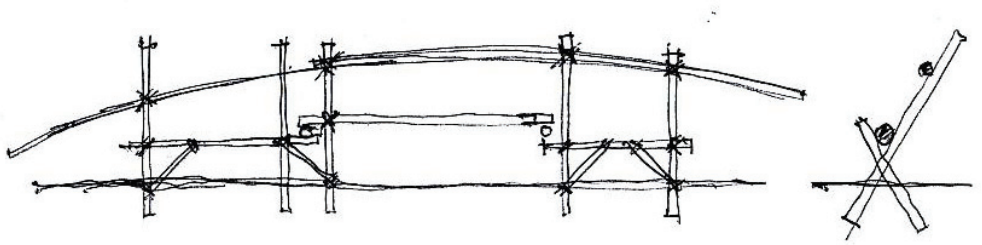
CHILD FRIENDLY SCHOOLS FOR MYANMAR



MINISTRY OF EDUCATION

UNICEF Myanmar
Carlos Vasquez, Architect

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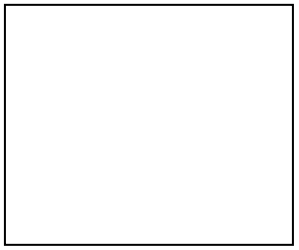


"Building of a new modern developed nation in accord with the new State Constitution"

"The initiative to shape the national economy must be kept in the hands of the state and the nationals peoples"

"Uplift of health, fitness, and education standards of the entire nation"

Some of the core Government Objectives
The New Light of Myanmar, 2-09-2008

Building a modern developed society, a sound economic system, providing proper health and educational systems are some of the objectives and commitments of the government of Myanmar to its people. Such objectives require the participation of all and the leadership of those with capacity to improved existing conditions.
The government of Myanmar has taken the leadership in the reconstruction efforts regarding schools and improving the existing educational system. UNICEF was invited to participate in these efforts capitalizing on a long presence and knowledge of the country. Seven new *CHILD FRIENDLY SCHOOL* models will be some of the end results of this collaboration.

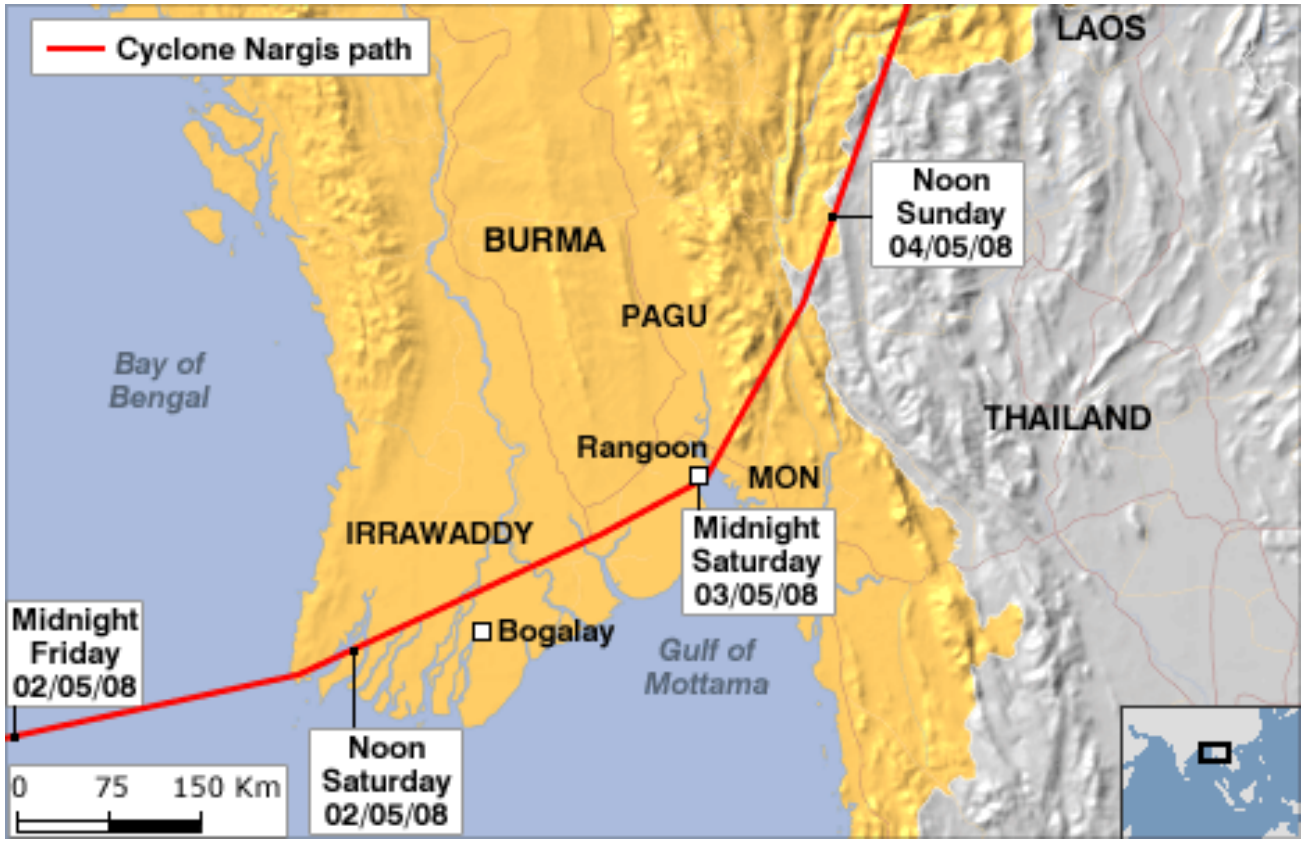
INTRODUCTION

At the very end of April 2008, cyclone Nargis was moving straight to the coast of India on a north-west direction. The climatic conditions were common for this area of south East Asia and especially for the east coast of India.
April is almost the end of the winter and summer season. Rain and heat are not the main characteristic of the weather conditions that facilitate many aspects of life in this region. Construction, rice harvesting, road repairing, etc. are just some of the activities that take place during the dry season. By early morning May 1st the cyclone had taken an unexpected turn in an

almost opposite symmetrical direction heading in a north-east path to Myanmar. By Saturday morning the cyclone was clipping its way around the Induburma rage mountain chains to the east of delta area, with a speed of 200 km/hr.
This is not the first time Myanmar has been affected by environmental or natural events. Millions of years ago when the Indian plate collided with the continental plate of Asia, the mountain ranges (to the east and west) that surround the central low lands of Myanmar and the delta were formed. This tectonic movement is still active today creating seismic movements along the Kyaukkyan fault line in the northern part of the country. Rangon, for example, sits at the very end of the Sagain fault line. The last big earthquake here was register in 1978 affecting the town of Daydaye across the Ayeyarwady river. Monsoons, high winds and heavy rain are common elements of the 5 months of rainy season, adding to the factors that influence how people live and how structures get built.

The cyclone touched land early Saturday morning on May 2nd with its full strength, devastating the township of Labutta and Ngapudaw first. It took the cyclone two full days to cross the delta area, Yangon and the eastern mountains. By Monday May 4th Nargis was about to cross the Thai-Burma border leaving the townships of Pyarpon, Mawlamyaianggyun, Daydaye and Kyaiklat in a state of devastation never seen before.

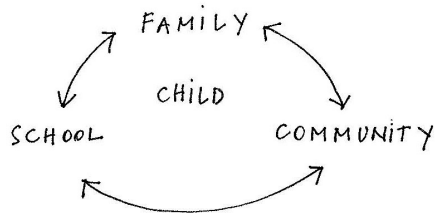
The damage and destruction was unparallel; 2.4 million People were directly affected, with 84,537 deaths, according to Unicef report and official data. The shore line of the delta was virtually erased in less than 48 hours. In terms of infrastructure 1,255 schools were completely destroyed and 4,106 over all were damaged. 431 health facilities including, hospitals, rural health centers and sub-health centers were also affected. Many villages lost 100% of their houses, paddy fields, animals and access to drinking water. The twelve foot high storm flood surge and tsunami destroyed entire villages, and it also contaminated drinking water and farm land with high levels of salt, affecting the immediate recovery efforts and subsistence on the population. Nargis had a radius of approximately 100 miles with wind speeds of up to 200 km/hr making it one of the most deadly natural disasters in the recent history of Myanmar.
The social impact of the cyclone was and is today equally tangible. 800,000 people were internally displaced living in refuge camps or were forced to migrate to villages close by. Women were among the highest numbers of dead people, having a direct impact at a social level, altering the basic



PATH OF CYCLONE NARGIS

family structures. Collapsed schools and latrines made it all the more difficult to manage any strategies to bring back a sense of normal or habitual way of life to children and communities.
Under this light UNICEF in conjunction with the Ministry of Education embarked on an emergency plan to provide temporary learning spaces, access to water and health services, and a long term plan to reconstruct schools under the **Child Friendly School** (see attachment) initiatives of UNICEF to "build back and safer" schools. The main principles of this efforts are based on the unequivocal effort to build "child friendly schools that can be used as shelters", establishing a clear distinction between schools that are places to learn (the child as the main audience) rather than places to teach (adults been the focus).

