

Report on the in house survey for the Safer Schools Project, Ayeryawaddy and Yangon delta areas of Myanmar



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1. Summary findings and recommendations

Adults have faith that the schools are stronger and can serve as refuges. They consider that both the strengthened schools and the bamboo frame structures serve as a good model of safer construction.

Children also confirmed in their drawings that they are aware of the safety features.

The people interviewed indicate that after the harvest they will try and build new homes in early 2010 and will apply the principles of safe construction, but common opinion puts the cost of strengthening as being some 20% higher than is often the case, which is a deterring factor. *There is need for an information campaign to correctly inform people about costs and good practice.*

The average cost of strengthening work represents 20% of the value of the building. The average cost is 1 994\$.

The average value for strengthening work including animation events per child is 23\$.

Overall, the quality of the strengthening work is good. Some are excellent, with very good use of colour to highlight strengthening features. The capacity of the staff who have worked on the SSP represents an excellent capacity for wider application of DRR principles in buildings.

Of the 23 schools visited, only one had serious defects in the wall bracing in at Naulk Pyan Toe school, Mawgyun and needs correcting.

There are several general recommendations:

- In many instances, additional knee bracing to reduce the possible hinge effect between trusses and supporting columns should be added.
- There is a need to find a thinner metal profile to make straight and U shaped metal brackets easier to use and cheaper.
- Window leaves *often* are not good quality and don't shut. The field engineers need to go and check windows in each school and explain to local carpenters how these window leaves can be made to shut.
- Tower bolts on windows are often of poor quality. The field engineers need to assess the quality of tower bolts need replacing and these should be supplied and replaced.

Other more technical recommendations have been made in section 4.3.3. They principally concern the right choice of bracing in the roof frame and horizontally, and should be applied in any future school and ECCD for greater resistance and consistency.

2. Context:

On the 6th May 2008 Cyclone Nargis hit the Ayeryawaddy and Yangon delta areas of Myanmar causing very widespread destruction. 800 000 houses were destroyed and damaged, and 4 000 schools damaged or destroyed. Over the ensuing months huge efforts have been made to rebuild damaged infrastructure, and to support the initiatives of the population in rebuilding their homes.

SCiM and DWF assessed the challenge of assisting people rebuild in August 2008. They concluded that one of the best short term ways to develop knowledge about safe storm resistant construction was to demonstrate this through a programme of preventive strengthening of existing schools, buildings that had been quickly repaired after Nargis but that had not included making them safe structures. The Safer Schools Project, designed by DWF and implemented by SCiM, was started in November 2008. By late 2009 it will have strengthened 105 schools and trained hundreds of carpenters and masons in the process. The SSP has been based on the experience of DWF in Viet Nam where for the past ten years it has successfully promoted and demonstrated the preventive strengthening of public building and home to resist typhoons and floods based on the application of ten key principles of cyclone resistant construction.

In order to increase the impact and message about safe construction to the inhabitants, in January 2009 the SSP added the construction of small bamboo frame demonstration structure in the playground of each school, that shows how the principles of safe construction used in the schools (mainly timber frame or brick noggin structures) can equally be applied to the construction and

strengthening of homes built with bamboo, poles, „dahni“ thatching and bamboo mat walls. People interviewed during the Safer Schools Survey in November 2009 say that the bamboo frame structures can serve as model for making homes stronger, and some families have already done so. The SSP and the DWF ten key points have in turn influenced the design of the ECCD, which now incorporate safe construction details, and the development of two SCiM shelter projects being started in Middle Island and Hlaing Bone Township which apply the same techniques.

After one year of activity this report summarises the findings of an “in house” review undertaken by SCiM and DWF staff to assess the performance of the SSP. This took place from the 19th to 27th November 2009.

