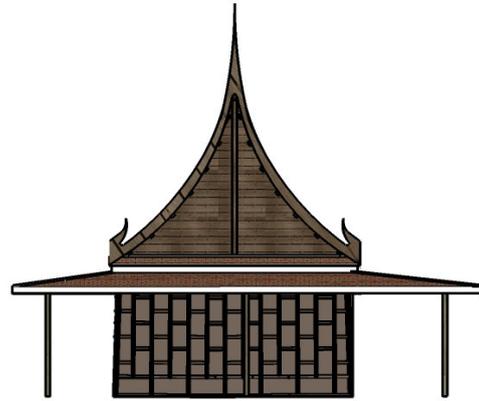
Appendix 5 Wing with master bedroom



Perspective



Façade East



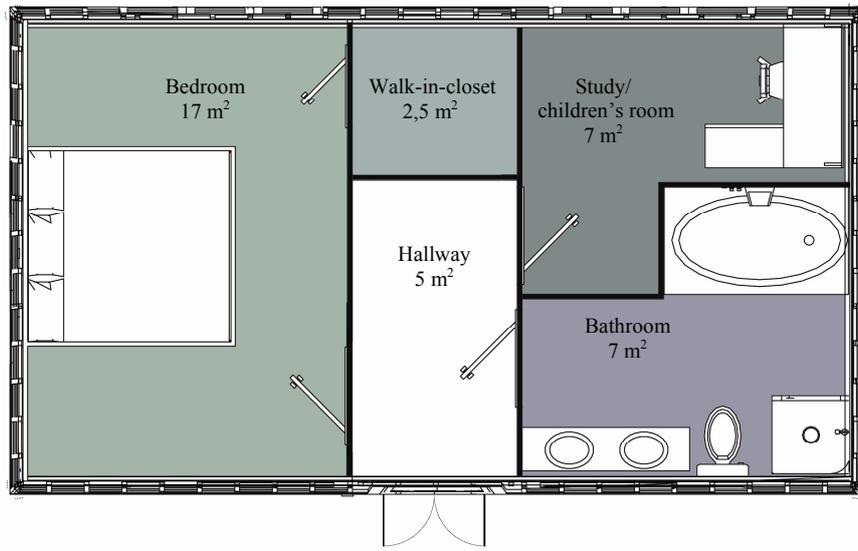
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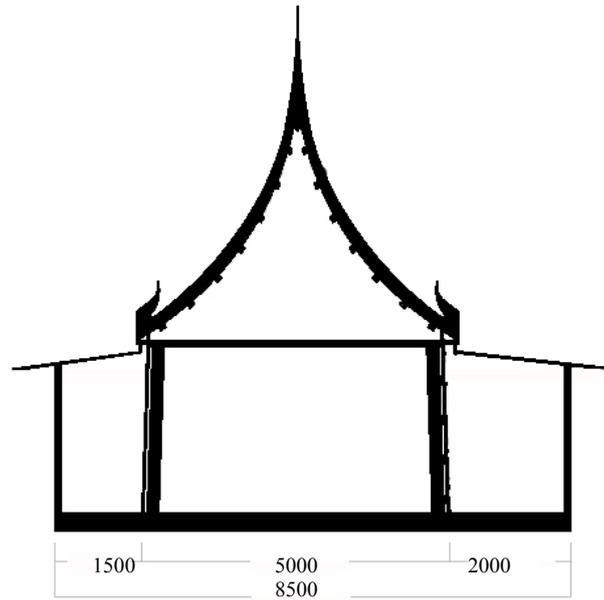
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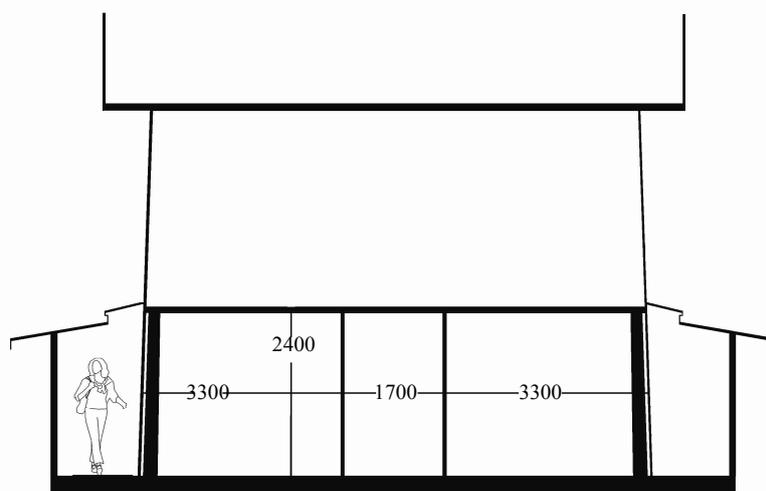
Façade North