Objective
The main goal of this project is to build "Safer and Better Structures" that are sustainable, structurally sound, and more Child Friendly. These structures can also serve as an epicenter for greater social community improvement. As part of the process to achieve this goal, the team conducted and completed surveys of 22 schools in 7 townships that will inform the designs. The assessment and design process will be closely discussed and developed in conjunction with the Ministry of Education (MoE) and the Ministry of Social Welfare Relief and Resettlement (MoSW) in order to make it a participatory and inclusive effort.
After a couple days of meetings and debriefings in Yangon, the team set out for a period of 3 weeks starting on July 28th to conduct site visits for 22 schools in 7 townships. After each field visit (usually 4 days) the team returned to Yangon to report back to the stake holders.



The Team
In 2007 UNICEF held an informal meeting with the Ministry of Education to review the principles of Child Friendly Learning Spaces (CFS), having an architect (Carlos Vasquez) as the co facilitator to review the principles and the construction aspects of a CFS school. After Nargis the Chief of UNICEF education department invited this consultant to lead the efforts to build 7 schools in 7 townships in order to build on experience and contacts already established. In order to build capacity at a local level and to minimize dependency by the national ministries, the consultant would work closely with with a local civil engineer, a local engineer from UNICEF and a representative from the Ministry of Education.
The team is composed by:

• Tin Maung Htun	Civil Engineer	CSC Company
• Kyaw Lwin Latt	Electrical Engineer	UNICEF
• Thura Aung	Electrical Engineer	Ministry of Education
• U Khin Aung	Structural Engineer	Ministry of Education
• Carlos Vasquez	Architect	UNICEF-Consultant

NARGIS

The devastation of Nargis was of monumental proportions. Even though the cyclone has affected the most basic aspects of the lives of people in the Delta region, the situation was already fragile before May 2nd 2008.

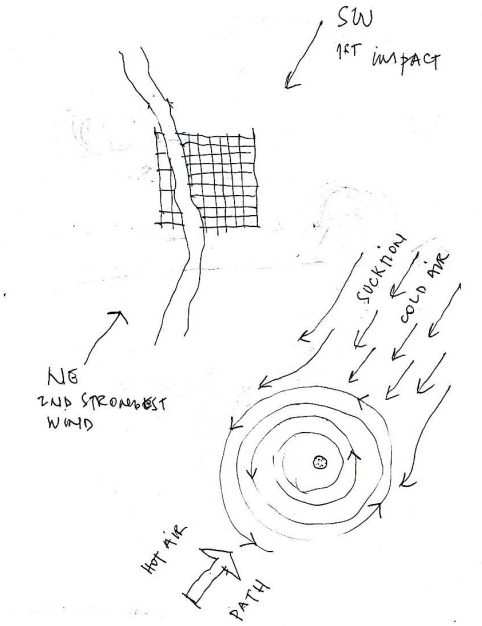
Before the cyclone

UNICEF has been working in Myanmar for almost 58 years now, allowing the organization to implement and monitor programs, to establish working relations with local counterparts and relevant ministries and to have a broader understanding of the cultural and social characteristics of the country. At the moment UNICEF is the only organization recognized by the government to carry out construction activities.

Based on a previous visit in 2007 and separate meetings with the UNICEF country officers here in Myanmar the observations regarding the overall conditions, and specially children in school environments, were grim. As a matter of policy the government of Myanmar allocates 1% of the GDP for the budgets of Education and Health *combined*. This policy translates into a basic school design that has 2 latrines regardless of student count; structures are more than 40 years old with little attention paid to maintenance. One big classroom with 3 teachers usually will serve 5 grades in a primary school. When communities decide to build an extra classroom to avoid the multi grade teaching system, government will only support 10% of total construction cost.

In terms of access to water and sanitation the situation is border emergency. Only 40% of children can wash their hands before after going to the bathroom. 86% of the total existing toilets are located at home but only 19% function properly. This lack of hygiene can have devastating consequences on the lives of children. Statistics show that 1 gram of scrota contains thousands of microbes; diarrhea kills more children globally than AIDS and asthma combined.

The direct results of such conditions are tangible facts that show that out of 5 million primary school children only 45% advance to middle school. There are 3 million children not attending school due to economical conditions or the location of the school in relationship to the village. For a full copy of the report see annex 1.



Current Climatic Conditions

Nargis is the perfect example of an ever changing and unpredicted global weather system that is affecting countries around the world. We no longer can afford to remain isolated from a world that is interconnected by political, economical and weather systems. The change in curse of the cyclone is unclear and yet dramatic; almost a 180 degree turn that resulted in the devastation of an unprepared government and civilian population.

Many of glaciers in Patagonia for example that normally would melt during the summer time (January ad February) are beginning to melt during the winter season in the months of June and July. Higher water temperatures in the Caribbean waters have increased the number of hurricanes, the magnitude and level of destruction. Deforestation around the world has reduce the natural capacity to clean the air and it has also increase erosion and land slides in different environmental scenarios; in our visit to Labutta we realized that there was a direct connection between the absence of electricity and gas, the use of fire wood for cooking, and land erosion at the river edge. Mangrove trees the favored specie for fire wood, was the indigenous environmental answer to providing protection from the wind and prevented land erosion.

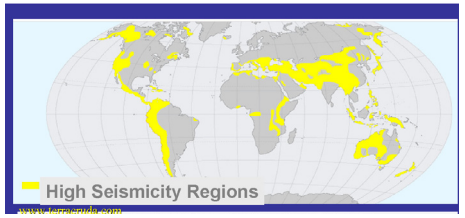
In our site visits we learned that structures can be affected by the forces of strong winds and water:

- The strong south west winds during the rainy season, coming from the Indian sea, can be dangerous if structures are not properly built and designed. Such winds can pick up speeds of approximately 60 miles per hour, translating into strong lateral load forces on structures.
- During the rainy season the amount and force of rain also has direct consequences; noise, maintenance and soil erosion are just some of the more visible affects. There

are 2 types of soil in the delta, sand and clay, and their low load capacity can be easily affected by any change in water content. Floods are common in some areas due to increased levels of water, and the absence of dykes leaves communities exposed to higher water levels and land erosion.

- Townships close to the sea have experienced an increased content of salt in the land and underground water. The cyclone also brought a massive wave sea water that in some areas reached heights of 15 feet resulting in the immediate destruction of villages but also changing the saline balance. Salt will corrode steel bars in reinforced concrete foundations but it also makes very difficult to reconstruct with local material if there are no stringent methods of construction supervision.

As we prepare this report and complete the design development phase of the project, there are 3 major systems affecting 3 separate parts of the world; Floods caused by higher than normal air temperatures in northern India in the state of Bihar, have forced more than 1 million people to relocate; An earthquake in the Sichuan Chinese province has killed more than 25 people so far; and Hurricane Gustav in the gulf of Mexico has forced the evacuation of the entire city of New Orleans after leaving a path of destruction in Cuba.



Because of these pre-existing climatic conditions and drastic changes in the global environmental system any future reconstruction efforts should be guided more towards *emergency preparedness* (disaster risk prevention) rather than emergency response. Practical measures such as soil testing, proper construction details, analysis of land erosion, proper construction administration and detailed site planning, must be conscious activities of future design and any decision making process concerning future school designs.

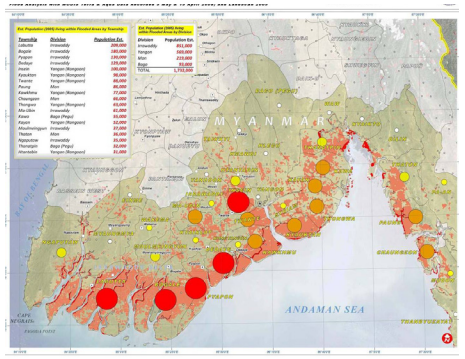
Seismic Conditions

Seismic movement is not a major factor in the delta but earthquakes have been recorded in Rangon and Daydaye since the late1950's. Rangon sits 50 miles west from the Sagaing fault line making the township an epicenter for seismic activity. Any city or township to the

east of the Ayeyarwady River has more seismic activity than the west part of the closer to the Induburman ranges. The last earthquake in Daydaye was a 6.2 magnitude in the Richter scale. In 2007 the government changed the seismic zone for Rangon from Zone I to Zone II and III for structural design purposes, thus increasing the earthquake resistance capacity of buildings. Up to recent years most buildings in Rangoon were design with lax seismic properties and standards.
Our school structural designs will have to respond to the forces and loads created by seismic movement, soil capacity at each location, geographical location and proximity to water (rivers or sea shore) in order to guarantee the safety of children.

After Nargis
Our 3 weeks of surveys and traveling through the Delta area allowed us to see first hand the impact and side effects of the cyclone. We were also able to do comparative analysis between villages and their schools in relationship to geographical location and the degree of the overall damage.
In general we found that the villages and schools that are located closer to the main city centers are the ones that have benefited the most from the relief efforts led by the government, NGO's and the private sector. Remote villages are struggling to cope with the aftermath of the cyclone and the recovery efforts. Some of the most poignant observations are:

- Remote villages have rebuilt temporary schools with left over wood and bamboo, resulting in uncomfortable learning spaces.
- In the township of Labutta the mouth of the rivers is almost double than that of the eastern townships. During high winds it is nearly impossible to travel by boat form village to village, and traveling via the canals and creeks can triple the traveling time.
- There is very little economic activity or trade. Some villages with approximately 300 inhabitants have few farmers and fishermen producing just enough food for local consumption.
- In some schools we found that 20 to 50 children do not have lunch due to poor economic conditions or lack access to basic food supply.



