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Federal Department of Foreign Affairs FDFA
Swiss Agency for Development and Cooperation SDC
Humanitarian Aid and SHA
Programme Office Yangon

Reconstruction of Schools/Storm Shelters in the Cyclone Nargis affected Delta of Myanmar

Compilation of "Lessons learnt" of Phase 1

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December 2010

Daniel Schwitter Architect Skat, Switzerland

1 Introduction

Within the framework of his technical backstopping mandate, Daniel Schwitter (DS), Skat's Education Infrastructure Specialist, conducted from 19 November – 5 December 2010 a mission of the SDC financed and implemented projects in Myanmar. The mission purpose was twofold: During its first part (November 21 – 27, 2010, the mission focused on the Reconstruction of Schools/Storm Shelters in the Cylon Nargis affected Ayeyarwaddy-Delta (ref Annex 1 Mission Schedule). During the second part (November 28 - December 5, 2010), the mission focused on the conceptualization planning and design of the new community infrastructure improvement project in the South-East of Myanmar that is subject to a separate report.

This report provides a summary of the lessons learnt at the finishing stage of Phase 1 for the project implementation of the School/Storm Shelter Reconstruction Project and the major findings and recommendations discussed during the joint review mission carried out by Skat/SDC-HA.

DS, together with the SDC team, visited four sites in the Delta as well as schools of other international organizations involved in cyclone reconstruction projects of the region. The mission came at a time when 46 classrooms serving 2300 students in 15 villages were about to be completed.

The mission was carried out in close cooperation with Thomas Fisler (FIO) Regional Humanitarian Aid Coordinator for Southeast Asia, and Peter Brunner (BRUPE), Project Manager Reconstruction Team, Yangon and his local project team. The outcomes and findings reflected in this report are a conclusion of the entire SDC team. The issues were discussed and agreed upon at construction sites and wrapped up on November 27, 2010 with key staff of SDC Yangon and the national Architect/Engineer Consultant.

2 Objectives of the consultancy mission

Main emphasis of the consultancy mission was laid on drawing lessons learnt from the first construction phase and providing recommendations for the subsequent construction phases. Due to the remarkable past and future investments into this post-disaster reconstruction project, it is essential that prior to the launch of the next phase, i) the design- and construction details are optimized, ii) the cost/benefit reviewed, and iii) the longevity and sustainability are ensured by the construction quality of work and a tailored maintenance concept.

3 General Findings and recommendations

3.1 General

The project achievements go far beyond of providing new school buildings. The goal of the first project phase to reduce sustainably the long-term vulnerability of Cyclone-affected families by reconstructing child-friendly and safe schools is clearly met.

The architectural design integrates local knowledge and internationally recognized school design standards. Beside safety other main aims like child-friendliness by creating a motivating learning environment and multipurpose use of the buildings are achieved. The SDC team fully succeeded in converting the ideas and strategies as laid down in the original design options (e.g. to create generous, bright and well ventilated classrooms with solid and glassless doors and windows, etc.). Many "small improvements" like washable walls in classrooms, provision of drinking water for students and school bells indicate the added value to a pleasant school ambiance and show that the SDC team is experienced in school construction. Teachers benefit from their own room to

retreat, prepare themselves, and store teaching aids. Compounds are well fenced, planted with shady trees and equipped with dustbins. The project intervention in the target villages of the Delta can be seen as an important contribution to DRR and the valuable assets prepare the ground for a fruitful and prosperous development of the communities in the otherwise very remote area. SDC-HA has well-established social interaction with the communities, thus creating ownership. However, the long-term operation and maintenance concept is currently drafted and still needs to be finalized and introduced.

3.2 Assessment of construction quality

An assessment of the quality of construction was carried out on four visited schools in the Delta. Spot checks on structural frame, roof structure and finishing works indicate that the high quality standards expected by SDC-HA are fully met. It can be said that the buildings are safe from cyclones and flooding, and constructed sustainably and child-friendly.

The listing below of the findings might create the impression that the quality of construction is weak. This is clearly not the case. The consultant/back-stopper found that the quality of workmanship as seen in the virtually completed schools of the first phase is in general very good (ref Chapter 4.1 Unique Features). Nevertheless, while the structural parts that have an immediate impact on the safety of the schools are fully in line with international standards and building codes, a number of improvements on finishing works can be considered. Good options for improvements were found, discussed and agreed by the mission in the provision of WatSan facilities. Fortunately these improvements are technically easy to do and do not have cost implications (ref. Chapter 4.2 Technical Improvements).

3.3 Design considerations

The Master Plans (layout, school yard etc.) of the visited sites are sometimes a result of too many compromises. They can be optimized to meet with the requirements of sustainable and child-friendly schools. In cases of cluster schools of new and existing buildings the site layout can be improved by ways of orienting the various structures, e.g. toilets are too closely located too classrooms and extensions at a later stage are hardly possible, etc. However, it was also clear that compromises due to available land, adjacent housing or main weather directions set limitations.