Layout



Section gable side

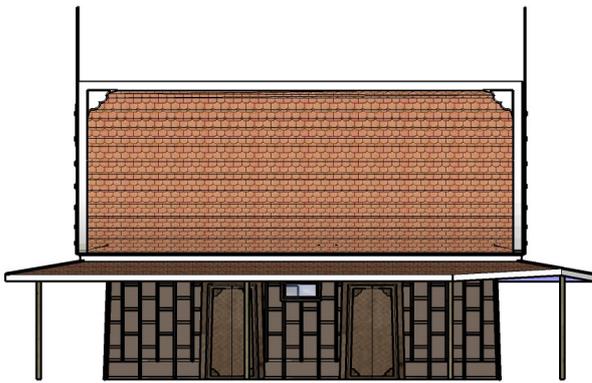


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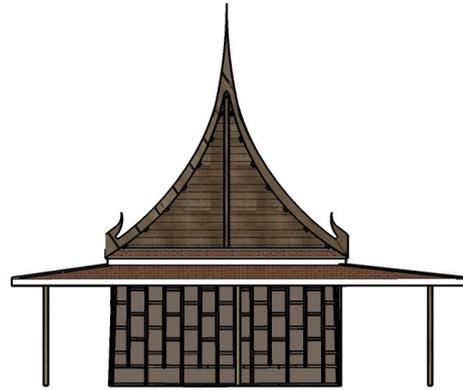
Appendix 6 Wing with single bedrooms