- In some cases children below five years old that lost their mother must go to the rice fields with their father because there is no guardian at home and the school does not have resources to build a separate space for pre K students nor a teacher to lead the activities.
- The psychosocial conditions of people living under these circumstances are of very low morale and a sense of hopelessness.

There are some common denominators across the delta and the 22 schools we visited during our survey. The issues range from access to water, construction, quality of structures and exposure to the elements. Some of these observations are:

- Access to water can be an issue especially in the dry season. We found a few schools and villages that have been buying water for the last two years. Traditionally rain water is what people drink the most but rain water harvesting is an issue at the moment especially when some townships register rain fall of 2" between December and March in recent years. Not enough ceramic pots and old decaying concrete tanks make it difficult to collect it.
- Villages have 2 or 3 ponds that can sustain the basic needs of a community and schools. Pond water is usually use for maintenance purposes and not drinking unless necessary. Evaporation and sanitation are big issues with ponds. Ponds that lack a fence are exposed to animal usage (urine and defecation) increasing the risk contamination.
- Proper sanitation facilities in schools are non existent. Children have limited access to hand wash water or sinks. Washing your hands reduces the chances of infection by 40% and most children do not have proper training or facilities to wash their hands before eating.
- The official toilet ratio in Myanmar is 1:50 (toilet:student), under UNICEF standards the ratio is 1:20. What we found in the field was usually 1:90 in big schools with no separate facilities for teachers. Some remote villages did not have toilets at all, allowing for serious sanitary conditions for students and teachers.
- Temporary learning spaces are built with bamboo or wood. Such structures can last about 1 or 2 years and they meet only minimal structural requirements. Heavy rain, high winds and floods can inflict great damage to the building. The typical tarpaulin roof makes the space very hot and visually uncomfortable due to the glare produce by the pink or blue color.

- The hall type structure is very common and not conducive to learning. Primary schools can fit anywhere between 50 to 150 students. At Ohnpin primary School in Daydaye the temporary school was 1,500 SF with 167 students, less than 10sf per student.
- It also common to see five grades with only 3 teachers, conducting simultaneous lessons, creating noise levels that make it hard to listen, concentrate and learn.
- Furniture is usually not age sensitive or properly constructed.
- Access to school is also a major issue. During the rainy parents must pay up to 5,000 kyats for transportation. It is normal to see 20 students in a small wood fishing boat.
- Most schools do not have a recycle program and very few provide garbage bins in the classroom. Plastic and other debris usually end up in the river or unsupervised sites.
- Salt content in the water and the ground has affected many aspects of the daily life: inadequate farming land contaminated drinking water and salt in the sand and water undermines the integrity of reinforced concrete construction systems.

As we have observed the situation post Nargis has only amplify already existing fragile conditions for students and villagers. The reconstruction efforts will also be affected by some of these issues when it comes to transportation, access to proper construction materials and community involvement.

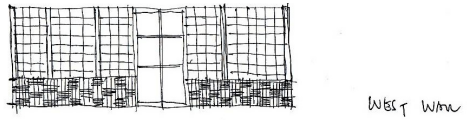
PLAN OF ACTION

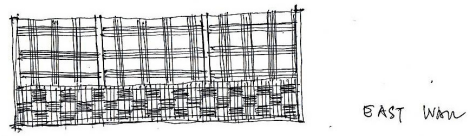
The main objective is to build 7 cyclone and earthquake resistant schools in the 7 affected townships mentioned above. Such schools' designs will respond to the local topographical and weather conditions of each location. The structures and the schools will be sustainable and an integral part of the community.

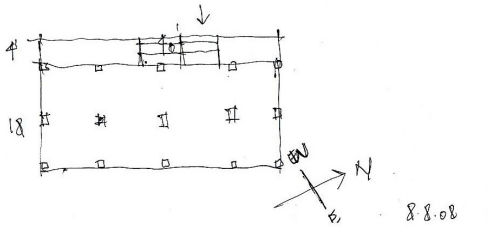
From the field

The first 3 weeks of our mission concentrated on surveying 22 schools in 7 different townships. The main goal was to be able to see first hand the affected areas and understand the environment in which we were going to be working. The main activities during the field trips at each school were the following:

- A comprehensive **school survey** to evaluate the school's infrastructural, social and economical conditions before and after Nargis. This document would allow us to have a record of the main characteristics of the schools (eg. Student count, teacher count, size of land and school) and also make comparative analysis between schools.
- Detailed **analysis of structures** that fell and of those that did not collapse and served as shelter. The collapsed schools became forensic evidence of why school collapsed opening the possibility to us to better understand design and building process. We quickly realized that the lack of construction supervision was an important factor for school collapsing. Structures that did survived were homes and monasteries. In both cases the craftsmanship and detail of construction was of higher level. Monasteries in particular have intricate wood roof structures and concrete fences around their compounds, preventing strong winds from taking the roof away, and flood water form directly impacting the structures respectively.
- **Soil samples** were taken at 3 different depths (12", 24" and 36") to analyze the load capacity of the terrain at each location. This is one of the most important parts of any efforts that deal with construction in general. Precise information regarding the load bearing capacity of soil will allow the structural engineer to properly design the size of footings and overall strength of the foundations. Without this information it is accurately impossible to design and built any structure.
- A comprehensive **material's price list** at each location was generated in order to get a general understanding of construction cost. Understanding your cost and budget early on gives you the advantage of controlling any future bidding process and value engineering when redesigning or making changes.
- **Interviews** with Township Educational Officers (ToE), school head master, teachers, parents and students. It is important to hear the beneficiaries' point of view and make them part of the process. Their participation will begin to establish the basis for any future community participation and the necessary feeling community of ownership and empowerment.
- Careful **documentation of travel itinerary** to understand the time and distance factors in relationship to logistics and future deployment of construction activities. Understanding your context is fundamental for the implementation phase. The east of the delta is more





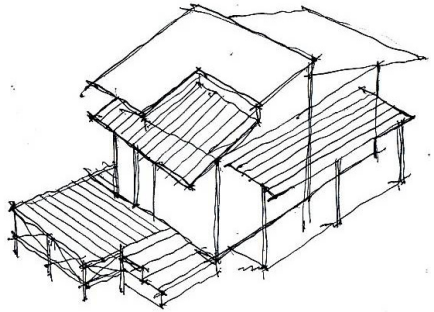


accessible than the east townships making the logistics activities between the areas completely different.

- Evaluation of **local materials** and existing available **labor force** specially carpenters and masons. Knowing what materials and labor are available can influence the design and ultimately the budget and construction time table.

At the end of each field trip (usually 4 days) the team held a debriefing meeting to report back to UNICEF and MoE in order to discuss our findings and begin to create consensus among the stake holders for any future reconstruction activities. Some of the specific observations that will have a direct influence on our designs and construction activities are:

- The majority of the soil in the delta region is composed of clay or sand when close to the sea shore. Clay has very low bearing capacity creating the need to design larger footings to prevent sinking or uneven settlement. Clay is very elastic whereas sand has better compacting capacity.
- The water table is very close to the surface, sometimes less than 24" below grade. For a reinforce concrete building your average footing is about 6'-0"x6'-0" with a bottom depth of 3'-6". Trenching the grounds to the form work for footings and grade beams would require special attention for dewatering during construction.
- Land erosion and sea intrusion is a real factor that needs to be dealt with. One school we inspected was moved 3 times in the last year. Many townships such as Bogale have dykes that prevent water intrusion, but places like Labutta that are more exposed to winds and wider rivers do not have dykes. Deforestation has also increased the level of erosion in the delta area, making tree planting an important component of any school design.
- High salinity levels in the water and sand will decompose the steel rods in the reinforced concrete footing. We will propose to apply plastic sheathing to all the foundation work in order to prevent the seepage of water into the structure.
- Traditionally, structures get built on pre cast footings that are readily available in the town centers. These structural elements already come with one pre drilled metal strap to connect to the wood post. Quality control of concrete mixture and curing time is poor, and many broke under pressure from the cyclone. Our design will propose 2 metal straps pre painted



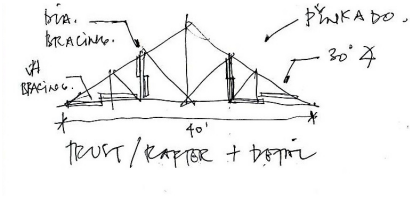
or galvanized. The footings and grade beams will be constructed under rigorous design criteria and supervision.