Recommendation: The current Master Plans should be developed prior to construction and in more details by the project, signed by all stakeholders e.g. the education authorities, the school committee and SDC-HA. The Master Plan should be drawn to scale 1: 500 and should include the main measurements of compound, buildings, outdoor facilities, and further contain:

- Cardinal points
- Compound boundary (fencing) and main entrance gate
- Location of existing buildings (if any)
- Location of options for additional new buildings (with border margins)
- Location of external toilets (min 20 distance to schools)
- Option of further extensions
- Location of water source
- Power supply (if applicable and required, e.g. water pump)
- Road access, foot paths and escape routes
- Outdoor facilities (playground, football, volleyball, etc)
- Indication of nearby rivers, rocks, power supply, settlements, etc. (if any)
- Flag pole and location of school sign
- Landscaping, land-filling, and vegetable garden (if any)
- Waste disposal area (including dust bins, means for cleaning of feet/hand)
- Signature by all the respective stake holders

The WatSan component requires a re-design. The toilet design prepared by the national consultant is not sustainable and does not withstand in-depth cost/benefit considerations. In agreement and consultations with the project team, DS has developed a new design scheme in which drinking water and toilet water is clearly separated. Plumbing is reduced to a minimum and the sanitary apparatus are familiar in rural areas. The revised design scheme of the WatSan-Unit is attached in Annex 2. A scheme of rainwater harvesting system is reflected in Annex 3.

Recommendation: For future schools the new WatSan design developed by DS should be applied. In schools of Phase 1 the WatSan component should be examined, modified and improved wherever necessary. This is part of the earlier agreed "post construction support" as a built-in step in the project execution.

Land filling of school compounds as proposed in the original design options of the Planning Mission May/June 2009 was not done due to difficulties to obtain soil. The child-friendliness of the schools would be substantially increased if the annual regular flooding of the compound would not limit the free moving space of the students. Raised access walkways are made, but only partly meet this objective.

Recommendation: Consider land filling of school compounds in Phase 2 wherever possible (or at least parts of the compounds). Evaluate resulting costs versus benefits.

The Working drawings provided by the national consultant (S&A) were checked by DS. A good number of details in the designs should be optimized and mistakes on the drawing eliminated in order to have clarity when the contractors do the work. S&A will improve/rectify the drawings before December 15, 2010.

3.4 Cost / Benefit considerations

The multifunctional use of the buildings results in relatively high construction costs. Particularly the safety requirements of storm shelters call for higher construction standards than common schools (reinforced two story RCC frame). To build a house on stilts is costly and labor intensive and the modern spatial requirements envisaging child-friendliness have an impact on the construction budget. The fact that the building materials have to be transported by boat over long distances adds considerably to the costs of the schools too.

For the above-mentioned reasons the high construction costs of schools built under Phase 1 are justified. However, during the mission the team identified the following saving potentials:

The Toilet design as applied under Phase 1 is complicated and expensive. The new design as proposed in chapter 3.3.2 by DS is more basic and therefore more economical than the existing design.

Storm water management: in many cases the plinth gutters are not relevant since the water cannot be discharged outside the school compound due to the fact that the entire area is flooded in the monsoon season. Costs can be saved by either eliminating those gutters that cannot be discharged out of the compound or replacing them with some common plinth protection slab.

Layout/Arrangement of schools: In cluster schools with a high number of students two or several 2-classroom-buildings were erected. Wherever possible such arrangements should be avoided. Instead of constructing two individual 2-classroom-buildings one big school accommodating 4-classrooms would be more economical (ref. design of options Planning Mission 2009).

Roof overhang: the external ceilings out of fiber cement sheeting at fascia and eave side do not have any function except esthetical reasons. If socially accepted, they could be abandoned in future schools.

3.5 Integrated planning and coordination

In many schools built in the Nargis affected area of the Delta various investors and agencies like the Government, JICA, Metta, German Agro Action etc. were involved in the provision of education infrastructure without coordinating their activities. The marginal coordination among the implementing agencies results in a great variety of designs, quality standards and investments. Particularly the WatSan facilities combined with school construction are often not optimal. Local authorities do not have the technical knowhow and capacity to coordinate and emphasize on “best practice”. The School Discussion Group, set up by some INGOs ad hoc one year ago, brought some limited coordination and exchange of information. However, since many ended their projects, the forum is no longer functional and the authorities have not attempted to coordinate the reconstruction activities. Every donor is more or less free to apply their own design.

Recommendation: In the future, SDC-HA could take a lead among the agencies involved in school construction (in the Delta or even elsewhere) and support the Department of Education in organizing systematic and periodical coordination meetings at township or divisional level. The outcomes of these meetings could lead towards more transparent Education Plans available for all investors. Ideally, a national standard for schools construction would evolve. However, given the specific context of Myanmar and the humanitarian mandate of SDC-HA limits the policy support with the authorities. At this stage, this may have to be considered only if a shift towards development would take place. UNICEF, with its national program on education could provide a good umbrella for such an initiative. The fact that SDC-HA will be an implementing partner to UNICEF and will also construct education facilities in the Southeast could be an opportunity and entry point in this respect.

4 Conceptual and technical issues

The chapter 4 reflects some of the unique features of the project but also some of the technical shortcomings that can be improved in the next Phase.

4.1 Unique features

In terms of physical facilities the schools built by SDC-HA meet the requirements as defined by UNICEF in the document “***Manual Child-friendly Schools***”:

Structure: The building is structurally stable, weatherproof, covered with high quality roofing sheets according to local environmental conditions, climatically comfortable, easily exited in case of emergency and well integrated in the environmental and cultural context.

