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TRADITIONAL HOUSING DESIGNS IN THAILAND\*

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## 1. INTRODUCTION

Thailand like other countries in the tropical zone used to have plenty of timber and wood products. Several important buildings such as temples, palaces and monuments were built of timber and have lasted for many centuries. Such great talent in art, architecture and engineering make Thai people really proud of such buildings. It should be noted that both the strength and durability of those buildings were obtained by selecting the best timber from a large variety of species and sizes. It is quite common that when populations increase new resources become scarce, and new technologies are developed to serve the requirements. Living standards will also change and adjust from time to time. When there are signs of timber shortages in Thailand, modern technology in timber engineering is required. Many changes in the housing industry have been observed. Traditional housing structures which were of timber for a long time are slowly being replaced by other materials which are stronger, more durable and more economic. Furthermore, many building components can not easily be replaced, so the timber may be changed to another form for the same appearance. Housing styles keep changing with time and popularity but the basic requirements are always the same. In developing countries, many differences can easily be noticed between rural and urban areas especially about basic requirement in housing design. The traditional structural systems will also depend on materials and economic status. The potential offered by modern timber technology or timber engineering seems to be greater in urban housing than in rural housing.

## 2. BASIC REQUIREMENTS

It is a tradition that a couple should own their house after their marriage. In the early stage, the house should be small with minimum requirements so that they can afford it. Basic requirements in rural areas are quite different from those in the city due to the life styles and the way of living. The Housing Authority claimed that 80% of the population lives in rural areas but that the basic requirements seem to be controlled by people who live in the city or suburban areas.

2.1. Rural areas

Most people who live in rural areas normally are farmers and their life style is very simple. The really basic requirements are shades to protect from sun or rain and floor space to lie down on or live in. The floors are usually elevated 1.5-2.0 m above ground to keep away from the dust, animals and floods. Table 1 shows a list of general requirements for rural housing and a traditional model is shown in Fig. 1. Construction materials are almost 100% timber, locally available. Logs are from the nearby forest and are sawn into timber by hand or by chain - owned by the community. When they plan to build houses, they will start to collect timber in advance for 1-2 years and it will take more than one year to complete. The buildings are one story but floors are elevated so as to utilize the ground level for general purposes such as visiting with neighbours, stocking crops, storing farming tools etc. Ten to twenty percent of the floor area will be porch, and in the house will be a large hall used for many purposes; living, dining, bedroom etc. Small rooms may be provided by partitioning the hall when the family is bigger and needs privacy. The kitchen is normally located at any corner of the terrace. Rest room and water closet are separated from the main house and located a few steps away. Each house must have a reservoir to collect rain for year-round drinking water; other water may be from open well, river, canal or pond in the village. It is quite common that neither road nor parking lot are required.

Table 1 Comparison of basic requirements between rural and urban areas

Description	Rural	Urban	Remarks
1. Living room	✓	✓	} in rural house may be combined into one room
2. Bed room	✓	✓	
3. Dining room	✓	✓	
4. Kitchen	✓	✓	
5. Porch or terrace	✓	✓	
6. Water closet/Rest room	✓	✓	
7. Parking area	X	✓	
8. Crop storage	✓	X	
9. Water storage	✓	✓	
10. Garden/lawn	X	✓	

