LIBERIAN PRIMARY EDUCATION RECOVERY PROGRAMME

PRIMARY SCHOOL INFRASTRUCTURE EXPANSION & IMPROVEMENT

Education Facilities Construction Specialist's Report
October 2008

LPERP: Primary School Infrastructure Expansion and Improvement
Education Facilities Construction Specialist's Report: October 2008

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SUMMARY OF REPORT

Primary School Design and Construction: The Current Situation

Liberia's primary schools experienced massive destruction during the recent civil war and there has been no large-scale primary school construction or renovation project since the early 1980s. The needs of the primary sector in terms of the numbers of classrooms that have to be reconstructed, renovated or extended are therefore very large.

One of the tasks of the Division of Educational Facilities in the Ministry of Education is to manage school construction. The Division has however been much run down over the years and its capacity to manage a large-scale school construction project is now doubtful.

There are at present two standard designs in use for primary schools and both designs have issues concerning design, construction and cost. It should be noted that the same classroom design is being used for both pre-schools and primary schools even though the needs are quite different. It should also be noted that the standards for physical facilities contained in the 'Education Sector Operations Manual' are inappropriate and require updating.

There are a number of non-governmental agencies currently involved in primary school construction and these include: the [redacted] which is using funds from the World Bank and the Liberia Educational Trust; NGOs such as Peace Winds and ZOA that use overseas government and privately donated funds and the Liberia Community Infrastructure Programme that uses USAID funds for school construction. There are also agencies such as [redacted] that would like to be involved in any school construction programme. There are issues with all these agencies such as the standards to which they construct schools, the designs they use and the locations of the schools that they construct or renovate.

While the DEF does not have at present the capacity to manage a large primary school construction programme, MOE has advertised for technical assistance to be provided by a local firm of civil works consultants. Although the advertisement is rather confusing, this TA could possibly assist the DEF to manage a small number of schools. There has also been a suggestion that the Special Implementation Unit in the Ministry of Public Works could be involved in school construction but it appears that they do not have the capacity to do this.

The number of competent contractors in Liberia is low and the capacity of the smaller contractors who carry out most of the work in the rural areas to construct school facilities without intensive management and supervision is doubtful to say the least.

The cost of construction in Liberia is comparatively high and is rising as there are few locally available materials and the cost of imported materials is very high. Good quality materials are especially hard to find.

Liberia Primary Education Recovery Programme

The MOE developed the Liberia Primary Education Recovery Program (LPERP) in March 2007 to meet the challenge of rebuilding Liberia's primary school system.

LPERP is financed through the regular Government of Liberia budget and the Liberia Education Pooled Fund which is a multi-donor funding mechanism established by Government and its development partners. Infrastructure expansion and improvement is the largest LPERP component at approximately $23 million over three years.

The magnitude of the investment required to eliminate the infrastructure deficit is too large to be fully addressed in the three-year implementation period of LPERP and the strategies, systems and approaches for expanding and improving school infrastructure developed through the implementation of LPERP should enable the MOE to continue the required expansion post LPERP in an efficient manner.

No infrastructure work was undertaken under LPERP in 2007/2008 and the time available for infrastructure work in 2008/2009 is now very limited and if the targets are to be achieved the programme will probably have to be extended into 2010/2011.

Implementation of the 2008/2009 LPERP Primary School Construction Programme

The window of opportunity to implement the proposed 2008/2009 primary school construction programme is now very small and there are a number of critical activities that will have to be carried out before construction can start.

Before these activities can start however, a decision has to be made as to the number of schools (and their locations) that will be included in the first year programme and how the construction will be managed. It is suggested that because of time and capacity restraints, the number of schools to be constructed is kept fairly low and that a number of agencies are used to manage the construction. These could include [redacted] and local NGOs.

The most critical activity is the selection of the actual schools to be included in this year's programme and this activity should, if at all possible be completed by the end of October 2008. Only schools requiring new buildings should be selected to avoid the necessity of surveying existing buildings that will require renovating and thus saving on time. Guidelines will be given to the agencies actually implementing the construction work for the setting out of the new buildings on the various sites.

While there is an urgent need to provide revised designs for primary schools, there is not sufficient time to do this before the construction of new schools has to start. It has been agreed therefore to use the existing design prepared by DEF for use by [redacted] for the schools to be constructed this year with some modifications to reduce costs and simplify construction. Revised designs and the necessary documentation will however have to be prepared this year for the 2009/2010 construction programme (see below).