3. Review of the safer schools project

The objectives of the Safer Schools in house review have been:

- One year after the start of the project, to assess the quality and cost of the strengthening work that has been undertaken on a sample of strengthened schools (20%) and to identify where if necessary improvements and additional strengthening can and should be done either to the existing schools or to future strengthening work on other buildings;
- To assess public opinion about the strengthened schools, including that of children;
- To assess the degree to which the example of the safer schools and the bamboo frame structures can and have influenced house construction and strengthening in the community.

The review has been undertaken by two staff members from DWF (John Norton, director DWF, and Nguyen D.P. Hung, engineer) and two members of the SCiM Safer School team (Thinn Thinn Wai, engineer, and Kyaw Win Maw, engineer) with the participation of field staff in each township.

The survey covered 6 townships and visited 23 schools in the equivalent of 6 days;



- Hlaing Bone
- Kawmhu
- Laputta,
- Mauwgyun
- Myaungmya
- Pyarpon

The team carried out a technical survey of each school visited, and in 19 cases interviewed village leaders and builders, and in Pyarpon, teachers as well.

It has assessed the technical quality of the work, and made recommendations on improvements. The cost of strengthening work on the 96 out of 105 schools has been assessed.

Children were asked to express their ideas about the safer schools in drawings.

During the survey there has been a lot of discussion with field staff and village builders about ways to improve, including making on the spot decisions that have started to be put into practice.

A huge effort went into organizing the logistics of this survey and it is thanks to this effort that so much got done with an impeccable timetable.

4. The survey:

4.1. Questionnaire for village builders and leaders:

A questionnaire with 16 questions was prepared; some of the questions generated slightly ambiguous answers, but the overall results are summarized in the following table and are both interesting and satisfactory.

Summary of Reviewing on Safer Schools Assessment in 6 Areas

	Questions	Answers
1	What do different groups think about the strengthened school? Is it safe? Can it be made safer? And if so, how?	Villagers from only two out of the 23 villages mentioned that the strengthened schools were not safe enough (for example, concern about foundations in Hlaing Bone). The majority believed that the schools were strong and safe enough, and cited the diagonal bracing in trusses, M shape trusses with bolts and nuts, and bolts and nuts used under the floor beams.
2	What remains weak in the school?	Mostly in walls and windows since low quality wood and components are used there.
3	Was enough strengthening work undertaken?	Only 42% of strengthened schools had enough work undertaken to make them strong enough. Some of the suggestions were not directly related to safety (the school needed a floor); some for example wanted more bracing. <i>The survey team also found small additional works to be done.</i>
4	Can the school be used as a refuge? If not, why not?	Almost all of the strengthened schools were said to be useable as the refuge during a disaster.
5	What did you learn about safety and resistance to flood and storms? Do you think this is useful?	They learnt about 10 principles of safe building construction techniques, and they could apply those techniques practically.
6	Have any of the safe construction ideas/principles and techniques been applied by others in your community or by families as a result of the SSP? Where?	At the moment almost no households have used the techniques. 69 households (provided by NRC) out of 112 used some principles in one village. In another 20 families had apparently used the BFS techniques. One lady will build a new timber house using safer construction techniques before the rainy season and she already has the materials.
7	What do you/people think about the bamboo frame structure (if there is one)?	All the villagers satisfy with the bamboo model house when they compared that to normal bamboo house, ours are stronger and stiffer. (In one village, school children use the bamboo model house as their classroom) However, one villager said that the size of bamboo model house was not big enough for a normal family to live in.
8	Has anyone copied any these frame techniques and principles in their own home? If yes, why? If no, why not?	Only 20 HH use BFS techniques. Mostly, no bamboo house as yet applied our techniques because it was not the right time to build or rebuild their houses; they will earn some money after harvesting and they will collect materials and only then, they will strengthen their houses before the rainy season (April, May 2010).
9	In each discussion of workshop activities, do people know about the principles of safe construction? When/where did they learn these?	Yes, they understand 10 Key principles of Strong Wind Resistance Buildings from workshop discussion. They knew some principles before workshop but not systematically and most of the villagers did not know those principles before the workshops.