- Grade beams will provide the proper stability to the foundation to settle evenly and react as a whole system when under different types of loads and pressure.
- Traditionally buildings in the delta are built with the longitudinal direction on the north-south axis in order to better resist the strong wind forces coming from the south-west during the rainy and monsoon season. Winter winds on the north-east direction are less powerful in comparison. Many of the structures that did survive comply with this basic principle.
- Maintenance is a major factor when it comes to failure of structures. Well maintained buildings can survive for longer period of times and resist strong loads. We learned that the government works on a 2 year interval for distribution of budgets. Capital that is allocated for schools today will get to the actual school program 2 years later. Many of the schools that fell had serious maintenance issues; rotten bottom wood post where pulled out of the footings by the wind, brick walls that needed re pointing work collapsed side ways as one piece. Allocation of budgets for maintenance must be an integral part of the school.
- Construction supervision was another crucial element missing in school construction. In one particular school we found wood trusses pilled up in one area but intact; their integrity was not compromised. On the other hand the walls had completely collapsed. The connection details between the walls and trusses were not done properly due to lack of supervision, allowing the wind to blow the roof away, and the walls to fall separately.
- The lack of power (electricity or gas) in the remote villages makes difficult to procure precise construction of structural elements especially those of trusses and wood fitting in general. Hand tools are the most common means for cutting, milling and making wood connection. Are intension and that of other NGO's is to precut and preassemble structural members in Yangon in order to guarantee and supervise fabrication methods.
- Many of the roofing sheets were and are still fixed to wood members with nails. High winds can pull roofs right out of the building becoming airborne and dangerous. The final designs will specify galvanized metal roofing screws.

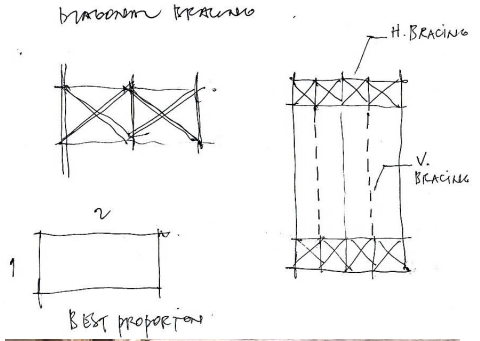
Cyclone and Seismic Design Parameters (sketches, bibliography, ect)

In response to the emergency several INGO and local government organizations created different coordination groups in order to maximize the efficiency of the relief efforts and avoid overlapping of services. We were able to attend some of the cluster meetings for construction and shelter.

The purpose of the group was to create guidelines for reconstruction and bridge the gap between the government policies and donors' intentions to support the reconstruction of schools and houses. Our designs will go a step further and provide stringent structural calculations than the cluster group has recommended, and at the same time we have complied with all the references recommended by Ministry of Construction and the Myanmar Engineering Society. The main guide lines and recommendations are:



- **UBC 1997 CODE** SEISMIC LOAD CALCULATION
- **ASCE-7 CODE** WIND LOAD CALCULATION
- **ACI CODE** REINFORCED CONCRETE CALCULATION
- **AITC CODE** TIMBER DESIGN CALCULATION



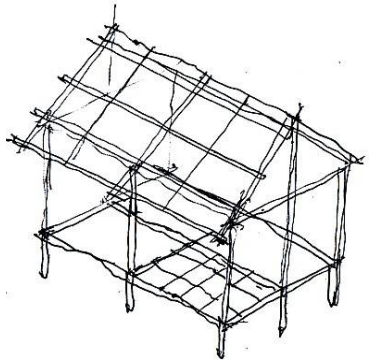
CROSS REFENCES AND DESIGN PARAMETERS

Design Parameter	Myanmar Engineering Society (MES) (for cyclone shelter)	Shelter Cluster Coordination Technical Working Group	UNICEF (for School)
Wind Speed	120 mph	80 mph	100 mph
Seismic Intensity	0.2 g (max. 7.3 Richter Scale)	0.15 g (max. 6.5 Richter Scale)	0.2 g (max. 7.3 Richter Scale)
Code & References	ACI 318-99 ASCE 7-98 UBC 1997		ACI 318-99 ASCE 7-98 UBC 1997, AITC

DESIGN WORK

One of the main components of a child friendly school is the cultural relevance of the physical space, the children and their culture. The typical “school” that we found in the rural areas, and even close to city centers, is a one building structure with no interior partitions and of very basic forms. The architectural richness of the delta is completely lost by the time you enter the school facilities. The variety of roofs, volumes, materials and basic public/private space arrangement is non existent in the school environment.

The need to recapture and harvest the vast cultural richness of the delta is fundamental to reconnect the school to the student’s life and learning experience. A school that reflects your culture and history is no longer a static monolithic bunker but a kinetic source of information; an organism if you will, that an essential part of one’s development experience.

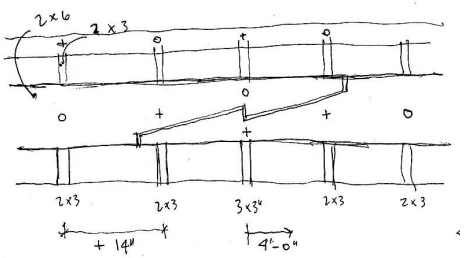


Concept and Observations

Water is main means of transport in the delta. It is the cheapest way but also rivers and creeks are the fluid roads of the land. Boats are an intricate part of the life of the people; for better or worse. In one school we found that 21 students take one small fishing wood boat to commute between school and home, making a very dangerous activity during rainy and windy days. One small boat can be built in one day by 3 carpenters. The life of a boat is a bout 5 years if it is well kept and maintain regularly. Crude oil is use to paint the outside and inside of the boat regularly to prevent decaying of the wood shell main members. The main structural members of a boat are the same size of that of a roof; 2”x3” purlins, 2”x6” main members bolted at main connection. Splice connections use the same zigzag design as columns and post (or vise versa). Most homes and buildings use nails rather than bolts, making boats more structurally sound than their land counterparts.

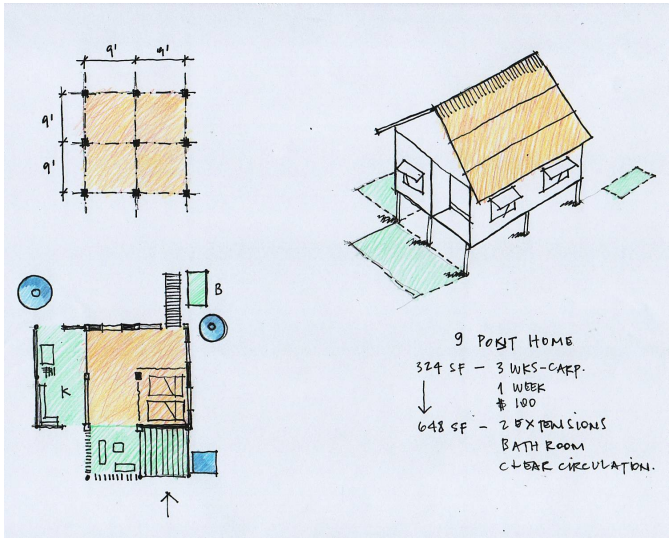
The 9 post system structure is the most common in the delta. The basic structure provides the genesis for any extension that the home owner may like to add later. The home takes 1 week to build, 5 carpenters and about 100,000 kyats. The size begins roughly with 320 SF and with two side extensions it can double in size with a kitchen, public space and toilet in the rear.

Our basic school model will be based on this post system that can easily expand and accommodate different school sizes. The requirements are to design 3 school sizes for 45, 100 and 250 students, providing proper **classroom** (conducive to learning), **water and sanitation, library and play ground**. A school master plan will be design for each school to properly locate the structures in the most effective relation to the wind direction, sun movement, and access from river and roads.

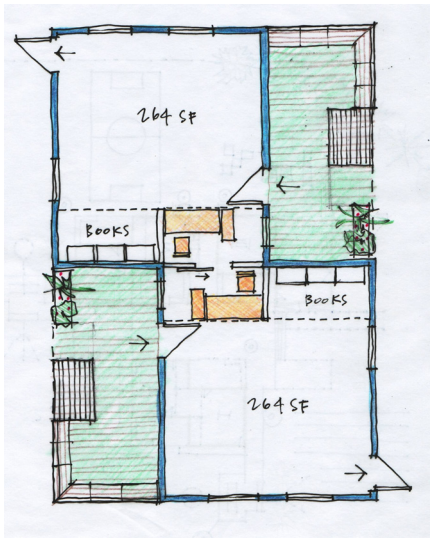


SELECTED SCHOOLS

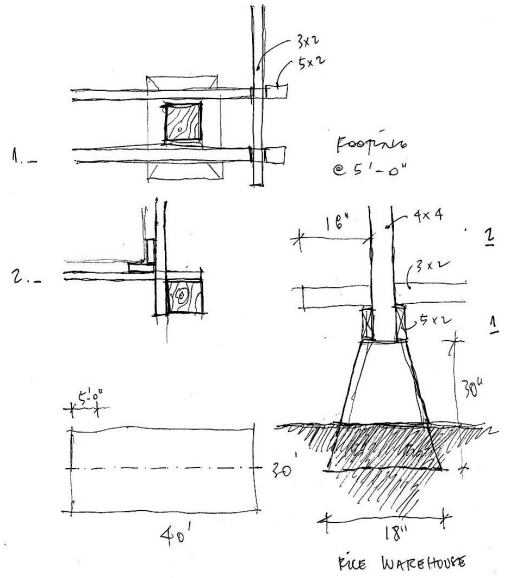
	Township	School Name	Village Name	number Students	Number Teachers	Comments
1	Bogolay	Ma Louk Myit Tan	Ma Louk	136	3	40 Pre K. 61/16
2	Mawlamyainggyun	Hlaine Phone Lay	Shauk Chaung	67	3	20 Pre K. 32/8
3	Phyarpon	Thamein Htaw Auk	Thamein Htaw Auk	67	3	20 Pre K. 17/8
4	Daydaye	Sinku	Sinku	72	2	1 asst. 33 Pre K. 20/5
5	Kyaiklat	Kaing Chaung	Thamin ore Chaung	152	5	20 Pre K. 60/17
6	Labutta	Mya Yar Gone	Mya Yar Gone	46	2	1 asst. 30 Pre K. 22/2
7	Ngapudaw	Kan Chaung	Kan Chaung	53	2	1 asst. 10 Pre K. 12/15