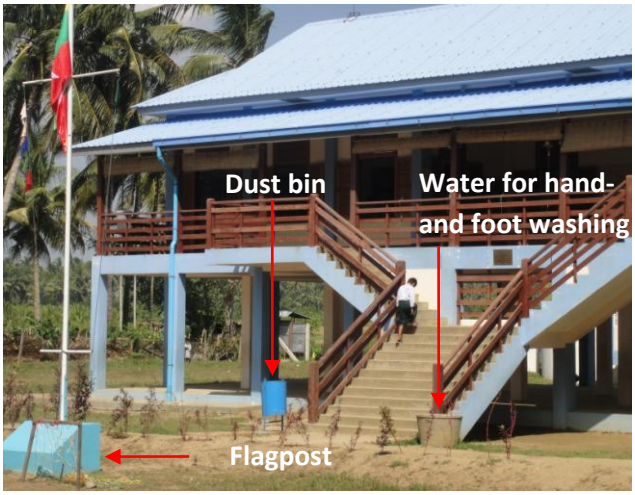
Light, air, sun, dust, glare, reflection, humidity: Classrooms have good fresh air circulation to avoid heat and excessive humidity. To ensure adequate daylight, more than 20% of the classroom floor area is window area. Classrooms are sufficiently shaded from direct sunlight, glare (direct light) and reflection (indirect light).

Administrative offices / Teacher's room: Separate space for teachers/administrative personnel gives privacy to teachers and maximizes the use of classroom space, enabling staff to work separately from students. Proximity between classrooms and administrative offices is given to monitor students' activities and create 'safety through transparency'.

Safe water: Potable water is available to students within the school fed by a rainwater catchment system in the roof and purified by Kathadyn filters provided by SDC-HA

Toilets/latrines: Separate toilets are available for girls and boys (the Watsan system will be re-designed)

Hygiene facilities: Separate space is provided for shoe racks and basins are available with water and soap for children to wash their feet/hands.



Compound: The planting of trees, shrubs and other mangrove vegetation within the school compound contributes to the ongoing process of **environmental regeneration** and protect these infrastructures. It further enhances ownership and pride in maintaining the assets.

Colors and finishes: Materials and finishes are in light, natural colors with materials selected in harmony by local, cultural preferences. For example, timber is finished using clear varnish to preserve the natural beauty and warmth of the material.

4.2 Technical improvements

Finding 1: Wooden columns of veranda roof and handrails

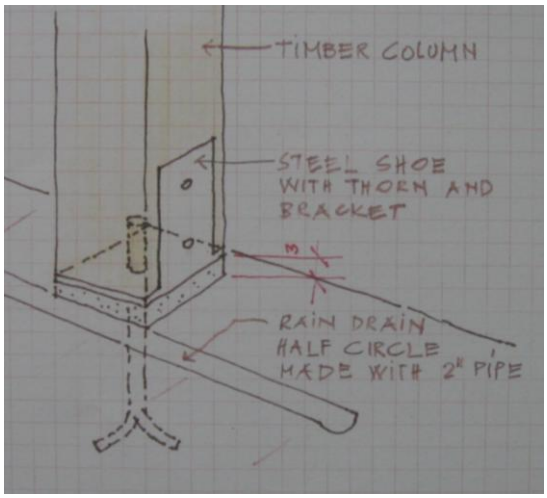
Shortcoming: the wooden columns are exposed to stagnating water at the base

Implication if not rectified: risk that the wooden columns will be rotten and reduce the stability of the veranda railing and roof.

Required improvement: the columns have to be out of stagnating water and placed on a steel plate or a concrete base.

Stagnating water at veranda columns

Damage due to stagnating water at veranda column of a 2 years old government school



Improve shortcoming by placing the column on a steel shoe and keep it well out of stagnating water (about 3 cm above the cement floor). Provide a rain drain all along the veranda

Finding 2: Sanitary appliances

Shortcoming: The school toilets are equipped with one western WC-pan (in consideration to provide access for handicapped), ceramic sink and urinals. The availability of enough running

water to flush these sanitary apparatus is very limited. Children and villagers in rural areas are not yet familiar with such appliances. Cultural context and common practice needs to be considered.

Implication if not rectified: Due to the scarcity of running water there is a risk that these modern sanitary appliances will not function.

Required improvement: All toilets (including teacher's and handicapped toilet) should be equipped with common floor pans (Asia type) that can be flushed with a water bucket. Urinals are not appropriate and unnecessary.

Appropriate floor pans flushed by bucket and fed with tap or shallow well

Finding 3: Roof gutter installation

Shortcoming: The roof gutters are not sufficiently fixed in a sustainable manner. The hooks are of poor quality and the distance in between is often too big.

Implication if not rectified: strong winds, heavy rains and hot sun will cause deformation of the gutters and make the use of rainwater impossible.