Perspective



Façade West



Façade South



Façade East



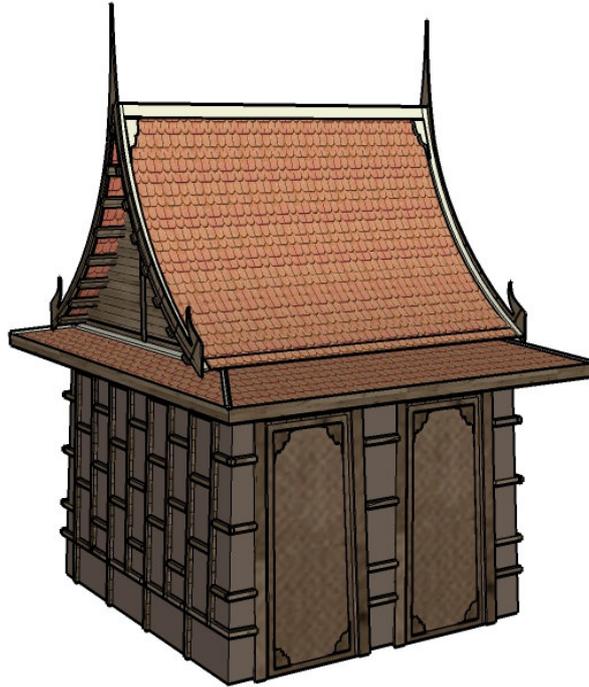
Façade North



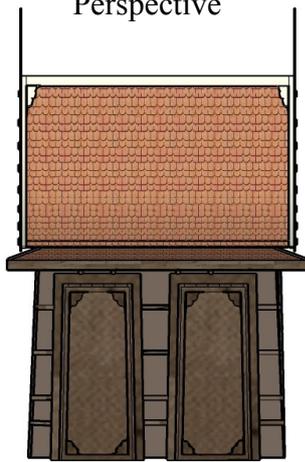
Layout

Sections identical to Wing with master bedroom

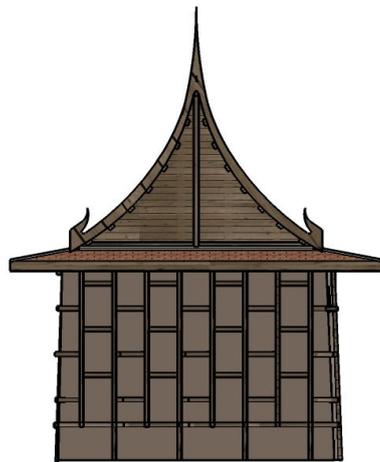
Appendix 7 Guest bathroom and storage room



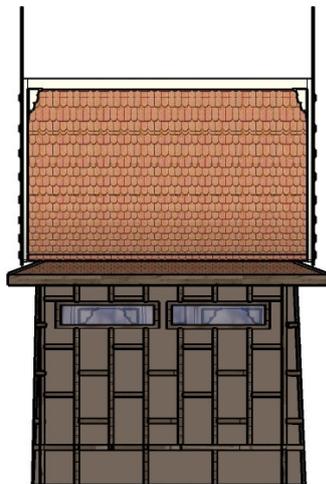
Perspective



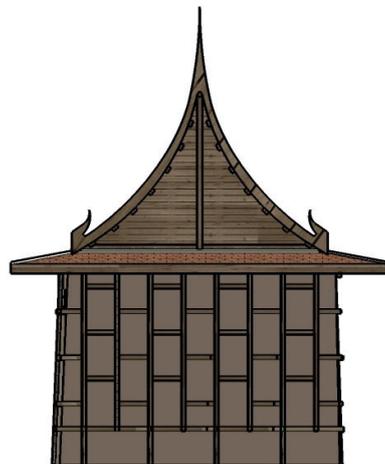
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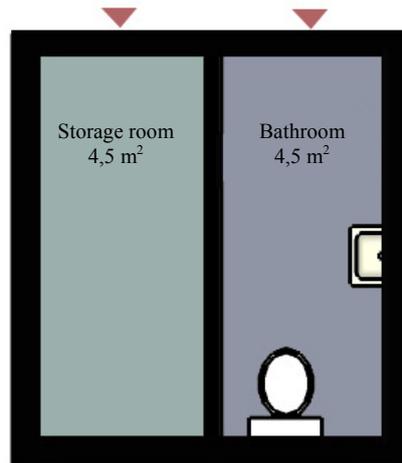
Façade South