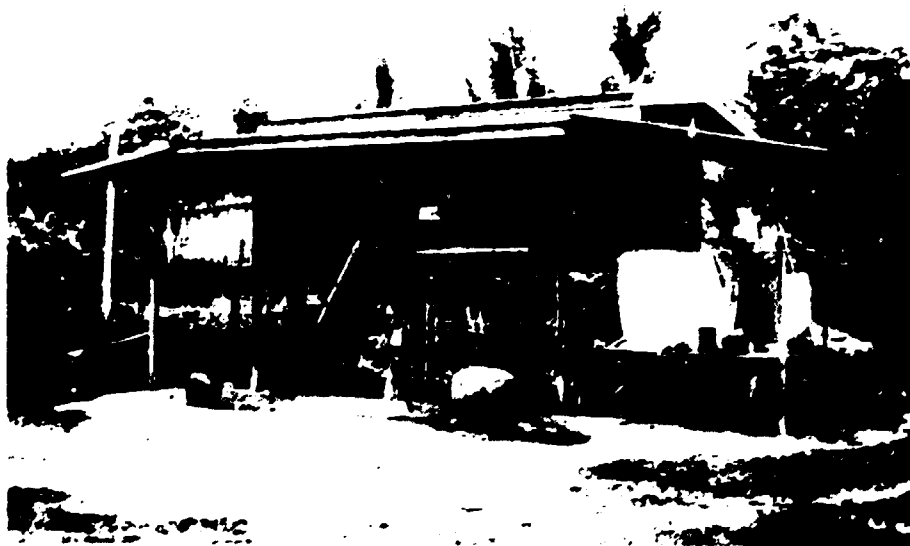


Fig. 1 Traditional rural house

## 2.2. Urban areas

In urban areas, people live in a different manner from people in the rural areas. Most people are working in the city or in industrial areas located some distance away. They spend most of their time outside the house. Land is also very expensive and housing becomes a commercial business run by realtors, developers or government authorities. There are several regulations to control basic requirement for better health and environment. Table 2 shows the minimum space for basic functions in the house. The minimum area should be about 30 m<sup>2</sup>. Traditional housing in urban areas can be categorized into three groups; low cost housing, normal rate housing and the luxurious category, by means of room size, number of bedrooms, number of water closets, parking lots and construction materials. Figs. 2, 3 and 4 show the appearance of those houses; one can see that the ration of covered area to over-all area is another index to be considered.

Table 2 Minimum space requirement by law

Function	min. size (m.)	Remarks
Living room	3.0 X 3.0	
Bed room	3.0 X 3.0	
Porch/corridor	1.0	
Lavatory	1.0 X 0.6	
Set back distance	2.0	
Opening area	20%	for light



Fig. 2 Low cost housing



Fig. 3 Medium cost housing





Fig. 4 Luxurious housing

### 3. CURRENT STRUCTURAL SYSTEMS

Structural systems for housing primarily depend on the construction materials. Typical systems used timber for many decades but they are now changing to some other materials. Table 3 shows typical construction materials for building components built in rural and urban areas. In rural areas, almost every component is timber but housing in urban areas is slowly changing to reinforced concrete structures although some parts may still be of timber. However, the utilization of timber is more efficient and rational in the sense of timber engineering use. Average housing cost includes the major components but they are unfurnished, as shown in Table 4 for structural systems of timber, semi-concrete and concrete, respectively.