Required improvement: roof gutters must be fixed with solid hooks placed at a distance of max. 60 cm. The veranda roof gutter does not need a downpipe. The water can be discharged by an open outlet (Ausspeier) with an adequate open drain out of the compound. The discharged water could also be caught in a simple collecting tank and used in rainy season by children to wash their hands and feet before entering the classroom.

a = max. 60 cm

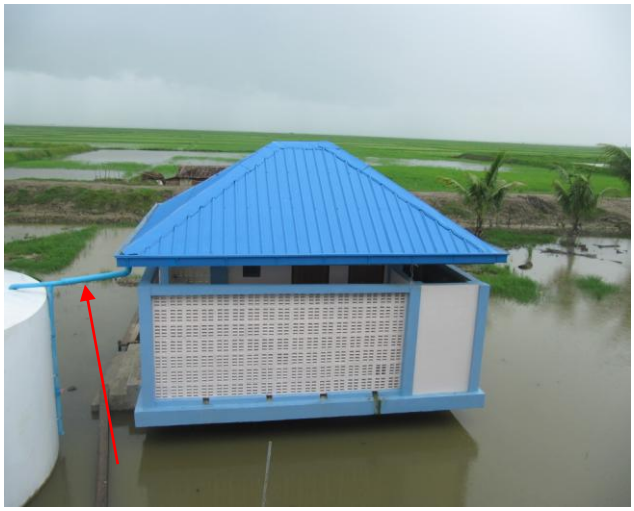
Result of poor roof gutter installation on a four years old school (not SDC built)

Finding 4: Roof water harvesting system (drinking water)

Shortcomings: i) The rainwater tanks (22,7m3) are fed through the relatively small roof of the toilet building instead of the main roof of the school. Hence the potential of a large catchment area is not utilized. ii) The piping of the inlet is weakly done and the outlets are equipped with poor quality of locally made taps. iii) Drinking water system and toilet water have the same source.

Implications if not rectified: The tanks will hardly be filled due to the limited catchment area of the toilet building. The taps, if uncontrolled or left open may drain the tank instantly.

Required improvements: The construction of roof gutters and the installation of a functioning and durable plumbing system require skilled laborers. GI plumbing should be considered. It is highly recommended to provide the toilets and the drinking water system with individual sources: the main roof of the school building should feed the drinking water tank. The toilets should be fed by water collected from the toilet roof and alternative sources such as shallow wells or pumping from nearby ponds for the dry months should be built if required (ref Annex 2). The tanks should – wherever possible – be located in a way that no horizontal piping is required.



Wrong water source: the small toilet roof feeds the big water tank while the water of the main roof of the school is not utilized

Unprotected plastic pipe, not sustainable

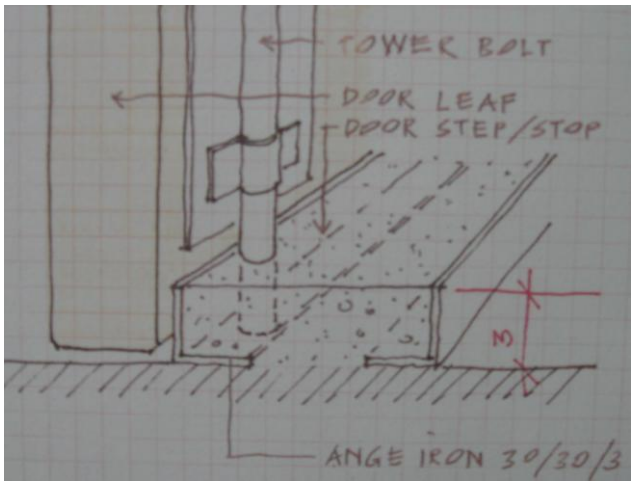
Complicated and expensive downpipe, not necessary, to be replaced by a simple outlet

Finding 5: Entrance doors to classrooms

Shortcomings: 1) The double wing door shutters have no proper stop at the bottom. 2) In cases of heavy rains and winds water from the veranda floor might spill into the classrooms.

Implications if not rectified: i) The guide for the tower bolt runner will get loose and the doors cannot be locked safely after some time. ii) No risk of structural of longevity problems.

Required improvements: Through the provision of a doorstep of 3 cm height (30/30/3 mm steel angle) the problems can be eliminated.



Finding 6: Classroom furniture

Shortcoming: The frame of the furniture is out of mild steel sprayed with paint. In some cases the paint has already faded away and the steel has become rusty after a few month of use.

Implication if not rectified: The steel frames will become unattractive and deteriorate after a short time.

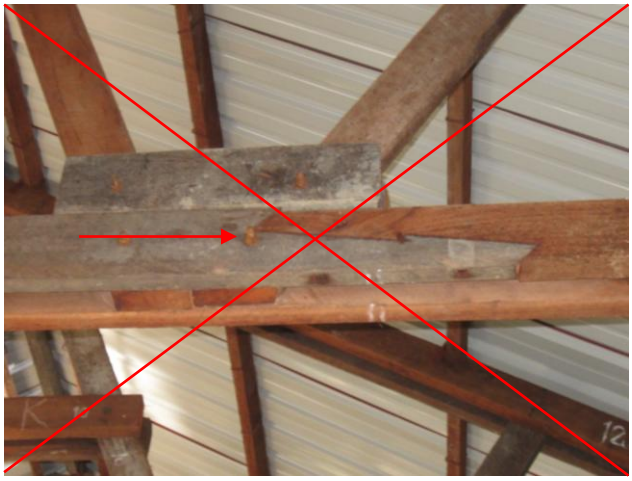
Required improvement: The use of mild steel (even if persevered) should be avoided wherever possible in the salty air of the delta. In the next phase only wooden furniture should be used.