Façade East



Façade North

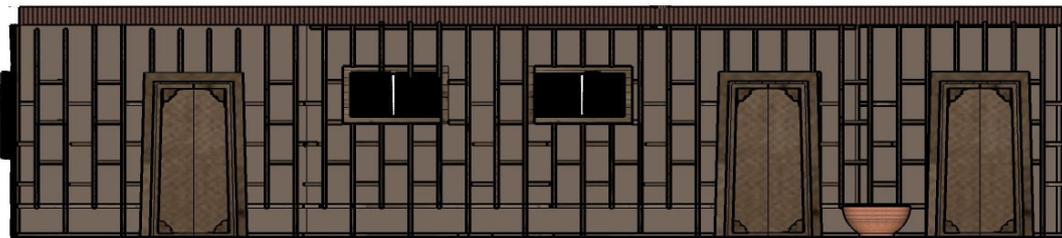


Layout

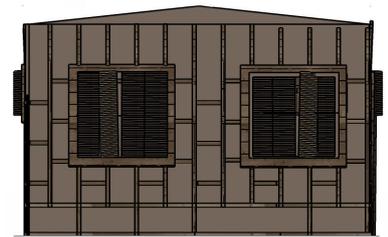
Appendix 8 Maid quarters



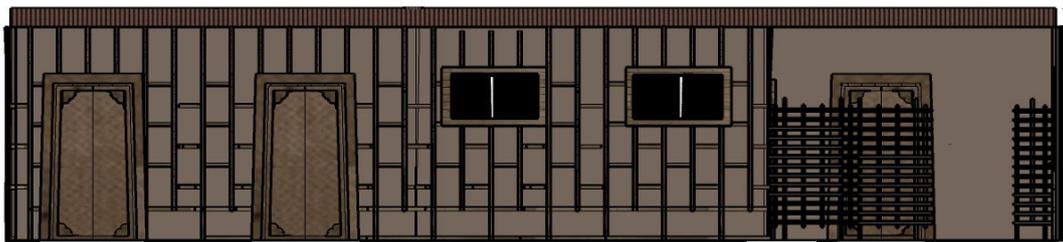
Perspective



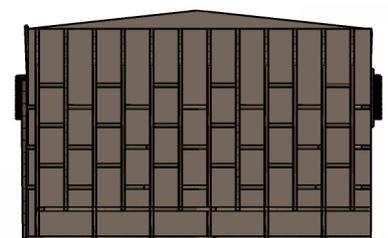