It will not be possible, because of the time constraints, to engage international consultants to assist with the management of the construction programme this year and a number of other agencies will therefore have to be used and these could include DEF, [redacted], local NGOs and possibly [redacted].

It is proposed that a technical assistant to be provided to DEF by a local civil works consultancy firm, [redacted] and some NGOs are used to manage the school construction in 2008/2009. Agreement will have to be reached with [redacted] and the NGOs on the number of schools they are to manage, their management costs, etc.

The procurement and construction programme is extremely tight and any delays especially in the selection of schools to be included in the programme or the engagement of [redacted] and the NGOs will probably mean that construction will not be completed before the start of the 2009 rainy season.

Implementation of the 2009/2010 LPERP Primary School Construction Programme

Preparation work for the 2009/2010 primary school construction programme should start as soon as possible even before the 2008/2009 programme is implemented. This programme will have to be much larger than the 2008/2009 programme and will probably continue into 2010/2011 and the DEF will require a great deal of technical assistance in implementing it.

The MOE should as soon as possible identify the schools to be included in the 2009/2010 construction programme and in particular, those schools that will require renovation and/or extension. These schools will have to be surveyed and a local civil works consulting firm (or firms) should be engaged to carry out this work in order to establish what work is required at each school and document it before the next rainy season so that the bidding process for all of the sites can be carried out during the rainy season i.e. from June to September 2009. The process for the schools where only new buildings are required can be similar to that for the 2008/2009 programme i.e. guidelines can be given to the agencies managing the construction process on the location and setting out of the buildings on the sites. The number of schools to be included in the 2009/2020 construction programme will have to be much greater (100/150 schools) than that for the previous year.

It is proposed that to reduce costs the present primary school designs are revised and proposals have been made for these revisions (see Annex 5). It was not however possible to reach an agreement between the consultant and the DEF on the design to be used in future during the September/October mission. Detailed costings will be prepared by DEF for two different designs and a decision will be made on which design to use during the next mission in December 2008.

It is also proposed that the MOE hires an international consulting firm with extensive experience of the design and construction of school facilities in the tropics and of the management of large school construction projects to provide technical assistance to the DEF in both managing the construction programme and in providing technical assistance, training and capacity building to the DEF in order that it can carry out its proposed functions in the future in a professional and competent manner.

The Future Role of the Ministry of Education's Division of Educational Facilities

The role of the Ministry of Education at this stage of the development of the country should be to manage the education system not to set itself up as an agency involved in the construction of educational facilities.

The DEF's role in the Ministry should therefore be to: set space and quality standards for educational facilities at all levels; procure the services of consultants to design and supervise the construction of educational facilities; monitor the performance of consultants and contractors and any other agencies involved in school construction programmes; assist the EMIS division of MOE in the management of a school facilities register; manage the maintenance programme for MOE facilities; manage any essential small works that the MOE requires that it is not economic to employ consultants to carry out.

There is an urgent need for the development of the capacity of DEF and other divisions in MOE to enable them to carry out these tasks and the services of an international civil works consultancy firm with extensive experience of the design and construction of educational facilities in the tropics and of the management of large-scale school construction projects will be required to do this.

Next Steps

The Ministry of Education needs to take a number of steps immediately if any construction is to take place in the 2008/2009 dry season and these include:

- The selection of approximately 80 rural primary schools all of which require a complete new 6-classroom school. For simplicity at least for this year no renovations of schools should take place. The selection of actual school sites should be completed by the end of October 2008.

- The amendment of the MOE school design at present being used by [redacted] so that it can be used for this year. The outside kitchen and the connecting covered ways should be omitted so that the cost is reduced and the positioning of the buildings on the site can be simplified. The designs should be revised by the end of October 2008. There will not be time to carry out surveys of the sites and guidelines should therefore be prepared by DEF on the location and arrangement of the buildings on the sites.

- Reaching agreement with [redacted] to manage the construction of 60 schools, 4 in each county. This agreement should include the cost of [redacted] management of the construction process including all overheads. [redacted] will be provided with the revised design for the schools and the exact location of each school. The agreement should be finalised by mid-November 2008.

- Reaching agreement with any NGOs interested in and with experience of primary school construction such as Peace Winds and ZOA, to manage the construction of a maximum of 2 schools each. This agreement should include the cost of their management of the construction process including all overheads. The NGOs will be provided with the revised design for the schools and the exact location of each school and will have to construct the schools to an acceptable standard i.e. at least to the standard of the [redacted] schools. The agreements should be finalised by mid-November 2008.