Table 3 Typical materials for major building components in Thailand

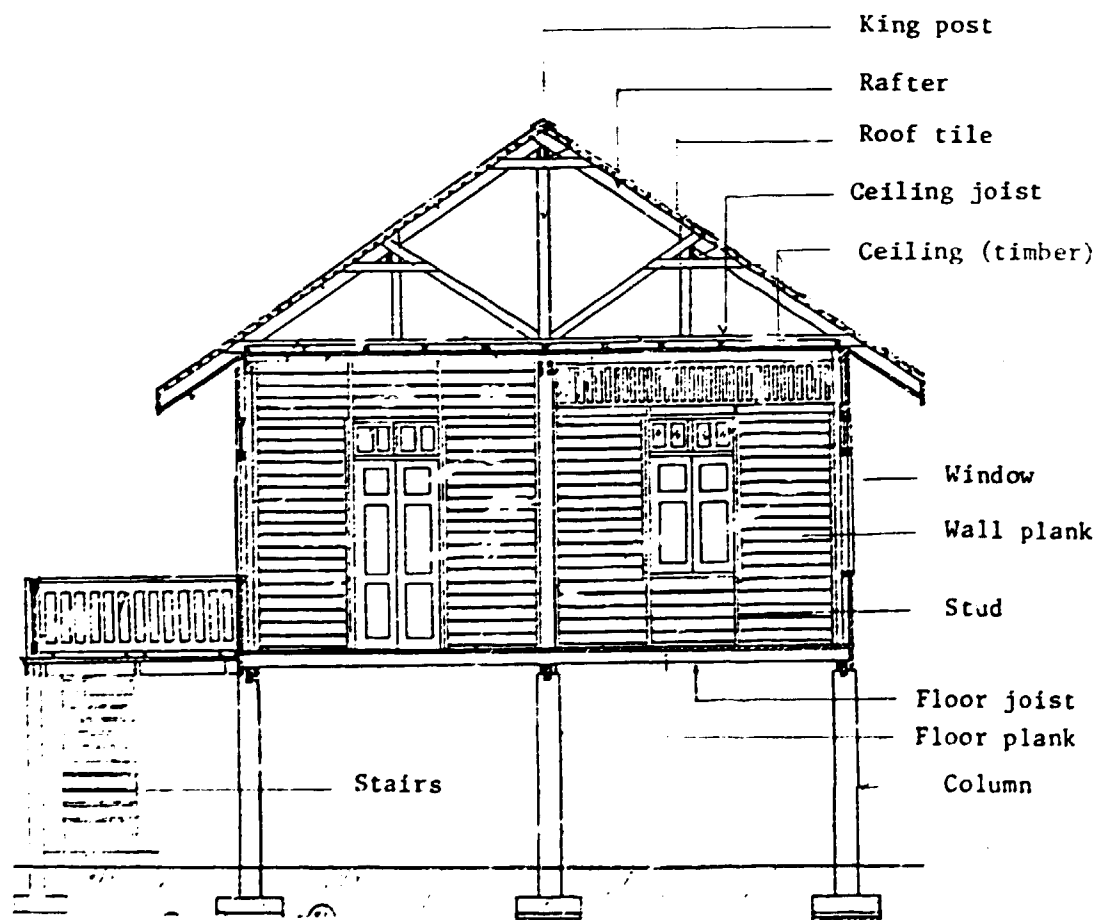
Description of component	Rural area housing	Urban area housing
Foundation	Wooden pile	spread conc. footing/ conc. pile/wooden pile
Abutment	timber/concrete	reinforced concrete
Structurals	timber	reinforced concrete
Roof frame	timber	timber/steel
Roofing	galvanized or/ asbestos sheathing	asbestos sheathing/ concrete tile
Wall	timber plank	brick wall/block wall
Partition	timber	plywood, gypsum
Floor	timber	concrete/timber
Door/window	timber	timber/aluminium

Table 4 Average cost of unfurnished house

Structural systems	Most applicable	Cost (฿ / m <sup>2</sup> )	Remark
Timber	rural	2,000	} unfurnished
Semi-concrete	rural/suburban	3,500	
Concrete	urban	5,000	

### 3.1. Timber house

Traditional system for timber house is shown in Fig. 5. The structures are mono-lintel; major systems are columns, beams and floors while minor systems are roof, walls and partitions. Columns may sit on pile caps or spread footing, beams are at floor and roof levels to tie the columns for stability. Wooden floors normally are planks laid on joists. Roof structures may be either timber trusses or rafters on beams; it depends on the span length. In general, roofing will be brick-tile, corrugated asbestos or galvanized metal sheathing. Exterior walls are wooden plank lapping nailed onto the studs while doors and windows are fixed between the studs. The ceiling may also be provided by hanging joists from the rafters. The house of this type can be one or two storeys but one storey is more common.