TRADITIONAL 9 POST HOUSE



NEW CLSSROOM

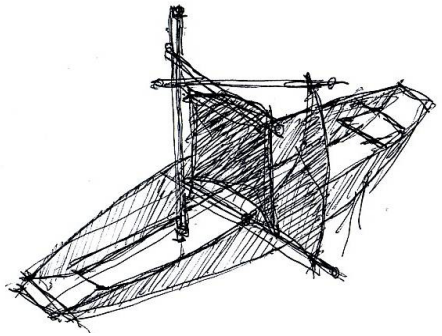


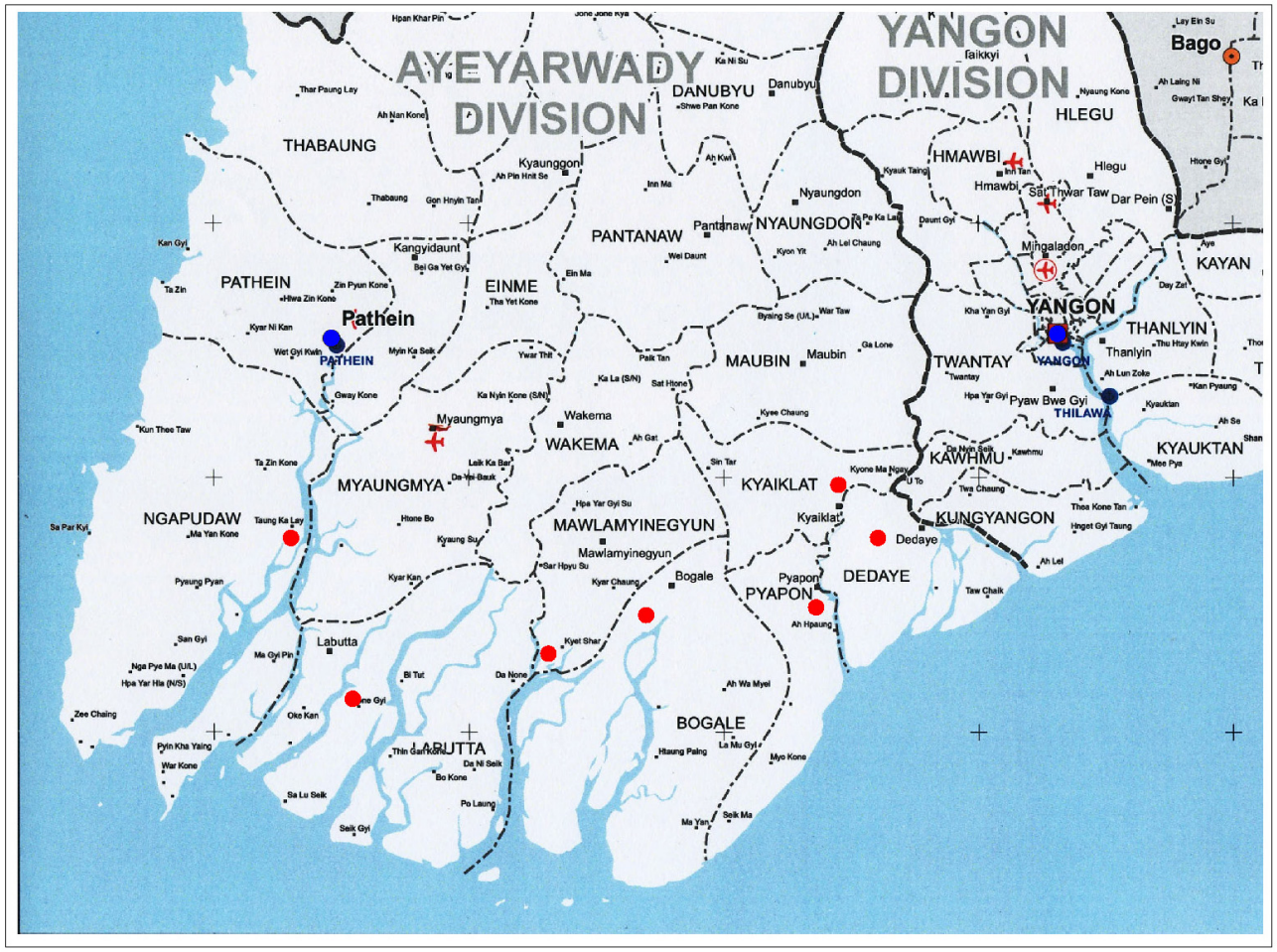
Our first schematic designs began with the review of the soil testing results that were generated by a lab in Yangon. These results began to inform what we could do and what the limitations we had in terms of loads and foundation design. Some the design changes due to computer modeling calculations were:

- In order to avoid big and deeper footings, the dead load of our floor had to be redirected away from the footing, thus we decided to design a floor slab that transfers the weight directly to the ground. The ground has to be treated to improve its soil capacity by compacting it, providing 18" of compacted soil and 6" of sand. A plastic sheathing must be provided to isolate the slab from ground water.
- The designs must provide shallow foundations no deeper then 4'-0" to properly respond to soils capacity.
- Our roof and wall loads had to be constantly and carefully monitored in order to keep weight low and be able to use the standard 5"x5" post structural member.
- Due to high wind load pressure the slope of the roofs will be less the 35 degrees but more than 20 degrees to avoid uplifting forces.
- The school model for 250 students will have the conventional "L" shape design to better resist the lateral wind loads.
- Based on our meeting with the Ministry of Social Welfare on September 3rd, the roof design will be single gable for all 3 models.
- As per the Ministry of Meteorology's records the sea water surge in the 7 townships was Mawlamyainggyun 11'-0", Ngapudaw 5'-0", Bogalay 7'-0", Pyarpon, Labutta 2'-0", Daydaye 3'-0", Kyaiklat 0'-0". Tow of the 7 structures will have to rise off the ground to provide adequate protection in case of sudden floods.
- The truss system will have vertical bracing as well horizontal bracing.

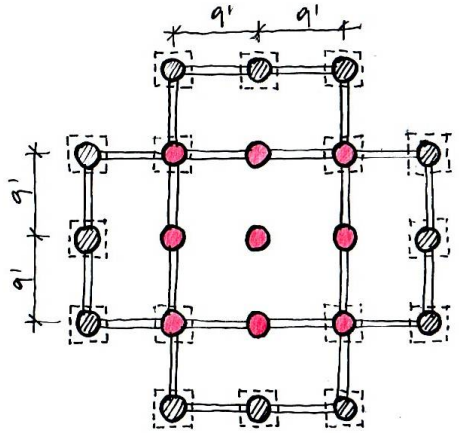
Some of the main soil load characteristics around the delta are:

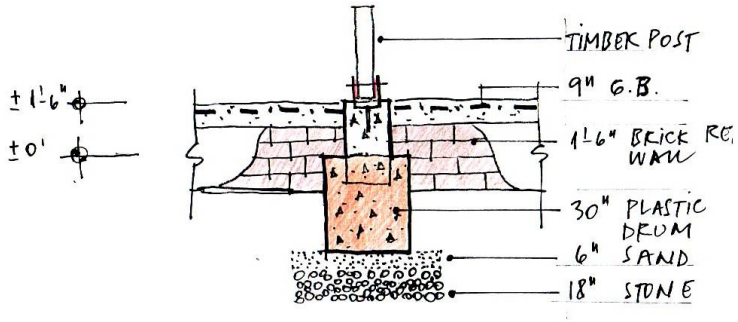
- Soil Type – **Soft Clay, Silt** and **Sand**
- Unconfined Compressive Strength (UCS) – **500 lb/ft2** to **800 lb/ft2**
- Standard Penetration N60 – **0 to 5**
- Bearing Capacity – **1148 lb/ft2**