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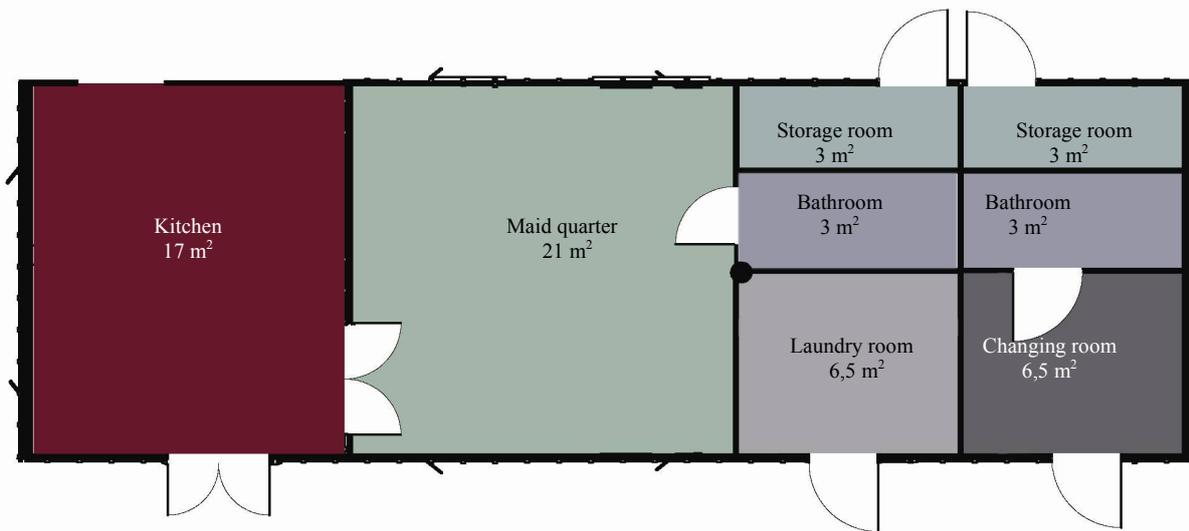
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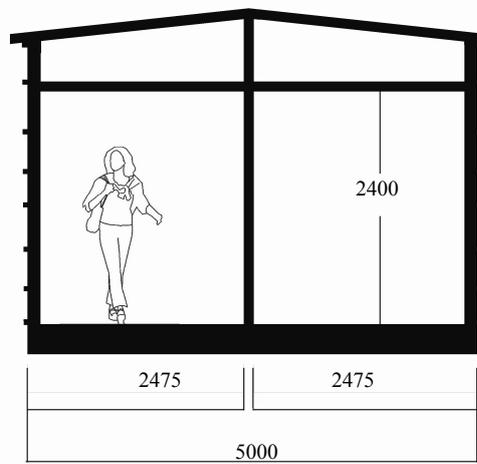
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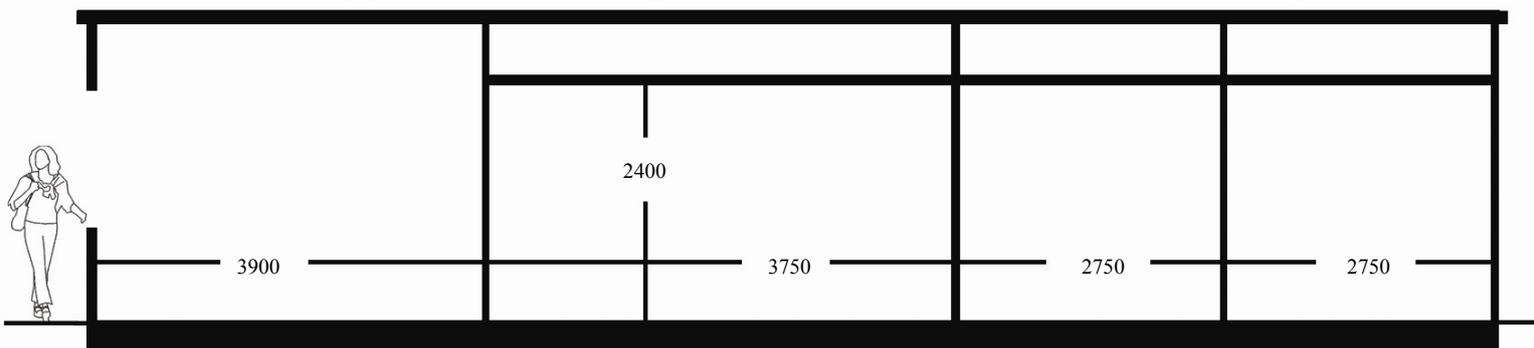
Façade East