- Reaching agreement with [redacted] if an acceptable cost can be agreed, to manage the construction of 10 schools. This agreement should include the cost of [redacted] management of the construction process including all overheads. [redacted] will be provided with the revised design of the school and the exact location of each school. The agreement should be finalised by mid-November 2008.

- Reaching agreement with the local firm of consultants selected to provide technical assistance to the MOE to provide a much more limited number of services than set out in the request for expression of interest. See details in main report.

Further steps need to be taken as soon as possible by the MOE to facilitate the construction process for 2009/2010 and these include:

- Initiating as soon as possible, the process of engaging an international firm of consultants to assist them with managing the school construction process and with building capacity particularly in the Divisions of Facilities and Procurement as set out in the main report.

- Identifying the schools to be included in the 2009/2010 construction programme and in particular, those schools that will require renovation and/or

extension. These schools will have to be surveyed and a local civil works consulting firm (or firms) should be engaged to carry out this work in order to establish what work is required at each school and document it before the next rainy season.

- Reaching agreement on the revised designs and standard buildings to be used for primary school construction in 2009/2010.

MAIN REPORT

Primary School Design and Construction: The Current Situation

Provision of Primary Schools

Liberia's primary schools experienced massive destruction during the recent civil war. Public and community schools were worst affected with 31% of public and 24% of community schools totally destroyed. A further 16% of public and community schools experienced major damage and only 45% of classrooms in the public sector are in good condition or only require minor repairs. This accounts for the extremely high learner-classroom ratio in public and community schools which is more than 300:1. Furthermore 30% of public primary schools have temporary classrooms made from local materials such as thatch and bush sticks and even where classrooms do exist, large numbers of pupils have to sit on the floor. In public and community schools only 22% have chairs or benches compared with 58% in private and mission schools.

The needs therefore of the primary sector in terms of the numbers of classrooms that have to be reconstructed or renovated and the numbers of schools which have to be extended or constructed are very large.

Ministry of Education, Division of Educational Facilities

One of the tasks of the Division of Educational Facilities (DEF) in the Ministry of Education (MOE) is to manage school construction but its staffing level is low and its capacity to manage a large construction programme is doubtful as it is many years since such a programme has been attempted. The DEF seems in fact to be having problems managing and supervising the current small government-funded school construction programme due to the lack of trained staff, transport and resources.

Designs for Primary Schools

There are at present two standard designs for primary schools being used by the MOE and other agencies. One design, which was originally developed by DEF has three main buildings that accommodate nine classrooms, three of which are pre-school classrooms, a small office and two very small stores for the principal. There is also an outside wood-burning kitchen and separate pupils' and staff toilets. All buildings have front access verandas and all buildings are connected by covered ways. The three main buildings are placed around a courtyard with the result that whatever the orientation of the buildings, at least one of them will face east/west. It also means that if the buildings are constructed on a sloping site at least one of them will have to have stepped foundations and roofs adding greatly to the cost of construction. This design is also being used by [redacted] (see below) but only six classrooms are being constructed in an L-shape with a covered link at the corner.

The other design has been developed by the DEF and consists of four main buildings accommodating nine classrooms, (including three pre-school classrooms); a cafeteria, store and service area; a reading room (including a librarian's office) and an administration unit with an entrance, registrar's office, store, production room, teachers' room and principal's office. There is also an outside wood burning kitchen and separate pupils' and staff toilets. The buildings are arranged on four sides of a central courtyard and all buildings have front access verandas and are connected by covered ways with quite complicated roofs. The result of this layout of the buildings is that at least two buildings will be facing east/west and if the buildings are constructed on a sloping site then at least two of them will have to have stepped foundations and roofs again adding greatly to the cost of construction. It should also be noted that the inclusion of many more facilities in this design, the necessity of which is doubtful for many rural primary schools, will also greatly increase the cost of each school and reduce the numbers of schools that can be constructed with any given budget.

It should be noted that in both designs there is no differentiation in either size or design between the pre-school and the primary school classrooms. In the long term at least, this should be reconsidered as the needs of pre-school and primary school children are quite different and the design of accommodation (which should not be considered as 'classrooms') for pre-school children should be quite different to that for primary schools.

It should also be noted that the standards for physical facilities set out in the 'Education Sector Operations Manual' are very vague and mainly inappropriate. These urgently require updating and more realistic standards need to be set.

A detailed review of the design and construction of the schools and the issues raised by both school designs is given in Annex 1.

There is a proposal to construct 'auditoria' in primary schools similar to the central covered space in the Oluremi Tinubu Elementary School (see Annex 3). This raises a number of issues including cost and these issues are discussed in Annex 5. If an auditorium is required in a primary school and can be afforded, it would probably best be provided as a separate building.