F.g. 5 Typical timber housing structures

### 3.2. Semi-concrete

Major structures are reinforced concrete to replace large timber beams and columns while other structural systems remain the same as in timber houses. Walls especially of the ground floor are brick work with plaster finish, in order to keep the timber away from ground moisture or floods. Floor joists are normally laid on reinforced concrete beams while floor planks and joists are all timber. Roof structures, rafters, purlins and braces are exactly as traditional timber houses whereas roofing is galvanized or asbestos sheathing or brick tiles. For details, see Fig. 6. It is noted that door and window frames are made of good timber. Ceilings of asbestos sheathing, plywood or gypsum board are generally accepted with timber joists.

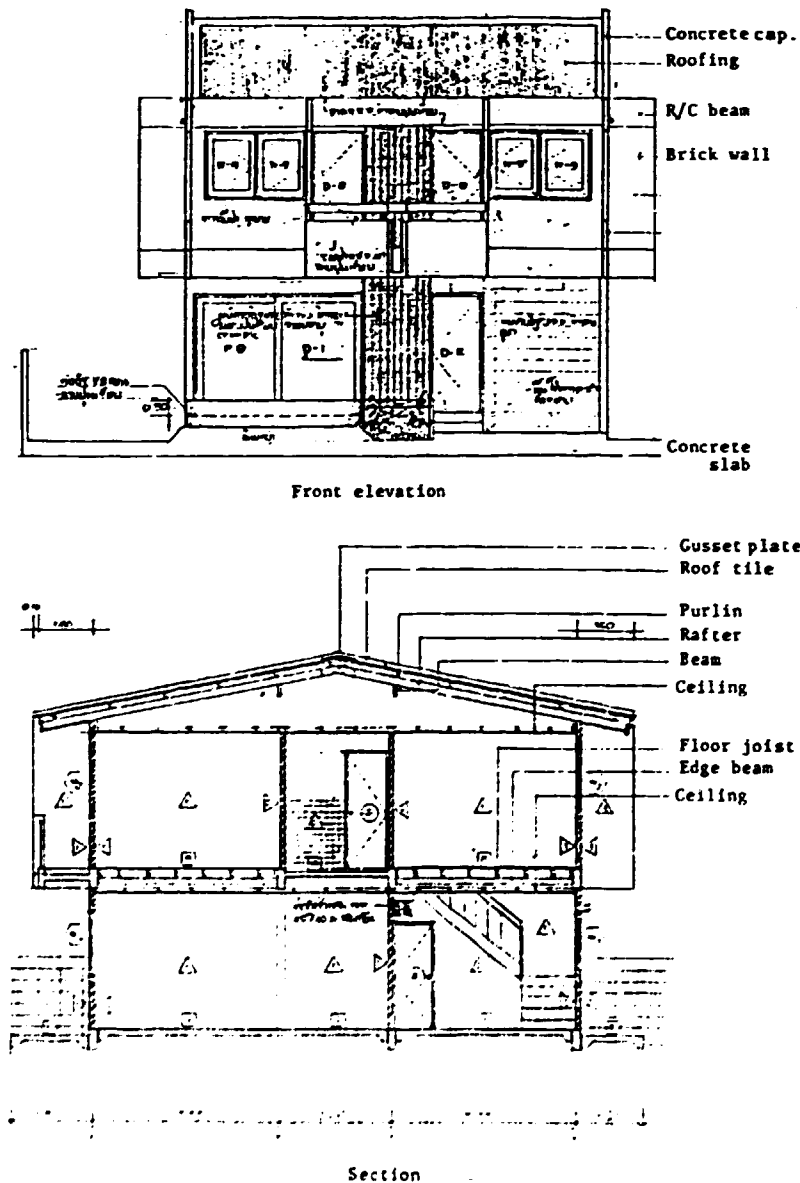


Fig. 6 Semi-concrete housing structures

### 3.3. Concrete

Reinforced concrete structures are introduced into housing design in many structural components such as beams, columns and slabs. Walls are brick-work or block-work with mortar plaster finishes. Door and window frames remain of timber in similar manner as do roof frames and roofing materials which are tiles or corrugated sheaths. It is quite common to keep floor finishings of wood in which case timber parquet is used to overlay the concrete slab by latex glue. Partitions can be brick wall, gypsum boards with timber studs or plywood with timber studs. It is quite popular to use gypsum board for ceilings with metal or timber joists hanging from the roof frame. Fig. 7 shows more details of typical system of reinforced concrete housing structures.