Layout

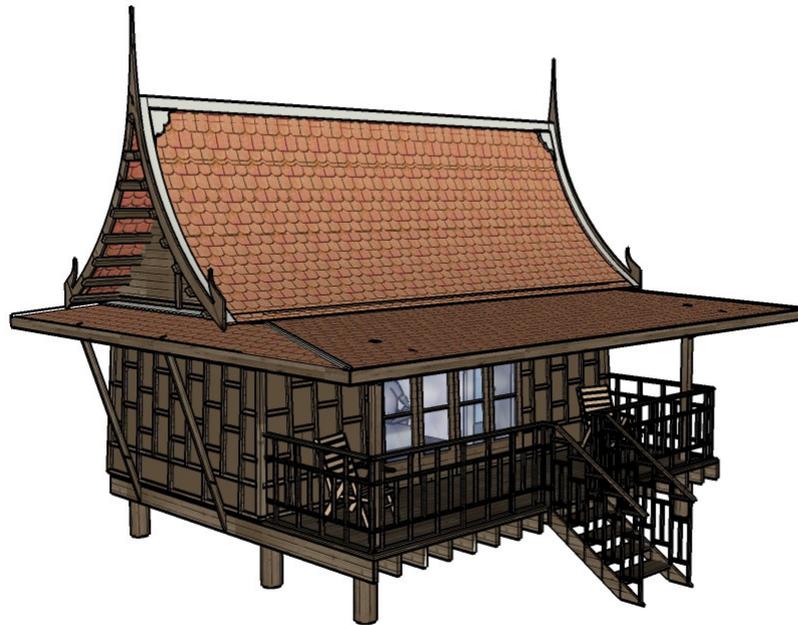


Section gable side



Section long side

Appendix 9 Guesthouse



Perspective



Façade East



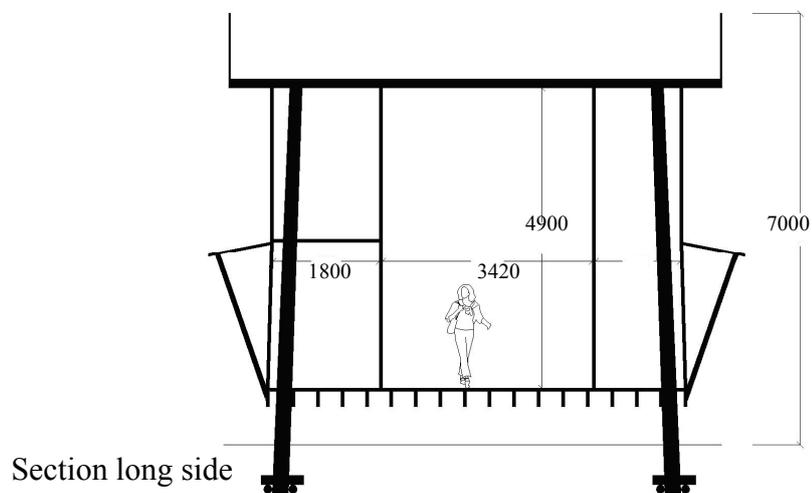
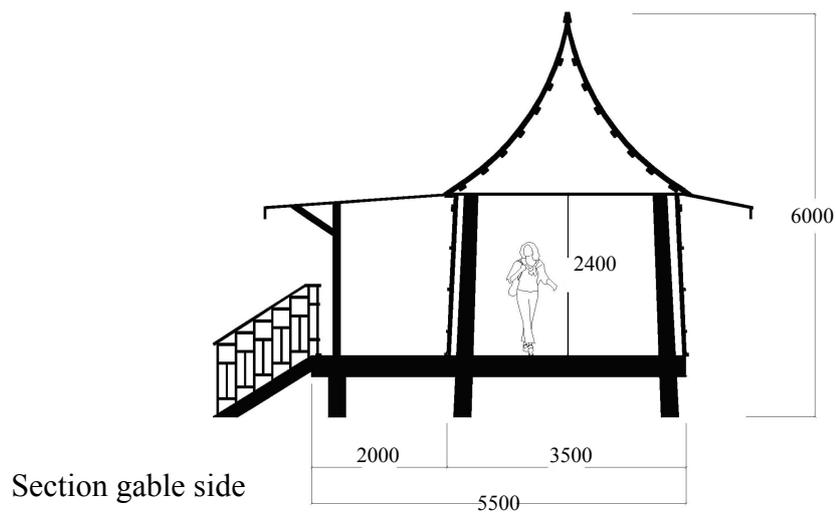
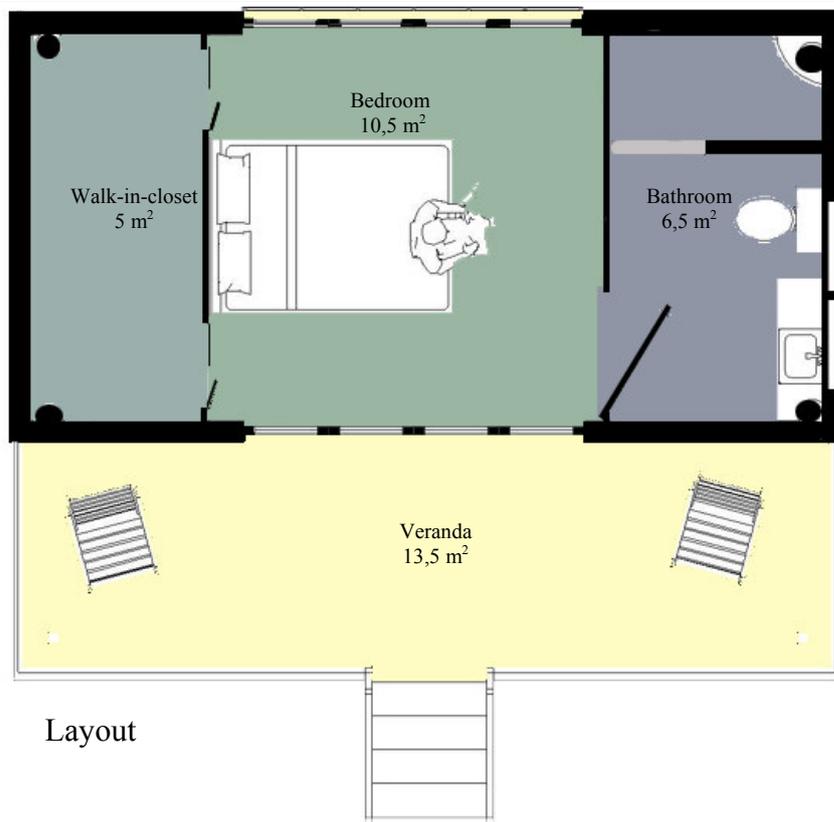
Façade South