10	What can be done to improve the safety of homes?	Applying 10 Principles, they will put bamboo/ metal grids on the roof, separate roof, tie with rope, support with timber post, use Bolts and Nuts for connections, make enough opening (Windows and Doors), diagonal support posts, Plant windbreaker Trees
11	What can be done to make public building safer?	For public bldg, they will apply 10 Principles, will put bamboo/ metal grids on the roof, separate roof, tie with rope, support with timber post, use Bolts and Nuts for connections, make enough opening (Windows and Doors), diagonal support posts, Plant windbreaker trees and cut some branches not to disturb the buildings. They will repair walls, roof and put soil on base of the posts; and some bracing inside the building and floor will be supported with short timber posts.
12	Are there buildings that have been built or rebuilt in your community that are still not safe? How many?	More than 95% of the HH in each village are unsafe.
13	How would you maintain your strengthened school if some parts were ruined? Do you check your school before monsoon season every year? Who are responsible persons for this school maintaining works?	In some villages, they have good maintenance work; all villagers work together led by committee members. They will paint earth oil (to protect materials); tighten screw for windows and bolts and nuts for connections and will replace broken timber planks;
14	In this year 2009, are there any buildings that have been damaged by cyclone or other disaster? If has how they were damaged and what kind of building affected by natural disaster?	In 2009 Rainy Season, a few houses and cattle sheds were destroyed by strong wind & tornadoes. Plastic roofing sheets of a few houses were gone and cattle sheds were collapsed in one village.

For workshop and open day's reviews on workshop participants:

15	Was the time for explanation and training at the start of the project enough? What would you have liked to have been different?	Mostly they were satisfied with the workshop time and explanation of 10 key principles for safe building construction techniques. Some are demanding to take more time in order to understand more clearly.
16	Did people learn about safety features during the open days? If not, why? If yes, how many features they can learn?	All the villagers learned about strengthening techniques which we used in strengthened schools and bamboo houses; other villagers from nearby villages also learned. The villagers asked questions concerning the 10 key principles poster and particular technical person answered them.

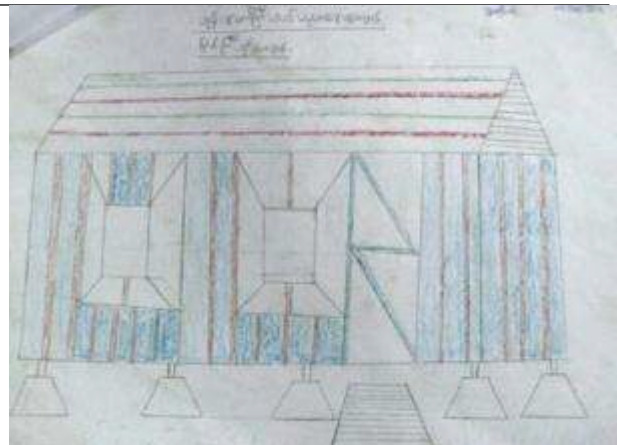
Assessor's Name: **Save the Children Education Team Staff**

Answering person and his/her duty: **Committee's Chairpersons, Secretaries, Members, Patrons, School Teachers and community members** from respective villages of each areas

4.2. Children

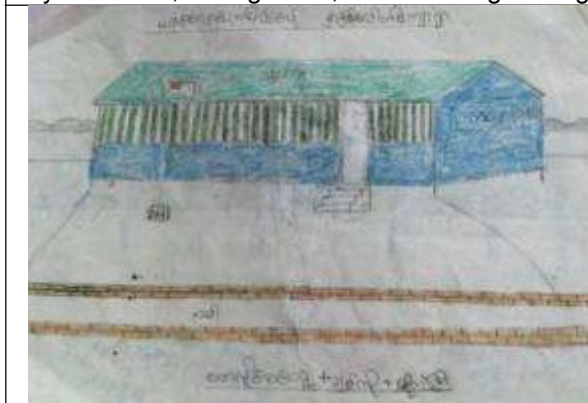
The survey asked, on average, 6 children of Grade 4 and Grade 5 students from each strengthened school and let them make drawings of schools in the before and after strengthening situation in A-4 size paper using pencil, ruler, colour pencils etc.