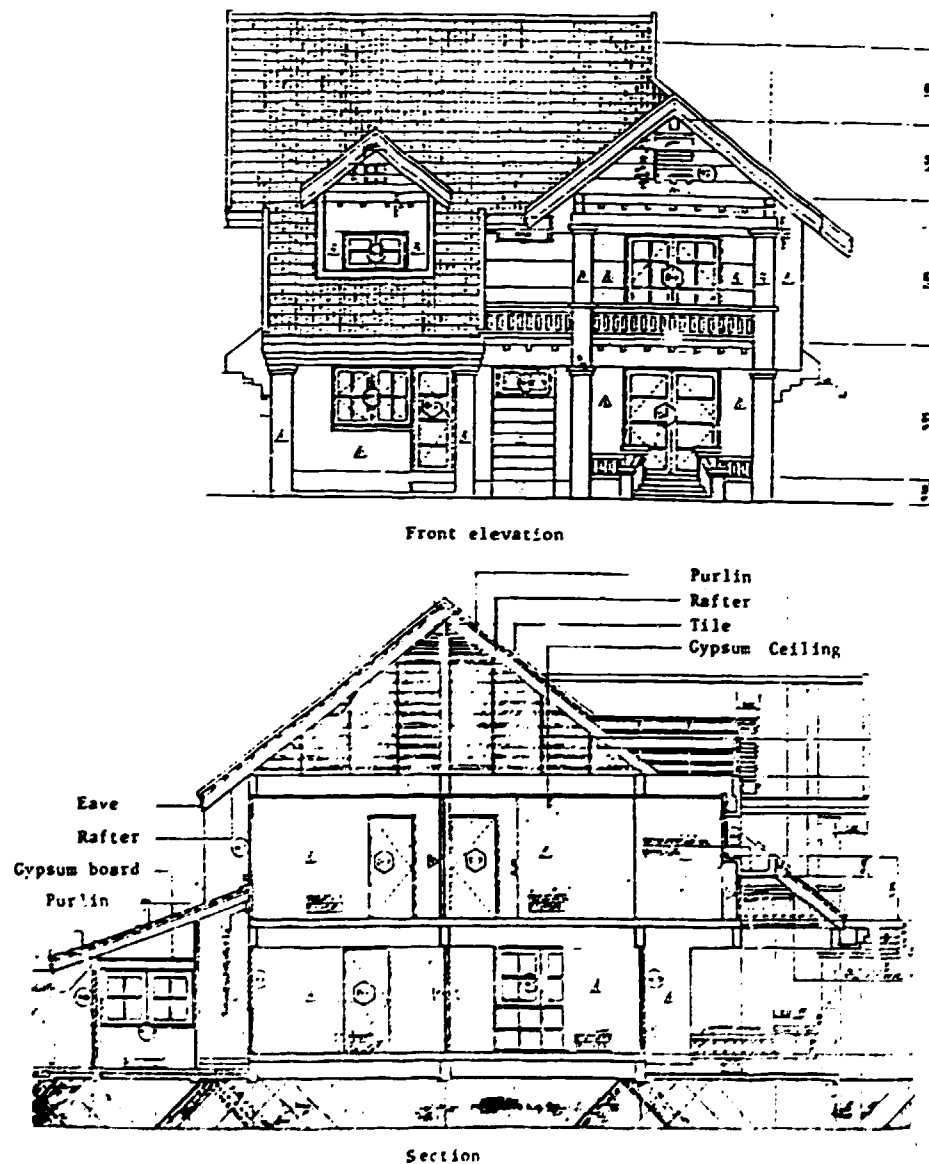


Fig. 7 Concrete housing structures

#### 4. POTENTIAL OFFERED BY MODERN TIMBER TECHNOLOGY AND ENGINEERING

Since timber was traditionally the cheapest of construction materials, people did not care how it was used effectively or wastefully. When resources start to run short and prices tend to increase, without limit, so modern timber technology and engineering can be very important to solve the problem and save the resources. From a timber engineering seminar in 1977 in Bangkok many specialists in this field agreed that several aspects can be offered by modern technology.

##### 4.1. Standardization of timber and timber products

Many professions such as engineers, architects, carpenters, saw millers and wood-product manufacturers have agreed to standardize timber and timber products by size and by strength grading and durability grading. In Thailand, now only physical grading and strength grading by timber species are used, but it is not accurate since some wood species are no longer available in the market. Size and strength grading can be adopted from ISO\* or CIB\*\* standards. Durability grading by means of specific properties or some tests are also required to specify certain treatment of timber for longer service life.

##### 4.2. Durability of timber

Modern technology especially in wood structures, can be developed to improve strength and durability of timber. Unfortunately, some chemicals which are successfully used to improve service life of timber in many countries are quite expensive in Thailand. Development of some other chemicals that can be locally produced, so as to reduce treatment cost and to create incentive for preservation, is needed.

##### 4.3. Metal connectors

When hard, durable woods become scarce, then soft or less durable species are introduced to replace them where strength is not critical but durability can be a problem. However, when softer woods are used, joint problems will arise due to their lower strength properties. Gusset plates, nailed plate connectors, timber bolts and glued joints should be considered and research work must be done to be able to advise in the most economic and feasible joints for local workmanship.

\* International Standards Organization

\*\* International Council for Building Research Studies and Documentation

#### 4.4. Glue technology

Glue production for the plywood industry, glue laminated members, particle board, and press laminated members should be promoted so they can provide good quality wood products at lower cost. The only glue now made in Thailand is urea formaldehyde which is used for plywood manufacturing. The quality is claimed to be the same as the ASTM-standard\* but it is mainly produced for interior plywood. The development of the wood-based board industry in the country will be stimulated by progress in glue technology.