Agencies Involved in Primary School Construction

Besides the MOE, which has a very small government-funded school construction programme, a number of other agencies are or have been involved in the renovation or construction of schools. These include the [redacted] which is a para-statal organisation and NGOs such as ZOA, Peace Winds, International Rescue Committee (IRC), etc. USAID has renovated schools through the Liberia Community Infrastructure Programme (LCIP) and other

agencies such as UNDP and UNHCR also construct or renovate schools (sometimes using [redacted]) or provide funding for school construction in a fairly ad-hoc manner.

Of these, [redacted] is the most important agency presently involved in school construction. Since its establishment by the government in 2005 it has constructed or renovated more than 50 schools and intends to build more schools this year. It uses the first design described above (but only constructs six classrooms) and it is estimated that the cost of this school this year will be around US$90/100,000 (US$15/17,000 per classroom). The standard of construction is quite high and [redacted] could be involved in the MOE's construction programme. They are however now engaged in a large number of other projects and while their capacity to manage and supervise additional schools is limited they are very keen to be involved in the programme.

There are a number of NGOs involved in school renovation and construction but it was only possible to visit schools constructed by ZOA who have constructed around 50 schools in recent years. The budgets for these schools are very small (formerly between US$18,000/20,000 and now between US$28,000/30,000 for a 6-classroom school) and consequently the standard of construction is quite low and the classroom sizes are well below the MOE standard. The budgets that the other NGOs are using are also very small so it is suspected that the standard of construction of these is probably not very good and the size of classrooms is also probably below standard. There is further problem in that few if any of the NGOs consult with the MOE on the selection of schools to be renovated. Some if not all of them would like to be involved with the MOE school construction programme but they would require additional funds in order to construct schools even to minimal standards and they would also need to consult with the MOE over the schools selected for renovation or construction.

Of the other agencies that have been or would like to be involved in school construction, LCIP at present only carries out projects funded by USAID and sub-contracts the design and supervision of construction works to local consulting firms and [redacted], who would like to be involved in the MOE school construction process, are likely to be too expensive.

For more details of these agencies see Annex 2.

For details of visits to schools constructed by the MOE and one of the NGOs see Annex 3.

Management and Supervision of Construction

As stated above, the DEF at present does not have the capacity to manage and supervise a large primary school construction programme. There are however a number of local firms of architectural and engineering consultants in Monrovia, some

of whom have carried out work for the MOE in the past, who would like to be involved in the new MOE school construction programme. There are also employees of some international firms of consultants working in different agencies in the country whose organisations might be interested in managing and supervising the proposed construction programme.

The quality of the local consulting firms varies considerably and there seems to be only one reasonably large and properly constituted firm although there are a number of smaller firms who could probably manage and supervise a fairly small construction programme. For a review of the local consulting firms see Annex 4.

There has been a proposal that the Special Implementation Unit (SIU) in the Ministry of Public Works could assist the MOE in the implementation of the proposed school building programme. However after discussions with the World Bank TTL, the SIU project manager and some of his international staff it became obvious that they are fully committed to the management of a number of very large infrastructure projects (which are likely to increase in number) and that they do not have the capacity to take on additional work for other ministries. It is also intended that this unit will eventually become a road construction and maintenance agency.

Contractors and Construction Costs

The number of competent contractors, both Liberian and foreign-owned is low and the capacity of the smaller Liberian contractors who carry out most of the work in the rural areas to construct school facilities without intensive management and supervision is doubtful to say the least.

The cost of construction in Liberia is comparatively high and is rising as there are few locally available materials and the cost of imported materials is very high. Good quality materials are especially hard to find. All building materials apart from timber and aggregate have to be imported and there is a particular problem with cement as there is only one manufacturer of cement and their capacity seems to be very low. This is compounded by the fact that when they cannot manufacturer cement only they seem to be allowed to import cement and their capacity to do this also seems to be low. The availability and cost of cement is therefore a particular problem in all construction programmes. While there is a regulated price for cement the actual market price is usually a good deal higher.

Liberia Primary Education Recovery Programme

The MOE developed the Liberia Primary Education Recovery Program (LPERP) in March 2007 to meet the challenge of rebuilding Liberia's primary school system. LPERP represents a collaborative effort on the part of MOE and its partners to mobilize resources and harmonise actions to implement a medium-term development strategy for primary education.