They described the main different features of school before and after strengthening during discussion. During assessment, school children showed their feelings and expressions on their schools' differences before and after strengthening as Children participation. All the children are satisfied with their strengthened schools and bamboo houses and they think that those buildings can be used as their refuge. They can clearly see the difference in the before and after drawings.



Myit Gui Boe, Hlaing Bone, before strengthening

Myit Gui Boe, after strengthening



Hnar Ngit Pauk, Hlaing Bone, before SSP

Hnar Ngit Pauk, after SSP



Atwin None Kaw, Mawgyun, before SSP

Atwin None Kaw, Mawgyun, after SSP

4.3. Technical assessment of safety features







4.3.1. The survey

The survey team assessed 23 schools and also visited a lot of ECCD buildings, many under construction.

The team checked the schools for conformity with the ten key principles of storm resistant construction, and for general comments on quality and resistance.

The table below summarizes the findings using this coding:

✓ : strong enough ☑ : Acceptable quality, need to be a little improved ☒ : bad quality, need much improvement

	Point 3: Keep roof angle above 30°	Point 4: Separate roof, avoid large roof overhang	Point 5: Good connections	Point 6: Diagonal bracing	Point 7: Fix roof down	Point 8: Opposing openings	Point 9: Window/door leaves shut
							
1. Kyune Kwin Laputta	✓	✓	☑	☑	✓	✓	☒
2. Poe Thin Laputta	✓	✓	✓	☑	✓	✓	☑
3. Kyune Chaung Laputta	✓	☒	✓	☒	✓	✓	☑
4. Amat Kalan Laputta	✓	✓	✓	☑	✓	✓	☑
5. Yae Twin Gone Laputta	✓	✓	✓	✓	✓	✓	☑
6. Zalat Kwin Myuangmya	✓	✓	✓	☑	✓	✓	☒
7. Ohm Pin Myuangmya	✓	✓	✓	✓	✓	✓	☒
8. Shan Chuang Myuangmya	✓	✓	✓	✓	✓	✓	✓
9. Aukkabar Pyarpon	✓	✓	☑	☑	☑	✓	✓
10. Nget Ka Lay Pyarpon	✓	☑	✓	☑	✓	✓	✓
11. Naung Taw Gyi Pyarpon	✓	✓	✓	☑	✓	✓	✓
12. Kanaso Chaung Hlaing	✓	✓	☑	☑	☑	✓	☒

Bone							
13. Pho Pan Hla Hlaing Bone	✓	✓	✓	✓	✓	✓	✓
14. Myit Gui Boe Hlaing Bone	✓	✓	✓	✓	✓	✓	☑
15. Ywaw Thit Hlaing Bone	✓	n/a	✓	✗	✓	✓	✓
16. Yay Cho Gone Hlaing Bone	✓	☑	✓	☑	✓	✓	☑
17. Hnar Ngit Pauk Hlaing Bone	✓	✓	☑	☑	✓	✓	☑
18. Myit Tan Gyi Hlaing Bone	✓	✓	✓	☑	✓	✓	✓
19. Nauk Pyan Toe Mawgyun	✓	✓	✓	✗	✓	✓	☑
20. Atwin None Kaw Mawgyun	✓	✓	✓	☑	✓	✓	✗
21. Tant Ngu Mawgyun	✓	☑	✓	☑	✓	✓	✓
22. Kung Yan Gone Mawgyun	✓	✓	✓	☑	✓	✓	✗
23. Aung Ze Bu Kawmhu	✓	✓	☑	✓	☑	✓	✓
SUMMARY	✓	✓/☑	✓	☑/✗	✓	✓	✓☑✗

4.3.2. Conclusions

Overall, the quality of the strengthening work is good. Out of twenty three schools, only one had serious defects (in the bracing on the walls). In some instances the work is excellent and imaginative. This is a credit to the field teams and the Yangon engineer management team. It also represents considerable individual progress during the past year with some of the field engineers gaining both in confidence and technical knowledge.