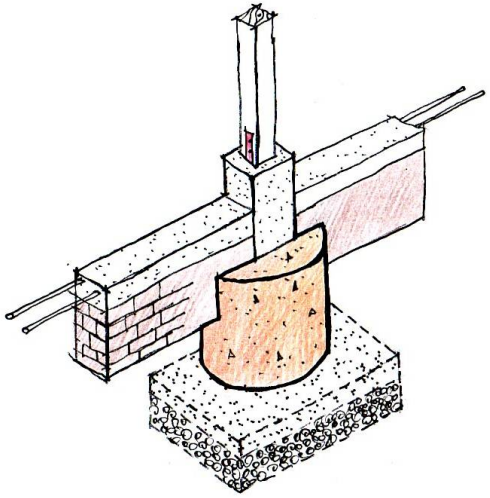




LOCATION MAP FOR THE SEVEN SELECTED SCHOOLS for the seven different townships

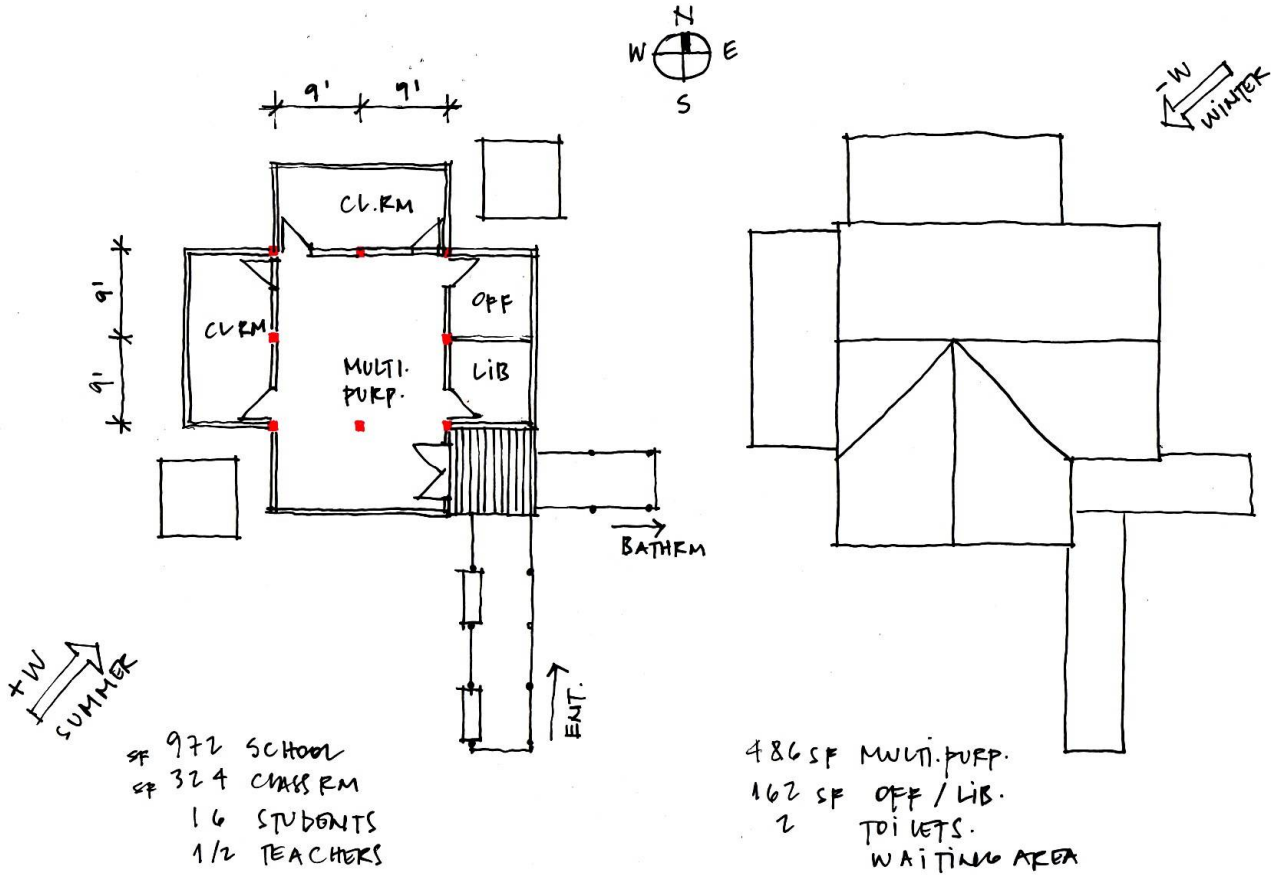


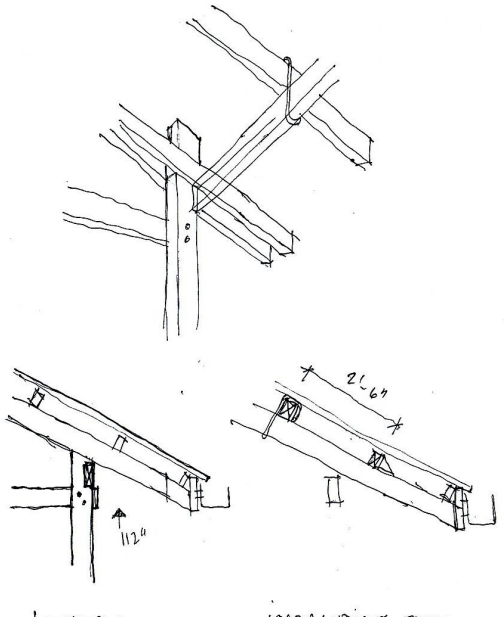




- DRUM V/S CAST IN PLACE
- EXISTING CONC. FOOTING
- GRADE BEAM V/S SETTLEMENT
- SALINITY V/S STRUCTURE
- SUBGRADE AS IMPROVE SOIL
- ROOF V/S WIND V/S WATER
- DOUBLE METAL STRAP.

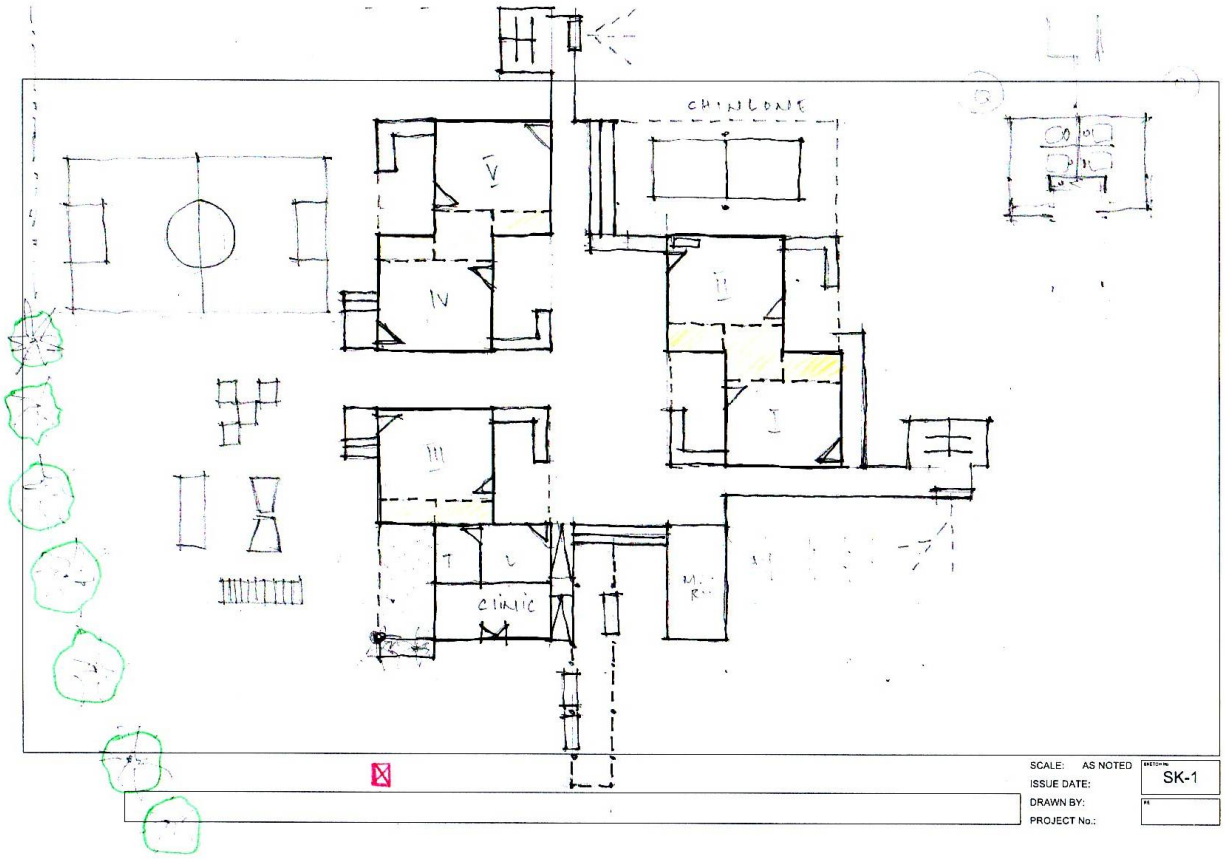
It was clear to us that the basic structural design had to come from existing technologies and built on knowledge people already mastered. Introducing new forms or technical details would require training and methods for greater supervision.
Improving existing construction methods will result in better school construction but it will also help the local community to harvest some information to improve their homes as well.