LPERP is financed through the regular Government of Liberia budget and the Liberia Education Pooled Fund which is a multi-donor funding mechanism established by Government and its development partners. Infrastructure expansion and improvement is the largest LPERP component in terms of spending at approximately $23 million over three years. An initial estimate of the new infrastructure and improvements that are required was developed to support the formulation of LPERP using data from the school census 2005/06 and UNDP population estimates

The magnitude of the investment required to eliminate the infrastructure deficit is too large to be fully addressed in the three-year implementation period of LPERP. The original LPERP targets were based on assumptions about the capacity of the education system to plan, procure and construct additional classroom spaces and make needed improvements to existing schools. Clearly the need for classroom spaces at the primary level will still be a significant challenge for the government at the conclusion of the LPERP implementation period. However the strategies, systems and approaches for expanding and improving school infrastructure developed through the implementation of LPERP should enable the MOE to continue the required expansion post-LPERP in an efficient manner.

	2008/09		**2009/10**	
	Numbers	Budget ($)	Numbers	Budget ($)
New classrooms	600	3,924,000	900	5,886,000
Classroom rehabilitation	150	450,000	240	720,000
Furniture	50,000	1,000,000	50,000	1,000,000
Latrines	400	930,000	500	1,550,000
Water pumps	300	600,000	500	750,000
Teacher housing	800	2,430,000	800	2,430,000
Total		**9,334,000**		**12,336,000**

Table 1: Proposed LPERP infrastructure development programme 2008/2010

It should be noted that the pooled fund was only established in June 2008 and therefore no infrastructure work was undertaken under LPERP in 2007/2008, that the time available for infrastructure work in 2008/2009 is now very limited and if the targets are to be achieved the programme will probably have to be extended into 2010/2011.

Implementation of the 2008/2009 LPERP Primary School Construction Programme

General

The window of opportunity to implement the proposed 2008/2009 primary school construction programme is now very small and there are a number of critical activities that will have to be carried out before construction can start. These include

the selection of the actual schools to be constructed; revisions to the design and documentation for these schools and decisions on who will manage the construction process this year. Proposals for school selection, re-design, and management of the construction process for the first year are given below.

Selection of Schools

As stated above the selection of the schools to be included in the construction programme will have to be completed before the end of October 2008 if the implementation of the programme is to stand any chance of success. The number of schools to be included should be kept low because of the constraints on managing and supervising the construction.

There will not be time to carry out surveys of existing schools and therefore the main criteria for the selection of the schools to be included in the first year's construction programme should be that they are existing primary schools that require new buildings and not renovations and they should have:

- A deficit of useable classrooms in relation to the actual school population or the number of primary school age children in the school's catchment area who are not in school.
- Sufficient children of primary school age in their catchment area to provide sufficient pupils for at least a complete one-stream school i.e. 45 pupils x 6 grades = 270 pupils. Only 6-classroom schools should be constructed.

They should also be included in the County Development Agendas

The schools included in the County Development Agendas have been selected by the MOE's County Education Officers as the schools most in need of new facilities in their county. This selection process has apparently been carried out in a very transparent manner and it would seem sensible to follow the CEO's recommendations and not, given the time restraints, go through the selection process again.

There should be sufficient information available from the national census and the 2007/2008 annual school questionnaire for the MOE to check that the schools selected in each county do indeed require new buildings and that they comply with the other criteria set out above. The MOE will have the final say in the selection of the schools.

Revision of Primary School Designs

While there is an urgent need to provide revised designs for primary schools, there is not sufficient time to do this before the construction of new schools has to start. It has been agreed therefore to use the existing design prepared by DEF for use by

[redacted] for the schools to be constructed this year with some modifications to reduce costs and simplify construction. Revised designs and the necessary documentation will however have to be prepared this year for the 2009/2010 construction programme (see below).

The modifications agreed are that the outside kitchen will be omitted together with all connecting covered paths. This will both reduce costs and simplify the arrangement of the school buildings on all sites. It will also make it easier to give all buildings the correct orientation. The buildings, including the toilets could be connected by simple concrete paths with no roofs depending on the site conditions.

For the first year's construction programme, the DEF should therefore prepare revised drawings showing the buildings with the kitchen and covered ways omitted and amend the bills of quantities to reflect these omissions. If the DEF does not have the time or resources to do this work then the omissions can be covered by instructions to the contractors during the bidding process.

Only new schools will be constructed in the first year and there will not be time to visit or survey all of these schools. The layout of the buildings at individual schools will however vary depending on the site conditions and the DEF should therefore prepare guidelines for site layouts as well as typical site layouts showing the entrance, paths, location of toilets, wells, etc (see Annex 6 for details). These will be used for bidding purposes and the agencies managing the construction work will agree the actual site layout for each site with the contractors before construction starts and following the guidelines that will be provided. Any additional work required for individual sites will be covered by variation orders and will be paid for from the contingency fund. This work should be completed by the end of December 2008.

