The Bamboo House: Nakhon Nayok province, Thailand

Nakhon Nayok is located on 14° 12’ 11” N 101° 12’ 53” E. Sixty five miles from Bangkok. It lies on the Dong Phaya Yen mountain range. The highest elevation is 1,351 meters. So the climate here is hot, humid and plenty of rain falls. Insects and vegetation are abundance. It has main attractions of rivers and waterfalls. The rainy season start from May to October. The highest rainfall is during September and October. From May to August is a good time to visit. November and December are probably the ideal months to visit if you want to see the large amount of the water shooting out from the giant boulders. From January to April, most of the rivers and waterfalls have dried up because the temperature rises above 100° F every day.

The local people have successfully built their house dealing with these extreme climates: hot and humid, extreme temperature rise and fall, large amount of moisture content due to the altitude and the vegetation. Amount of excessive rain falls, insects, animals and poison snakes and of cause a strong win that generated from monsoon each year are great difficulties for the design challenges.

With all of these challenges the local have been integrated the modern material like concrete block, bricks and concrete slaps in their design. But the main building structure is still use local material like Bamboo.

Why Bamboo? It is the cheapest material that you can find. Most of it are free they grow wild in the forest. However the bamboo for construction needs to be treated using Borax solution to preserve it. This prevent from Moisture and UV ray penetration that can reduce the life span. Not only that, bamboo still had to be the heat and smoke treat to prevent the exterior surface from bugs attach. As we know the tropical climate is always warm where the insects and moisture are the greatest threat to bamboo vitality. Bamboo also has great tensile strength is suitable for withstand the strong win. It is a great solution for construct columns and beams, why not bamboo.

Concrete is a great solution for maintain the comfort zone because the soil temperature rise and fall sharply throughout the day. It also acts as a moisture barrier form the ground as well as a protection from animals that live under the ground. Since heat rises and the UV ray radiates, it increases temperature inside the house. The passive thermo mass barrier of concrete blocks, concrete stones and brick walls are used as the insulation and barrier. It is because they keep the sun ray out and can maintain the inside temperature well. They are also helped strengthen the structure keeping the rain water out and preventing the animals and insects to get in the house.

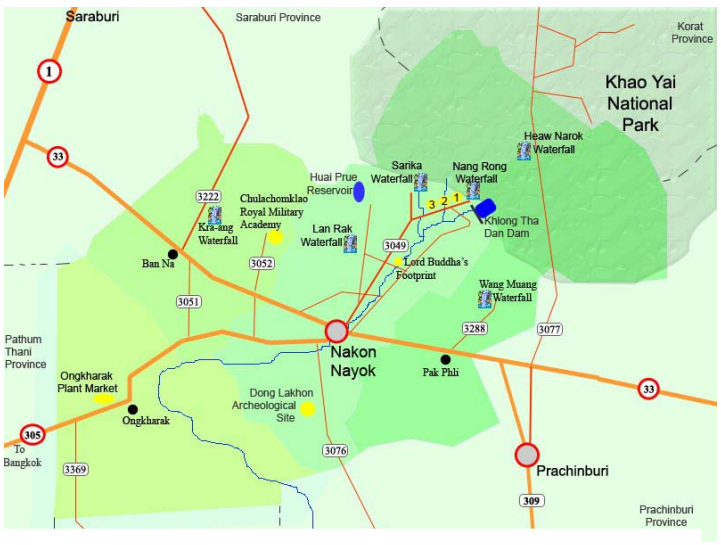

Figure 1: Map of Nakhon Nayok Province


Figure 2: Building structure


Figure 3: Bamboo Column establishment


Figure 4: Beam span and column


Figure 5: Triangle roof frame


Figure 6: Roofing structure #1


Figure 7: Roofing structure #2


Figure 8: Second floor

Since it is hot and humid condition, the structure needs to accommodate the air flow and to release the heat inside as the day progressing. Ventilation chamber is a must. This case the triangle shape is use with integrated design to be open and close windows on the roof. When the heat raises and traps inside the triangle roof, the windows are opened to let the air flow and release the heat. The design of the triangle roof is also opened both ends for constant air movement.

To block the sun ray and keep the house cool, dried palm leaves are used for roofing. Since it is organic, it will not absorb as much and it is a good insulation by itself. As it tidy stacked up, they also add the strength to the structure. The triangle shape also helps moving the rain water off the roof. The drawn back is the roof need to be replaced every so often due to the decay of the leaves. In this design, to prevent the rain from coming inside, the roof has extended out further. The bamboo curtain is integrated to batter climate when the rain and strong win come.

As we see, all the design challenges had accomplished with a simply basic design and good use of materials choices. Understand the Mother Nature is the name of the game for successfully designing a house in the tropical paradise living.