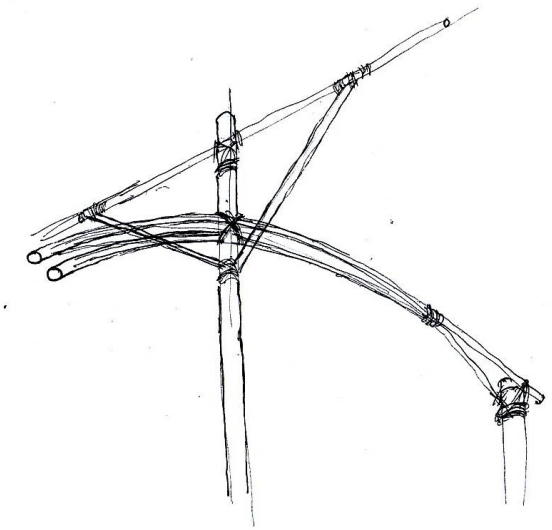




30 STUDENTS

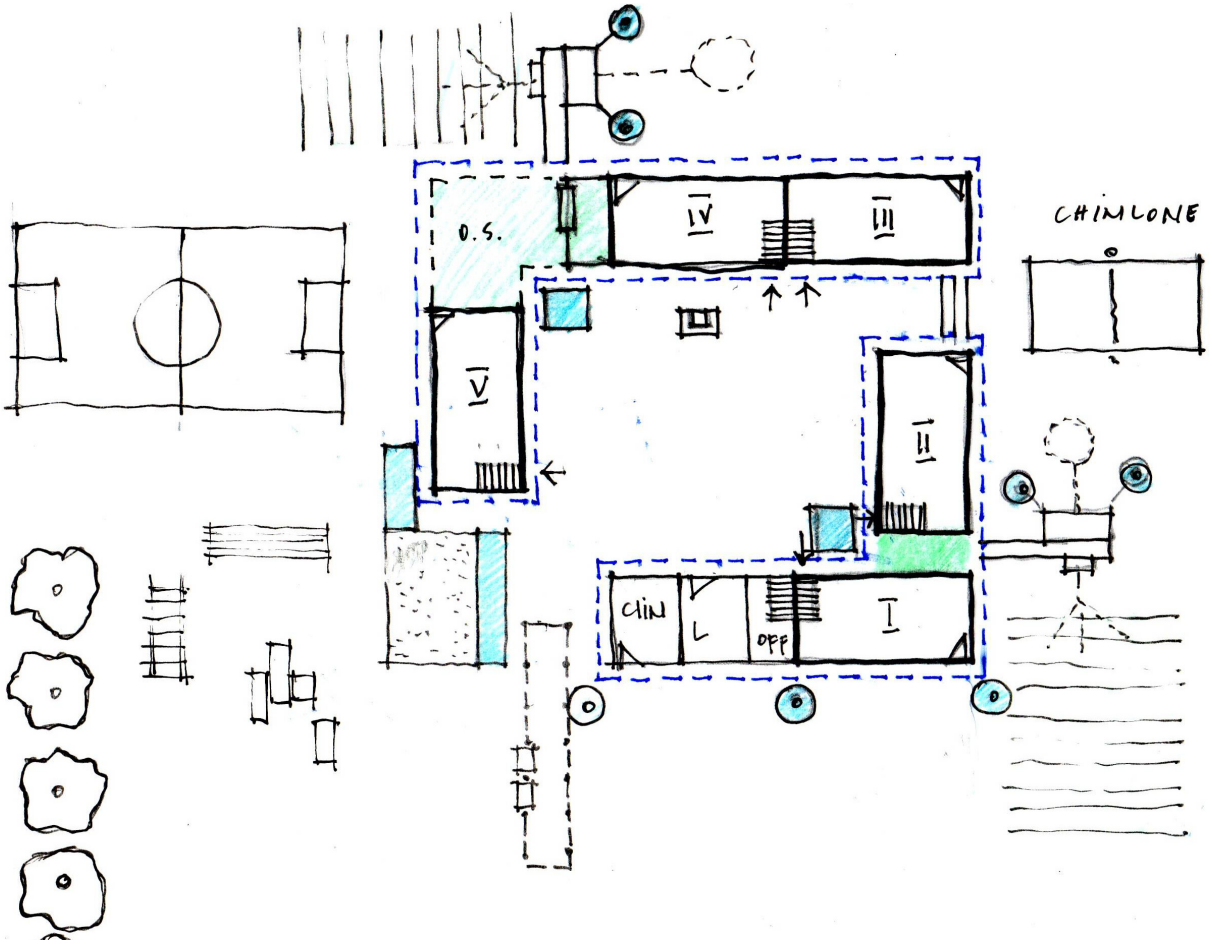
THIS SCHOOL MODEL CAN BE USE BY 30 STUDENTS, BUT ONE CAN ALSO REMOVE THE WALLS OF THE CLASSROOMS AND THE STRUCTURE IS ADDAPTABLE FOR AN ECD CENTER IN A SMALL VILLAGE. THE MASTER PLAN WILL INTEGRATE THE SAME BASIC REQUIREMENTS OF A SCHOOL.

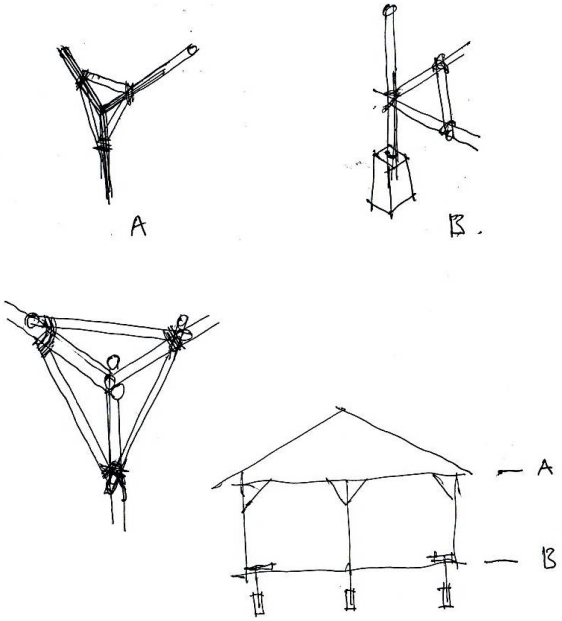




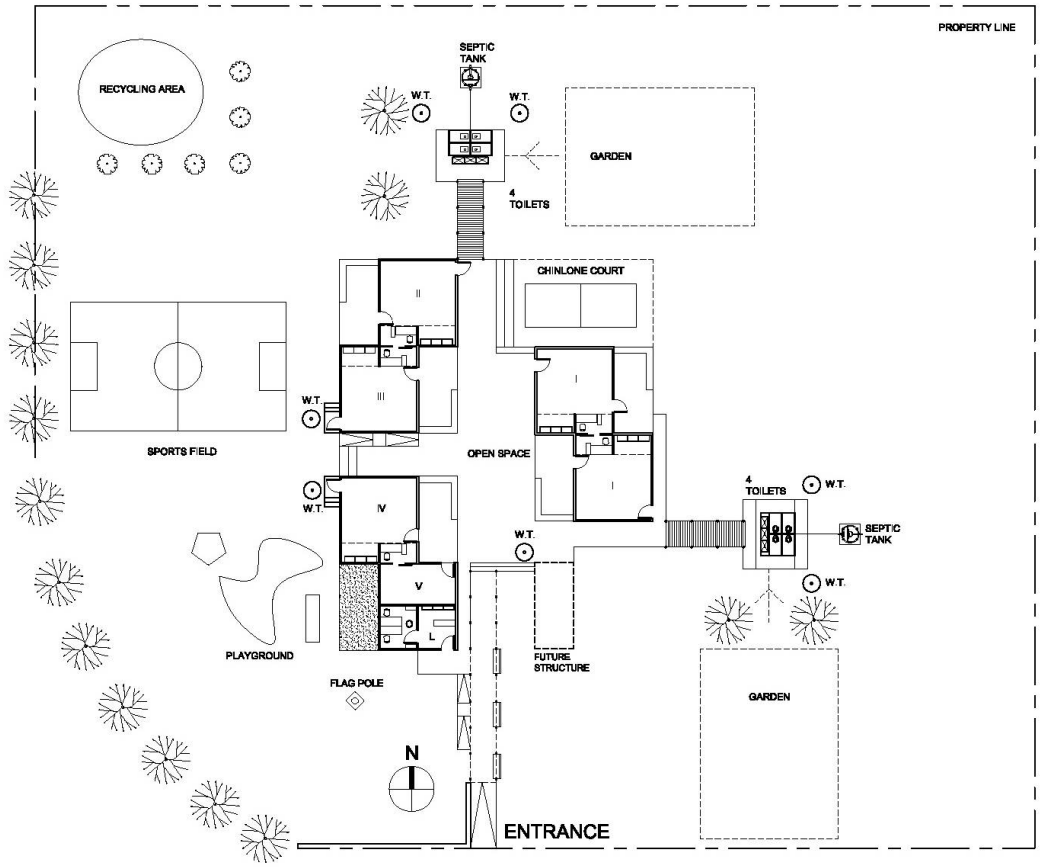
100 STUDENTS

THIS MODEL BUILDS ON THE PRICIPLES OF THE SMALL SCHOOL MODEL AND ADS THE INTERIOR COURTYARD. THREE FLEXIBLE STRUCTURES CAN ACCOMMODATE THE FIVE GRADES PLUS OFFICE, LIBRARY AND SCHOOL CLINIC/KITCHEN. A RECYCLING AREA WILL BE PART OF THE FINAL DESIGN