Management and Supervision of the 2008/2009 Construction Programme

It will not be possible, because of the time constraints, to engage international consultants to assist with the management of the construction programme this year.

A number of other agencies will therefore have to be used to manage school construction this year and these could include DEF, [redacted], local NGOs and possibly [redacted] The numbers of schools to be managed by these agencies should be kept comparatively small (apart from [redacted] and possibly [redacted]) because their capacity for managing school construction is fairly low. When construction is completed the standard of construction achieved by these agencies can be evaluated and a decision made as to whether they should be used again in following years.

The MOE has recently placed in the local newspapers a 'Request for Expressions of Interest' (EOI) from local civil works consultancies for the provision of a technical assistant to be placed in DEF (see below). While there are problems with the wording of this advertisement (which is more like a tender than an EOI as it asks for

priced bids) this TA could be used to assist DEF to manage the supervision of a small number of schools.

The MOE has also recently placed in the local newspapers a 'Request for Expressions of Interest' from local NGOs and other non-profit entities for collaborating with the MOE in implementing school construction.

It is proposed therefore that after the schools to be included in this year's programme have been selected, the MOE should enter into agreements with [redacted] and selected NGOs and other non-profit entities such as [redacted] for the management and supervision of the schools that they will be responsible for as set out below:

- [redacted] for the construction of four schools in each county making a total of 60 schools.
- Peace Winds (if selected) for the construction of two schools in Lofa County.
- Zoa (if selected) for the construction of two schools, one in Margibi County and one in Montserrado County.
- Any other NGOs that might be selected for the construction of a maximum of two schools in locations to be agreed.

Funding will be provided to these agencies for the schools that they are to manage on a similar basis as is now done for [redacted] and the bidding process, evaluation and award of contracts will be managed by them.

If [redacted] expresses an interest in being included in the school construction process they could be asked to submit their estimate of costs for managing and supervising ten primary schools in a number of counties and if their estimate is acceptable they could be engaged on a similar basis to [redacted] or the NGOs. At a meeting with the consultant during his mission however, the [redacted] representative stated that the total cost for managing ten schools would be around 31% of the construction cost which is an extremely high and probably unacceptable percentage.

The procurement and construction programme is extremely tight and any delays especially in the selection of schools to be included in the programme or the engagement of [redacted] and the NGOs will probably mean that construction will not be completed before the start of the 2009 rainy season.

This process will give a clear idea of the cost of managing and supervising construction using different local agencies and the completed schools will also indicate the quality of construction to be expected from using them in future. Any agency that does not produce schools of the required standard would of course not be used again.

	08			09										
Activity	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Site Selection														
Engagement of LACE & NGOs														
Revision of documentation														
Bidding process														
Construction & supervision														
Rainy season														

Table 1: Best case scenario for school construction 2008/2009

Role of the Division for Educational Facilities in the 2008/2009 Construction Programme

The present staffing level of the DEF is low and its capacity to manage a large construction programme is doubtful. The MOE has however recently placed in the local newspapers a 'Request for Expressions of Interest' (EOI) for the provision, by a local civil works consultancy firm of a technical assistant to be placed in the DEF.

Unfortunately the wording of the advertisement is somewhat confusing and it is not clear whether the MOE is asking for an individual or a firm and what is asked for is not really an EOI because the firms are asked to submit priced bids for the work.

It is suggested therefore that when the EOIs or bids have been received that the MOE reduces the number of tasks to be carried out and clearly sets out the terms of reference for the individual architect or engineer to assist the DEF.

The duties of this architect or engineer will depend to large extent on when he or she is appointed but could include assisting the DEF in:

- Preparing the revised designs and documentation for both the 2008/2009 and 2009/2010 construction programmes.
- Supervising a small number of school sites.
- Monitoring the work of [redacted] and the NGOs who will be managing and supervising at least part of the construction programme
- Monitoring the work of the contractors constructing the school facilities.

He or she could also assist the DEF in compiling all the existing information on the location and condition of schools from all available sources as part of the preparation process for the establishment of a national school facilities register.

It is considered however that the other tasks set out in the request for EOIs would be better carried out by an international firm of civil works consultants with extensive experience of the design and construction of educational facilities in tropical, developing countries and of the management of large-scale school construction programmes who it is proposed should be engaged before the second year's construction programme starts. For details of their work see below.