Figure 9: Opening roof

Figure 10: Completed house

----------INTERNATIONAL STATION METEOROLOGICAL CLIMATE SUMMARY----------

:STA 496431 | | SARA BURI , ,TH
:LAT 14 30N :LONG 100 55E :ELEV 100(ft) :TYPE AWS WWAS V2.0 05101990
Worldwide Airfield Summaries (NCDC TD-9647)

Parameter Description	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann	POR	#Obs.
ABS MAX TMP (F)	101	102	105	108	108	101	99	99	97	97	96	99	108	18	-48426
MEAN MAX TMP (F)	92	95	98	98	95	92	91	90	89	89	89	89	92	18	-48426
MEAN MIN TMP (F)	66	72	75	76	76	76	75	75	75	75	70	66	73	18	-48426
ABS MIN TMP (F)	45	50	63	69	71	66	68	68	68	62	51	51	45	18	-48426
MEAN NO DYS TMP = OR GTR 90(F)	23.8	26.9	29.8	28.8	29.8	23.0	21.0	17.9	14.3	14.8	14.3	14.8	259.2	18	-29
MEAN NO DYS TMP = OR LES 32(F)	0	0	0	0	0	0	0	0	0	0	0	0	0	18	-29
MEAN NO DYS TMP = OR LES 0(F)	0	0	0	0	0	0	0	0	0	0	0	0	0	18	-29
MEAN DEW PT TMP (F)	62	65	70	73	75	75	74	75	76	73	68	62	71	10	-48426
MEAN REL HUM (PCT)	55	60	61	63	71	73	76	77	81	77	69	60	69	17	-48426
MEAN PRESS ALT (FT)	84	132	176	232	283	306	306	324	280	172	131	81	209	0	-50
MEAN PRECIP (IN)	0.10	0.90	2.00	3.60	6.30	9.30	9.20	9.40	10.20	5.60	1.80	0.20	58.6	20	-40
MEAN SNOW FALL (IN)	0	0	0	0	0	0	0	0	0	0	0	0	0	18	-29
MEAN NO DYS PRCP = OR GTR 0.1 IN	0.3	1.9	3.9	5.2	5.4	13.7	13.6	13.8	12.9	8.9	4.6	0.5	84.7	20	-29
MEAN NO DYS SNFL = OR GTR 1.5 IN	0	0	0	0	0	0	0	0	0	0	0	0	0	18	-29
MEAN NO DYS W/OCUR VSBY LES 1/2 MI	0.5	0.4	0.4	0	0	0	0	1.3	0.9	1.6	0.3	0.4	5.8	10	-48426
MEAN NO DYS TSTMS	1.0	3.0	9.0	13.0	19.0	12.0	12.0	11.0	14.0	9.0	3.0	0	106.0	15	-48426
P FREQ WND SPD = OR GTR 17 KTS	7.1	4.7	5.1	4.8	1.7	2.9	1.4	0.9	0.7	2.0	3.2	6.9	3.5	17	-48426
P FREQ WND SPD = OR GTR 28 KTS	0.9	0.6	0.1	0.2	0	0.1	0.1	0	0.1	0	0	0.6	0.2	17	-48426
P FREQ LES 5000 FT A/O LES 5 MI	21.8	33.4	40.5	32.5	20.8	21.8	24.9	23.6	24.5	16.7	12.3	9.2	23.5	17	-48426
P FREQ LES 1500 FT A/O LES 3 MI															
FOR' 00-02 LST	2.2	2.5	6.4	2.0	4.8	2.5	5.2	6.9	12.6	6.6	1.4	0	4.4	12	-48426
03-05 LST	-	-	-	-	-	-	-	-	-	-	-	-	0	0	
06-08 LST	23.4	25.7	21.5	17.4	5.0	4.6	7.2	4.8	9.6	9.7	7.5	10.3	12.2	17	-48426
09-11 LST	7.2	13.8	17.1	7.6	0.5	2.3	2.0	2.7	4.2	2.1	0.8	1.5	5.2	12	-48426
12-14 LST	4.0	11.8	13.0	4.5	1.6	1.5	1.8	1.9	3.8	2.4	0.8	0.5	4.0	17	-48426
15-17 LST	2.4	12.8	13.8	4.0	1.7	0.4	3.8	1.9	4.0	4.4	0.7	0.3	4.2	12	-48426
18-20 LST	8.7	18.0	13.1	5.9	5.1	4.8	6.6	9.2	9.3	6.3	3.2	3.9	7.8	17	-48426
21-23 LST	-	-	-	-	-	-	-	-	-	-	-	-	0	0	
P FREQ LES 300 FT A/O LES 1 MI															
FOR 00-02 LST	0	1.7	1.8	0.7	0	0	0	1.7	6.7	2.0	0.7	0	1.3	12	-48426
03-05 LST	-	-	-	-	-	-	-	-	-	-	-	-	0	0	
06-08 LST	11.5	9.3	8.6	2.8	0	0.4	0.3	0.7	4.2	3.1	4.3	6.3	4.3	17	-48426
09-11 LST	1.3	2.6	4.3	1.0	0	0	0	0	0.5	0.8	0	0.7	0.9	12	-48426
12-14 LST	0	1.1	1.8	0.6	0.3	0.3	0	0	1.6	0.6	0	0	0.5	17	-48426
15-17 LST	0.4	1.0	2.8	0.4	0	0	0.8	0.8	1.2	0.4	0	0	0.7	12	-48426
18-20 LST	0	2.6	2.9	2.2	2.4	1.2	0.9	3.1	3.3	0.9	0.6	1.7	1.8	17	-48426
21-23 LST	-	-	-	-	-	-	-	-	-	-	-	-	0	0	

References:

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