Finding 7: Roof trusses

Shortcoming: The joints of the truss members are in some cases not ideally located.

Implication if not rectified: The load bearing capacity of the truss might be reduced.

Required improvement: As a rule of thumb, the joints of the horizontal member should be placed approx s/3 away from the diagonal joint.

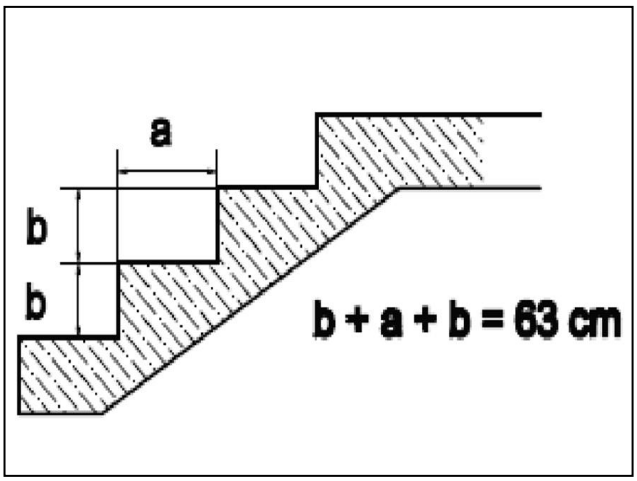


Finding 8: Staircase design

Shortcoming: The staircase is not designed according to common rules. The ratio between riser and tread is not appropriate.

Implication if not rectified: The shortcoming has no implication, the stairs are just uneasy to use.

Required improvement: The sum of the dimensions of two risers and one tread should be 60 – 65 cm, and the minimum dimension for the tread is 25. The steps of the stairs have to be re-designed. No change of the foundation is required.



Existing: a = 23 cm, b = 14cm → 23 + 14 + 14 = 51cm !

Finding 9: Location of green board

Shortcoming: The green board is not conveniently placed. Teachers need a step to utilize the whole board properly. Students can only use the lower part of it.

Implication if not rectified: No implication, just inconvenient.

Required improvement: Place the green board in future schools at a height between 75 to 175 cm above floor level.

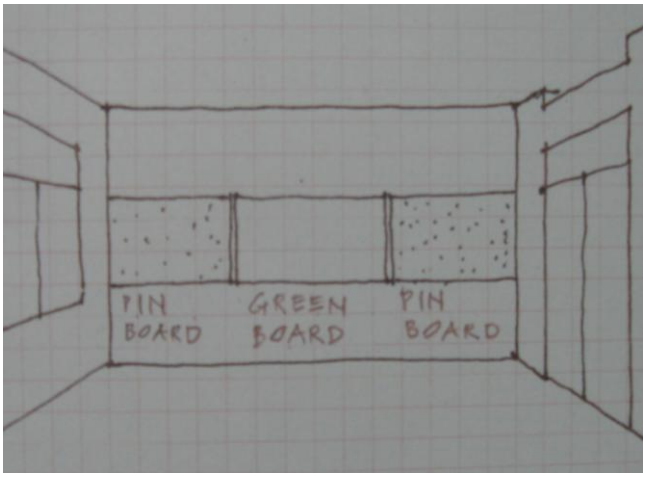
Finding 10: Pin-up area for posters

Shortcoming: The cement plaster of the classrooms walls does not allow an easy pinning up of posters and drawings, pictures, etc.

Implication if not rectified: White wash of the walls will peal off due to use of cello tape.

Required improvement: Install Pin Boards (enamel painted plywood or particle board) at the front wall of the classroom to make the fixing of posters easy.

Posters fixed with cello tapes on the wall plaster create ugly stains on the whitewash



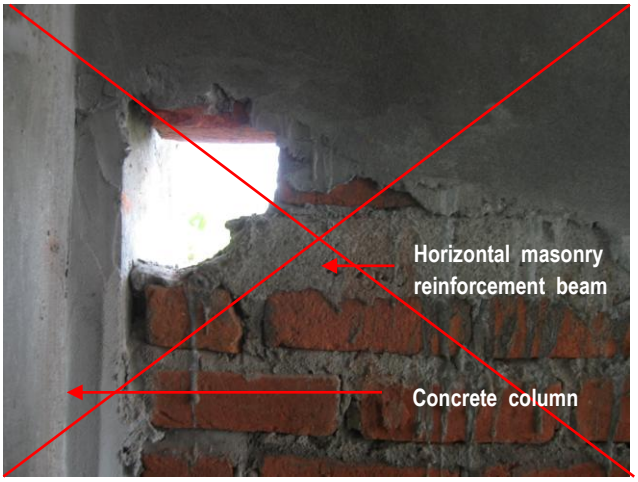
Pin boards on both sides of the green board (out of plywood or cork sheeting)

Finding 11: Wall masonry reinforcement

Shortcoming: In some cases the wall reinforcement beam at mid height of the walls is not connected to the concrete columns.

Implication if not rectified: There is a risk of cracks occurring in the masonry walls. Earthquake resistance is reduced.