Façade West



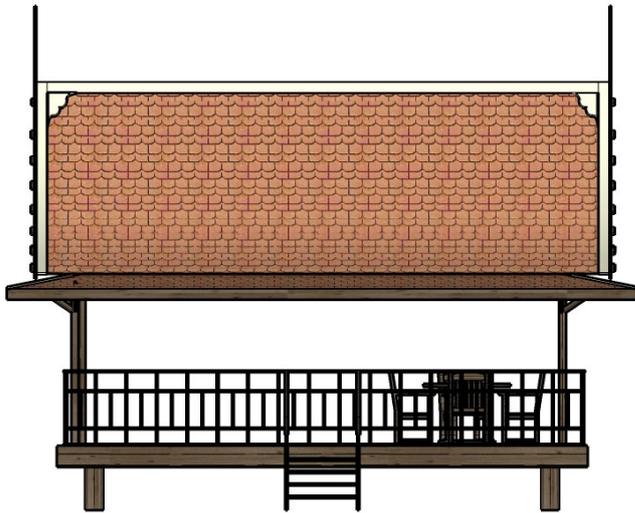
Façade North



Appendix 10 Tea house



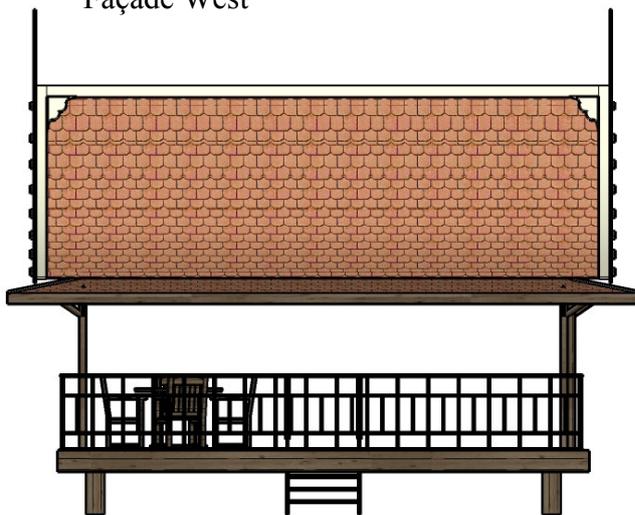
Perspective



Façade West



Façade North



Façade East



Façade South