Implementation of the 2009/2010 LPERP Primary School Construction Programme

General

Preparation work for the 2009/2010 primary school construction programme should start as soon as possible even before the 2008/2009 programme is implemented. This programme will have to be much larger than the 2008/2009 programme and will probably continue into 2010/2011 and the DEF will require a great deal of technical assistance in implementing it.

It is proposed that to reduce costs in order to facilitate the construction of the maximum number of new classrooms and new schools as well as to simplify construction, the present designs being used for primary school facilities are revised and proposals have been made for these revisions (see Annex 7). It was not however possible to reach an agreement between the consultant and the DEF on the design to be used in future during the September/October mission. Detailed costings will be prepared by DEF for two different designs and a decision will be made on which design to use during the next mission in December 2008.

It is also proposed that the MOE hires an international consulting firm with extensive experience of the design and construction of school facilities in the tropics and of the management of large school construction projects to provide technical assistance to the DEF in managing the school construction programme. This same firm should also provide technical assistance, training and capacity building to the DEF in order that it can carry out its functions (as set out below) in the future in a professional, competent manner.

The process of advertising for, selecting and getting such a firm in country will take at least six months and the MOE should therefore prepare terms of reference for such a firm as soon as possible and advertise for expressions of interest. If this process is successful then the MOE should ask for bids from the interested firms for actually carrying out the work probably over a two to three year period. The consultants should if possible be in place by the beginning of July 2009.

At the same time the MOE should identify the schools to be included in the 2009/2010 construction programme and in particular, identify those schools that will require renovation and/or extension. These schools will have to be surveyed and a

local civil works consulting firm (or firms depending on the number and location of the schools) should be engaged to carry out this work in order to establish what work is required at each school and document it before the next rainy season (i.e. before the beginning of June 2009) so that the bidding process for all of the sites can be carried out during the rainy season i.e. from June to September 2009. The process for the schools where only new buildings are required can be similar to that for the 2008/2009 programme. The number of schools to be included in the 2009/2020 construction programme will have to be much greater (100/150 schools) than that for the previous year.

If the documentation work and the bidding process are completed by September 2009 then this should mean that the actual construction programme can start in October or November 2009 giving it a very good chance of being completed before the rainy season of 2010. If they perform well in the 2008/2009 programme, LACE and the NGOs can be kept on to carry out some of the management and supervision work together with a local civil works consulting firm or firms who will have to be contracted during the 2009 rainy season. The overall management and supervision of the construction work will be monitored by DEF who will be assisted by the international consultants who should be in place by then.

If the construction programme is to be continued into 2010/2011 then a similar process will be required to be carried out in 2010.

Revision of Primary School Designs

It is essential for the success of the proposed primary school construction programme that designs for standard primary school facilities are developed that:

- Conform to the space and quality requirements of the MOE.
- Are inexpensive to construct.
- Can be built by small local contractors using as much as possible locally available materials and the minimum of imported materials.
- Will have a useful life of at least 30 years.
- Are easily maintained.

All existing and new primary schools to be included in the construction programme whether to be renovated, extended or newly constructed should be provided with the same facilities which will include:

- Sufficient classrooms to accommodate the primary school age population in their catchment area in streams of six grades assuming a class size of 45

pupils i.e. six classrooms for a one-stream school, twelve classrooms for a two-stream school, etc.

- A small library, a principal's office and store and a teachers' office.
- Enough furniture in each classroom to seat 45 pupils.
- A safe drinking water supply.
- Sufficient toilets of an appropriate design for all pupils at a minimum ratio of one toilet to 40 pupils with separate toilets for boys and girls and additional toilets for teachers.
- And a 'bush' kitchen to be constructed by the community.

If provision is to be made for pre-school children this will have to be done by providing two shifts as it will not be possible to provide extra 'classrooms'. The morning shift would be for pre-school children and Grades 1 – 3 and the afternoon shift would be for Grades 4 – 6.

See Annex 7 for details of the proposed improved primary school designs.

For the second year's construction programme, the DEF will have to engage consultants to prepare the documentation for the new standard buildings and this will include:

- Final designs and working drawings using AutoCad, bills of quantities and specifications for the proposed new standard facilities to be provided at primary schools.
- Surveys of existing buildings and sites for the schools that are to be renovated and extended together with similar documentation as for the new standard facilities.
- Typical site layouts for the proposed buildings and guidelines for setting out the buildings on the sites.