Required improvement: Make sure that all the wall reinforcement is properly connected to the concrete columns. This detail must be visible on the working drawings.



In some cases the masonry reinforcement beam not connected to column

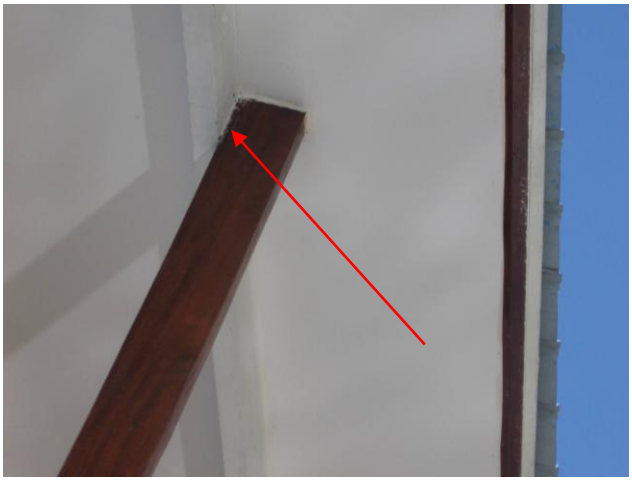
Correct connection between masonry reinforcement and column

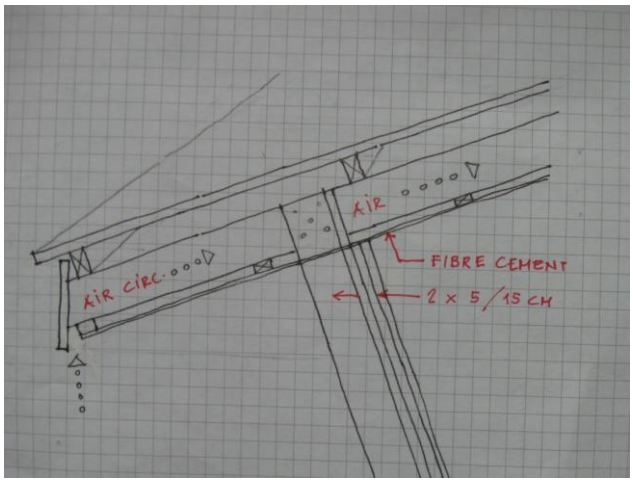
Finding 12: Purlin of side roof

Shortcoming: The purlin is fixed to the stand only by one bolt.

Implication if not rectified: The load bearing capacity of the structural frame is not utilized.

Required improvement: Replace single stand by a twin post and simplify roof structure as per the below sketch.





7 Conclusions and Lessons Learnt

Lesson 1: Combination of schools with the use as storm shelter

The successful implementation of Phase 1 gives evidence that the combination of safe storm shelters and child-friendly schools is unique and an excellent example of applied DRR. The communities consider this as an asset that provides a safe heaven in emergencies, thus the village gains also a "psychological" added value. SDC-HA schools serve as an excellent model for similar post disaster reconstruction project interventions in the region.

Lesson 2: Architectural design options

The investment in a well thought-out architectural design in the planning stage pays off. It is the basis for a successful and appropriate construction implementation.

Lesson 3: Quality of construction

Good quality of construction is possible also in remote areas under very difficult circumstances. The project design has considered the post construction support as an important aspect during the implementation and therefore allows optimizing and improving the assets from the experiences gained.

Lesson 4: Master-Plans

The availability of a complete Master Plan prior to the final approval of the school by SDC-HA is difficult to obtain. Construction activities should not be started unless a Master Plan is available duly signed by all stakeholders.

Lesson 5: Focus on schools, not only on buildings

*The SDC-HA team is advised not to focus only on "their" individual building but integrate the whole campus into the planning. As the project engages social mobilizers to interact with the community prior, through and post construction, the aspect of achieving a high level of ownership through what is considered as the **"Soft Component"** is an essential project component. The time during mission was too short to evaluate the project's achievements in this respect in detail. However, a number of indicators provided evidence that the project team is actively engaged in many activities, thus contributing to sustainable ownership by the school community. It was remarkable to notice the level of commitment by the mostly young female teachers.*

Lesson 6: Maintenance Concept

*Operation and maintenance and its awareness (considering the sustainability and longevity of the schools) still need to be improved. **Maintenance must be an integrated component.** The O&M concept should now be finalized in collaboration with the school community for all existing schools and prior to the start of the next Phase. The fact that SDC-HA maintains its team of social mobilizers along with the construction experts is an opportunity to accompany the communities while they*

learn on how to use and maintain their assets. There are positive indications by committed teachers and the establishment of a maintenance fund.

Lesson 7: Coordination among implementing Agencies

The problem of efficient coordination in reconstruction projects is well known. The local government is overstrained with the provision of meaningful Education Development Plans. ***SDC-HA could take a lead*** *among the implementing agencies and support the local Government in organizing systematic coordination meetings during the planning phase to optimize resources and introduce common standards of best practice.*

Lesson 8: Appropriate Technologies

"*Ready made" solutions of appropriate technologies do usually not exist in any given context. Each problem requires an individual planning (e.g. WatSan component). It is essential that the project maintains a "learning curve" and builds in improvements through the experiences gained.*

Lesson 9: Provision of drinking water

While for hygienic reasons the availability of enough domestic water is a must in schools, the provision of drinking water within the school compound for the community has to be well thought about. The provision of Kathadyn filters at each classroom seems to be common practice in the Delta and serves the purpose. Should SDC-HA intend to provide drinking water to the community beyond the schools, the supply systems have to be well separated. The use of the large storage tanks must be regulated and close monitoring during the coming dry season will provide the necessary experience whether expectations could be met in this respect.