The SSP has developed an important capacity to identify and undertake DRR work for making building stronger and safer.

Several schools visited in Hlaing Bone have made very good use of colour to highlight the safety features and make it very clear what has been done, highlighting u shaped brackets in green paint and straight brackets in blue, and bracing in red. No one can fail to see these strengthening items.

Popular reactions: the population appreciates what has been done, and believe that the schools are stronger, and can serve as a refuge in many cases. There is wide recognition that the bamboo frame

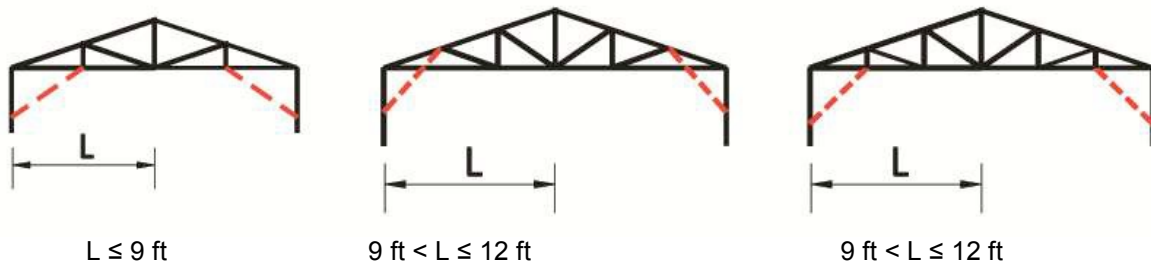
house serves as a model for safer houses, and there are already a few families who have copied these ideas.

4.3.3. Technical points:

Bracing: Out of 23 schools, 17 required some additional bracing, and in one instance at Naulk Pyan Toe school, Mawgyun, the wall bracing was defective, (there was no possible resistance to deformation, in part because the brace had been simply nailed to the bottom and side rail, and that the top horizontal brace was missing). Overall, the survey noted that there were many different interpretations in the way longitudinal bracing is done (the bracing that goes from one end of the classroom to the other), and that in some instance the choice made was not the best one, and overall the variety of choices could only be confusing to external observers, including the public.

Techniques :

Need knee-bracing for all trussing

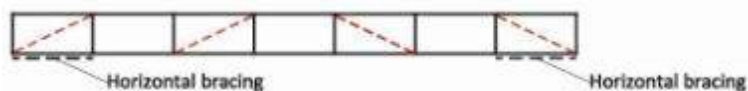


Vertical diagonal bracing at 2 end of building



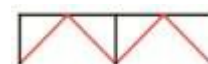
With timber bracings $\leq 2\text{ft} \times 3\text{ft}$

Or



With timber bracings / $2\text{ft} \times 4\text{ft}$

The following configuration should be avoided, as it makes the top horizontal ridge piece weaker.



Horizontal bracing



During the survey recommendations were made for adding knee bracing and horizontal bracing under the lean to structures to reduce the possible hinge effect between trusses and supporting columns, and this needs to be done comprehensively in all schools.

Roof eaves overhang need to have suitable bracing to bear the load beneath cause of strong winds, and overhangs on the gable end wall should be less than 1'6".

Window leaves:

Doors and windows have enough top bolts and bottom bolts, can be shut from inside



Window-handles should be in a line so in case of typhoon, we can put a timber bar to shut it ...

The window leaves on 14 schools were not very good, and in 6 of them very poorly made and would not shut.

The field engineers need to go and check each school and explain to local carpenters how these window leaves can be made to shut.

Tower bolts: With few exceptions, the tower bolts on the windows are very weak, some are broken, many bent.

The field engineers need to assess the quality of tower bolts need replacing and these should be supplied and replaced.