#### 4.5. Wood-based boards and panels

Many wood species such as rubberwood and coconut palm do not now produce economic timber, but instead are thrown away or left to decay or are burnt for heat. These waste timbers can be used to produce particle boards or wood-based panels which become valuable. Raw materials of this type are predictably available since they are planted and cut at certain ages. Glue technology is also involved in production of these products.

#### 4.6. Concrete formwork

Since the trend of the construction industry has developed towards reinforced and prestressed concrete members, then timber can also play an important role in this industry. For many decades, contractors never paid any attention to formwork cost because timber for formwork components was quite cheap. When timber prices increased, then contractors started to consider the cost. With proper use of formwork, the cost can be reduced down to one tenth of the original. Formwork design and formwork management become especially important in reinforced concrete construction contracts, and only contractors with effective formwork management are awarded the contract.

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\* American Society for Testing and Materials

## 5. CONCLUSION

Traditional housing design primarily depends on basic requirements which in rural areas and in urban areas are quite different. Rural houses are self constructed using local materials from nearby forests and timbers are collected well in advance of construction. Urban houses normally are commercial. They are built by developers or a government authority; spaces and functioning are controlled by government regulation. Typical housing structures classified as timber, semi-concrete and concrete are generally governed by availability of material and economic competition. Timber houses are more common in rural areas while semi-concrete or concrete structures are usually constructed in the city. Even as reinforced concrete becomes more popular for housing structures, other building components remain of timber. The potential offered by timber engineering and technology can be realized by several means such as standardization of timber, improvement of durability, use of metal connectors, glue technology, development of wood-based board or panels and improved concrete formwork practices.

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