Lesson 10: Do's and Don'ts in cases of emergencies

The utilization of the schools as storm shelters in emergency cases can easily end up in chaos or a disaster if the community is not trained. SDC-HA conducts training (mock drills) for the school community on how to use the building during natural calamities. Several organizations are equally active in this respect and good coordination will provide synergies.

8 Annexes

Annex 1 Mission Schedule

Annex 2 Preliminary Design of Wat/San Unit

Annex 3 Sample Scheme Rainwater Harvesting System

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
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Federal Department of Foreign Affairs FDFA
Swiss Agency for Development and Cooperation SDC
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Annex 1

MISSION SCHEDULE
BACKSTOPPING CONSULTANCY DANIEL SCHWITTER
RECONSTRUCTION OF SCHOOL/STORM SHELTER IN THE DELTA

Sunday 21 November 2010		
18.40	Arrival on flight TG 305 in Yangon, transfer to SEDONA Hotel	Zarchi Hotel reservation, Min Min to pick up airport
Monday 22 November 2010		
08.15 whole day	Pick up at Hotel for office, introduction to the SDC-Yangon Staff, handing over of drawings and other school/storm shelter related documents (Hard/Soft copies), security briefing,	Min Min / Peter / Thomas
Tuesday 23 November		
05.30? 05.50 06.00 10.30 11.00 13.15 15.00 17.30	Pick up Thazin Daniel at Hotel SEDONA (check out) Thomas/Peter at Marina, departure to Bogale by Taxi. Break in SDC office Bogale – Set San by speedboat, lunch. Look at the project activities Set San Set San – Tei Pin Seik by speed boat Arrival Tei Pin Seik, dinner and night stay	Thazin Daniel Thomas / Peter Kyaw Min Aung Kyaw Swer Hein
Wednesday 24 November		
08.00 11.00 12.30 13.45 16.00	Tei Pin Seik – Nyaung Lan Ngu (by motorbike) look at the project. Nyaung Lan Ngu – Aung Hlaing (by motorbike) look at the project. Aung Hlaing – Daw Nyein (by motorbike), lunch Daw Nyein – Myo Gone (by speedboat) look at the project Myo Gone – Tei Pin Seik look at the project Dinner and night stay	Thazin?/Kyi May Soe/Kyaw Min Aung Kyaw Swer Hein
Thursday 25 Novembe		
08.00 11.00 12.30 13.30 18.00	Tei Pin Seik – Ah Si Gyi (by speedboat) look at the project Ah Si Gyi – Bogale Lunch in Bogale Departure to Yangon by Taxi Check in SEDONA	Thazin?/Daniel/Thomas/ Peter
Friday 26 November		
10.00 13.30	Dr. Ye Myint MRCS Strand Road 5th floor Meeting with UNHCR in SDC office	Daniel/Thomas/Peter Daniel/Thomas/Peter

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Tei Pin Seik **+95 (0) 9 8595204**
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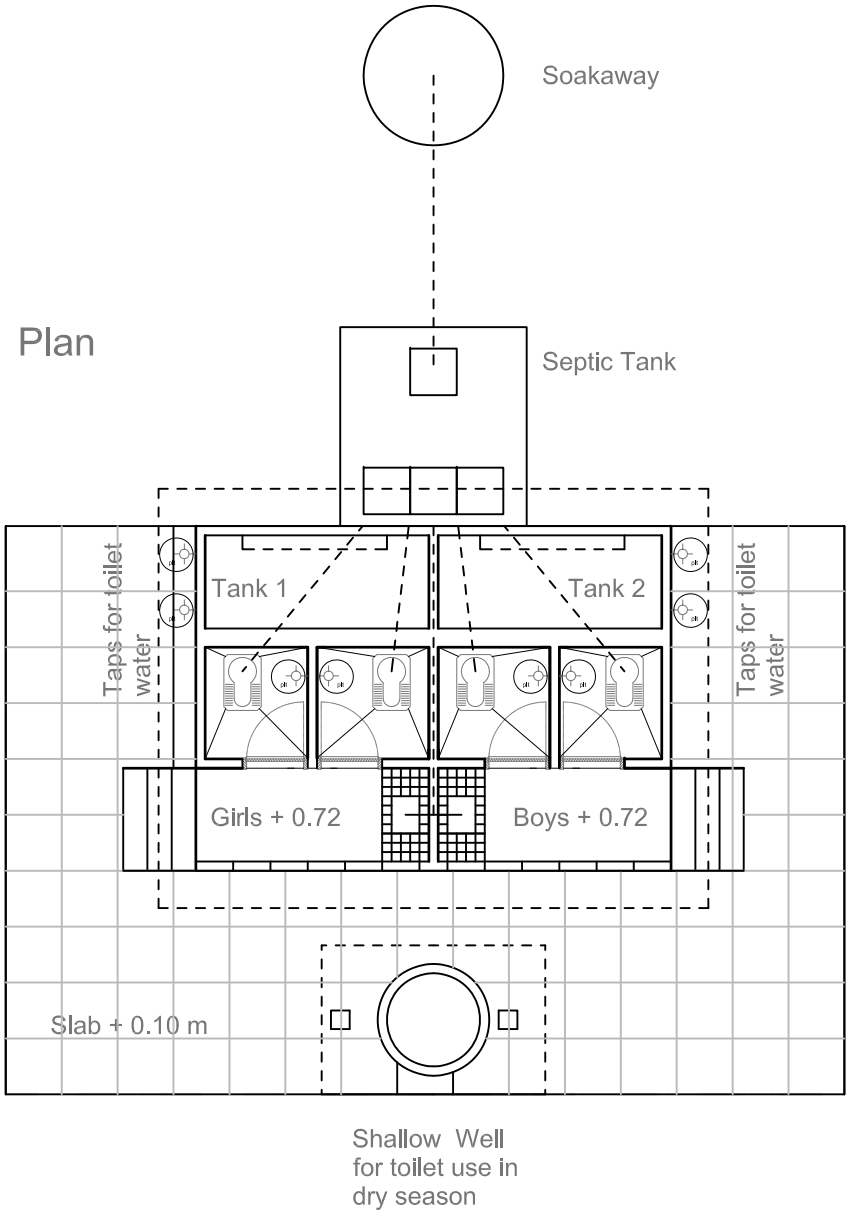
Plan