Building materials: On some schools the quality of building materials has not been very good, and this has been mainly a concern with planks for walling.

Because of lack of suitable materials, the metal straps are made thicker than they need to be (sometimes 3mm instead of 1mm), so they have to be pre-bended and can only be easily installed before roofing, and this is difficult on existing schools. (Cost more money on material and labour). *There is a need to find a thinner metal profile for this to make brackets easier to use and cheaper.*

Foundations: The people we spoke to said that more could have been done about foundations, to hold the building down, and in Hlaing Bone steps are being taken to put in an underground ring beam linking all the supporting perimeter posts, which is considered a good and proven measure in HB to help buildings resist. However, this is quite a difficult procedure on an existing building, and may not be applicable in many instances.

Key point 10: The villagers have the intention of planting trees for protecting the school.

The specific technical recommendations that have come out of the survey, concerning bracing in the roof frame, concerning window security, should be applied to the ECCD building as well.

The Safer Schools technical handbook is being revised to take account of these changes.

4.4. The cost of strengthening the schools

The team has analysed the costs of 96 out of 105 schools. The remaining schools were not complete at the time of the survey, and will be added.

The analysis has taken each school, and, using its plinth area (ft²) (the floor area of the building) determined its construction value (plinth area value/PAV) for the type of construction that has been used: timber frame, brick noggin, brick pucca and RC concrete. This gives an overall unstrengthened value for the classroom (what it would cost to rebuild the room if damaged by a future Cyclone).

The costs of strengthening work has divided by the PAV to establish a percentage value for the strengthening work – eg, 20% of total unstrengthened value to make the school safer. This has also been shown as a USD value of strengthening, and finally, the cost of work done per child using the classroom.

School name	Township	Dimensions	N° Pupils	Type	Construction	Ft²	PA value in Kyat	Strengthening costs kyat	%	Work done	Value Kyat per child	Work cost in USD
The Pyu San	Kun Chan Gone	(L/W/h) 30' x24' x10'	130	Primary School	Timber frame	720	5 760 000	937 000	16 %	Stronger walling & roofing	7 208	\$ 937

Overall, the average figures are:

- Average strengthening cost: 1 993 797 Kyat / **1 994\$**
- % strengthening costs: **20% of PAV**
- Strengthening value per child: 23 267Kyat / **23\$**;

The lowest strengthening % was 6%, the highest 48%, in the latter case where the school has essentially had to be rebuilt.

The average strengthening % of 20% represents remarkably good value for money.

4.5. Impact on how people are or will build stronger safer houses

The survey showed that the example of the strengthened schools and the bamboo frame house has been well appreciated, but that the opportunity to fully capitalize on the achievements in terms of encouraging inhabitants to follow the example has not really been sufficiently made use of.

The “open days” when each school is complete have drawn in many participants from the target village and from other villages. There have been other forms of disaster risk reduction activities with the children, but little directly concerning encouraging making people strengthen their homes.

During the interviews (see above) people said that last year/season there was little opportunity to build houses - as opposed to getting some sort of basic shelter - and they indicated that people now hope that after the 2009 rice harvest and once they have generated income from this, people will have the opportunity, really for the first time since Nargis, to turn their attention and scarce resources to the question of getting a better home, beginning by acquiring the building materials they will need, and then by starting to build in April and May before the next monsoon period. People say that they will apply the ten key principles of safe construction when they do start to build, but there is popular concern that the safety features cost too much – although this extra cost is generally exaggerated and higher than reality. In practice the costs of school strengthening has averaged at 20% of the basis building value, and

The survey team are therefore proposing to launch a “Safer Construction information and support campaign” in the villages where the SSP has already strengthened schools. The aim is to encourage as many people as possible to rebuild safely.

The campaign will aim to demystify the costs and components of strengthening, so that people can clearly appreciate that the additional effort is not too expensive compared with the risk of not doing it.

A concept note is being prepared for the proposed safer construction information campaign for 2010.