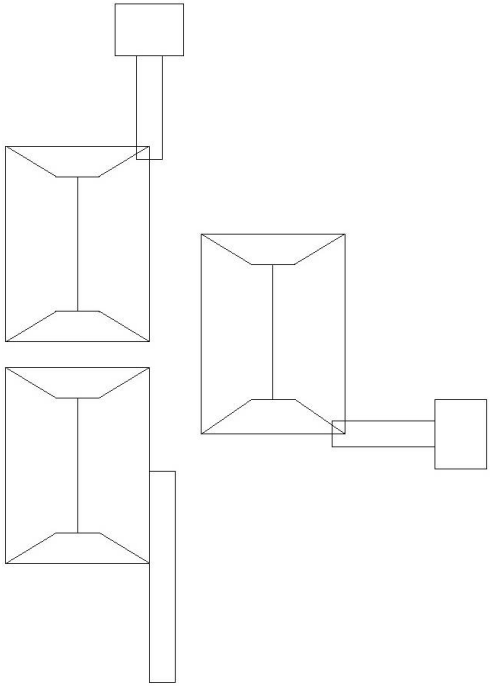




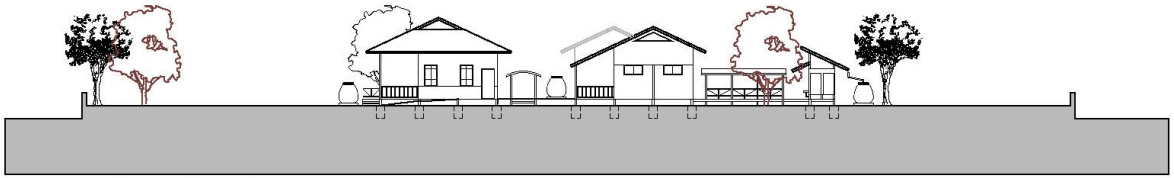
250 STUDENTS
THE LARGEST SCHOOL MODEL CAN HOLD ACTIVITIES SUCH MORNING CEREMONIES IN THE INTERIOR COURTYARD ALLOWING FOR THE REST OF THE PROGRAMS TO TAKE PLACE AROUND THE CLASSROOMS; GARDENS, WATER AND SANITATION, PLAYGROUND,SPORTS AREAS AND PARENTS WAITING AREA.



SCHOOL MASTER PLAN



ROOF PLAN

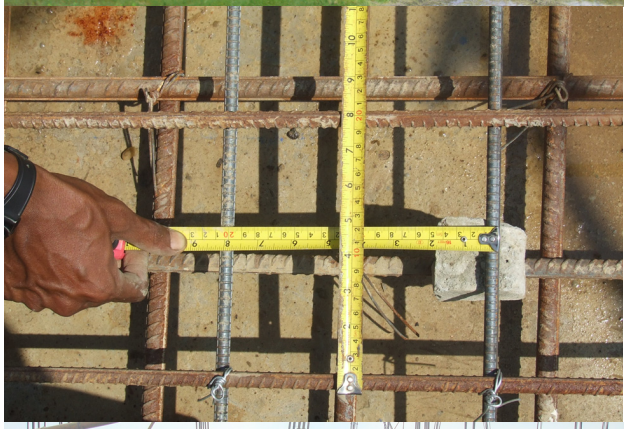


SOUTH ELEVATION

Foundation	REINFORCE CONCRETE
Super Structure	REINFORCE CONCRETE
Wall System	BRICK AND TIMBER
Roof	METAL SHEET (OPP)
Size	2,400 SF
COST	$96,000 ($40xSF)

SCHOOL NAME	100 STUDENTS	OWNER	UNICEF	TITLE	PLAN AND SOUTH ELEVATION	SCALE:	N.T.S.	DWG.NO.	REV.
VILLAGE TRACK		TOWNSHIP		SUBJECT	CHILD FRIENDLY SCHOOLS FOR MYANMAR	DATE:	30/08/2008		


TOILET-A

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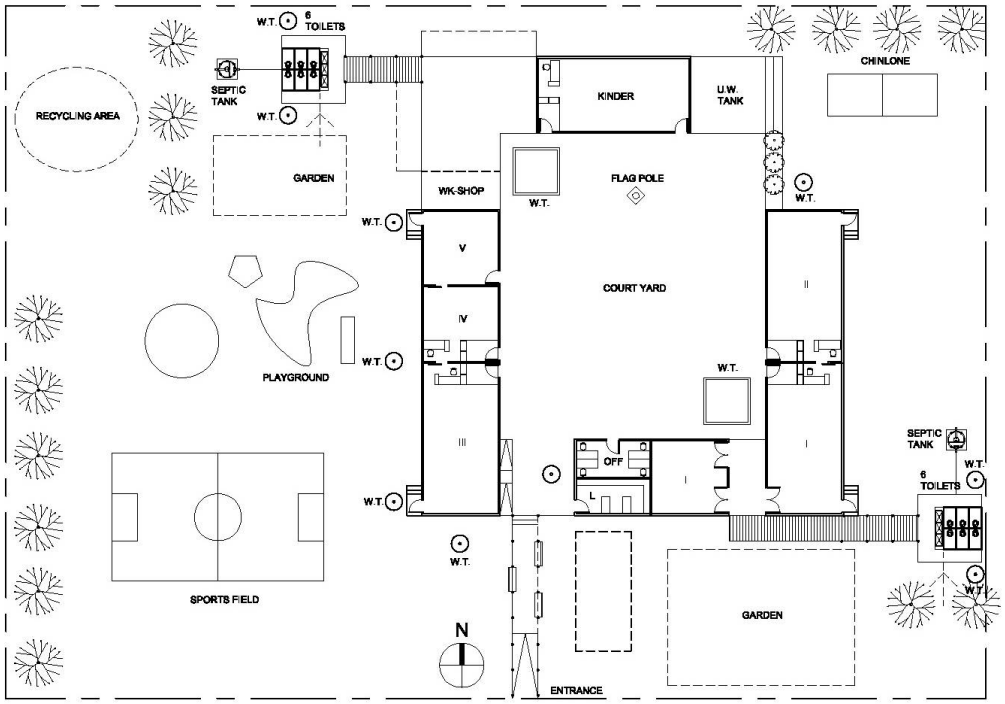
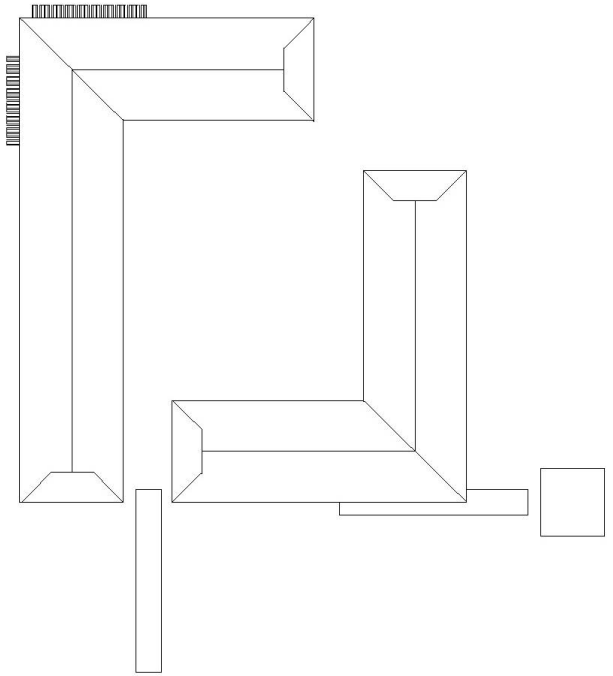
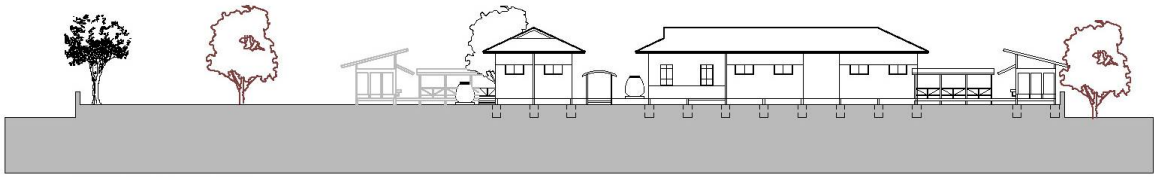


SCHOOL MASTER PLAN



ROOF PLAN



SOUTH ELEVATION

Foundation	REINFORCE CONCRETE
Super Structure	REINFORCE CONCRETE
Wall System	BRICK AND TIMBER
Roof	METAL SHEET (OPP)
Size	4,858 SF
COST	$194,320 ($40xSF)

SCHOOL NAME	250 STUDENTS SCHOOL	OWNER	UNICEF	TITLE	PLAND AND SOUTH ELEVATION	SCALE:	N.T.S.	DWG.NO.	REV.
VILLAGE TRACK		TOWNSHIP		SUBJECT	CHILD FRIENDLY SCHOOLS FOR MYANMAR	DATE:	30/08/2008		





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