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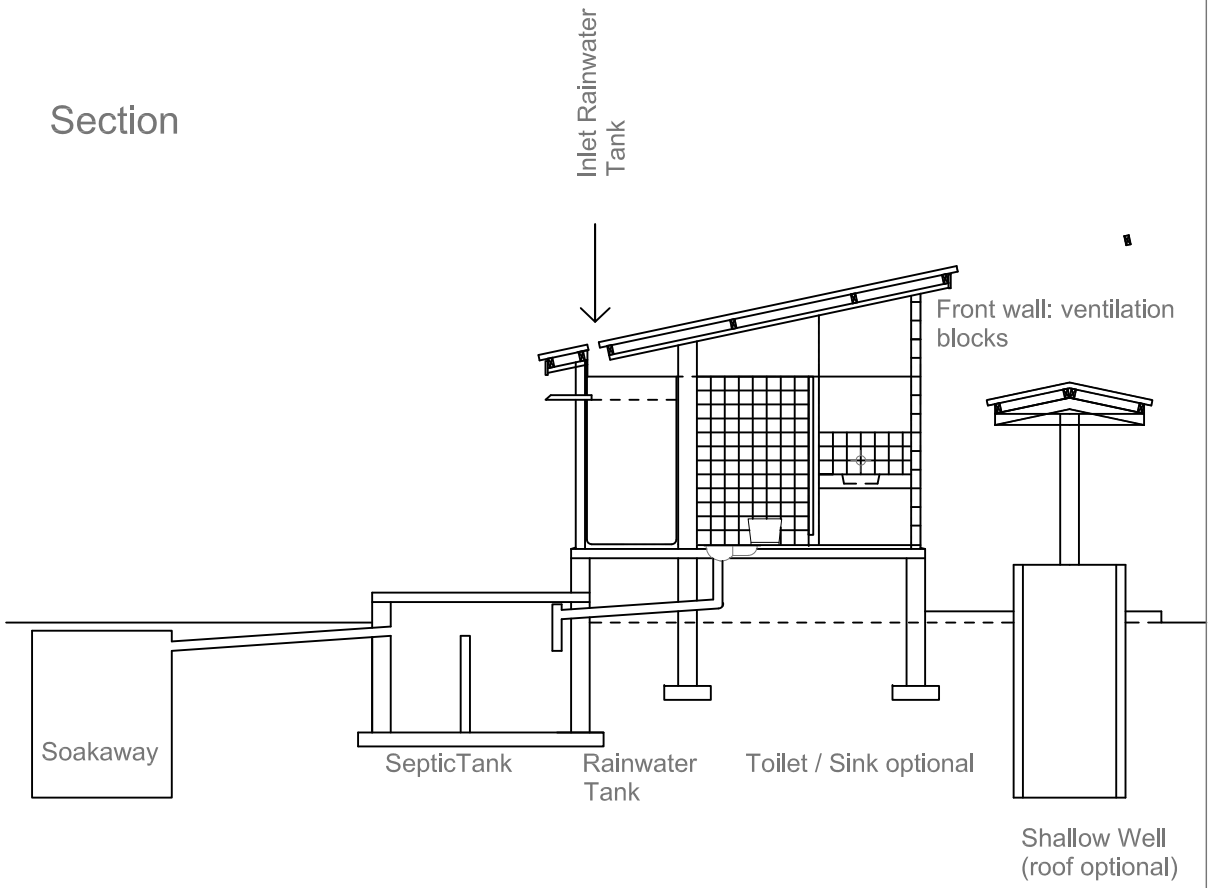

Scheme Rainwater Harvesting System

Annex 3