As in the first year in order to save time and reduce costs, schools which will receive only new buildings will not be surveyed. The consultants should prepare for these typical site layouts showing the entrance, paths, location of toilets, wells, etc and guidelines for the use of the agencies actually managing the construction work. These will be used for bidding purposes and the consultants and the other agencies will agree the actual site layout for each site with the contractors before construction starts. Any additional work for individual sites will be covered by variation orders and will be paid for from contingency funds.

This work should be completed by the end of June 2008.

The Future Role of the Ministry of Education's Division of Educational Facilities

The role of the Ministry of Education at this stage of the development of the country should be to manage the education system not to set itself up as an agency involved in the construction of educational facilities. It is considered neither necessary nor practical therefore to build up the DEF to a level where it can manage the actual construction of schools in major school construction programmes.

The DEF's role in the Ministry should be to:

- Set space and quality standards and provide design briefs for architectural and engineering consultants for educational facilities at all levels.
- Procure the services of consultants or consulting firms to both design new educational facilities and to supervise their construction.
- Monitor the performance of both consulting firms and building contractors.
- Monitor the work of [redacted], NGOs and other agencies who may be involved in school construction programmes to ensure that they are constructing schools to the required standards and quality and in the right locations.
- Assist the EMIS division of the Ministry of Education in the establishment and updating of a school facilities register.
- Design and manage a maintenance programme for all of the Ministry of Education's facilities.
- Manage and supervise any essential small works that the Ministry of Education requires that it is not economic to employ consultants to carry out.

There is therefore an urgent need for developing the capacity of the Division of Educational Facilities and other divisions in the Ministry of Education to enable them to carry out these tasks and the services of an international civil works consultancy firm with extensive experience of the design and construction of educational facilities in the tropics and of the management of large-scale school construction projects will be required to:

- Assist the DEF in the management and monitoring of the 2009/2010 and 2010/2011 primary school construction programmes and any other construction programmes that might be started during the period.
- Assist the DEF to establish space, quality standards and design briefs for educational facilities at all levels for the use of architectural and engineering consultants in the designing of these facilities.

- Enable both the DEF and the Ministry's Procurement Division to more effectively and efficiently procure the services of architectural and engineering consultants to design, document and supervise construction and to procure if necessary the services of construction firms to carry out the construction of both large and small projects. This will include assistance with the preparation of bidding documents and training in the evaluation of bids, etc.

- Train DEF staff in the use of computer-aided design and the use of other software currently used in the building industry and advise the MOE on the provision of hardware and software.

- Enable the DEF to manage more efficiently and effectively the work of consultants engaged to both design and supervise construction projects for the Ministry and to monitor both their work and the work of contractors.

- Assist the DEF in setting up a data-base of construction costs for educational facilities which can be easily managed and updated.

- Assist both the DEF and the EMIS Division to set up and manage an educational facilities register for the whole country.

- Assist the DEF to set up an effective system for the management and maintenance of all of the Ministry's facilities.

- Train DEF staff in the management and supervision of small construction projects for the MOE.

- Assist the MOE if necessary in the establishment of Educational Facilities Units in the three regions of the country.

The international consulting firm should be in place in Liberia by the beginning of July 2009 in order to assist the DEF with the management and monitoring of the 2009/2010 primary school construction programme.

There is a possibility of funding from the EU for short, medium or possibly long term technical assistance for capacity building in the DEF and the Ministry should approach the EU concerning this if it is felt that this might be more effective than using the services of a civil works consulting firm for all the activities set out above.

It might be more efficient and appropriate to separate off some of the activities described above and use technical assistance from the EU for, for instance the establishment of an educational facilities register as the EU is already committed to providing assistance to the EMIS Division on school mapping. It may also be possible to use technical assistance from the EU for the design and establishment of an educational facilities maintenance system and for the establishment of improved standards for educational facilities at all levels.

ANNEX 1: REVIEW OF EXISTING DESIGNS FOR PRIMARY SCHOOLS

General

Two primary school designs have been reviewed. Both designs are for complete Grade 1 to 6 schools and both designs also include three classrooms for pre-school children. The classrooms in each of the school designs are approximately the same in area but the shape of the classrooms is slightly different. Offices for school staff and toilets for both teachers and pupils are included in both designs as are a kitchen for cooking school meals and in one design a cafeteria and a library are included.

In both designs there is no differentiation in either size or design between the pre-school and the primary school classrooms. In the long term at least, this should be reconsidered as the needs of pre-school and primary school children are quite different and the design of accommodation (which should not be considered as 'classrooms') for pre-school children should be quite different to that for primary schools.

All drawings were hand drawn and while the drawings are fairly comprehensive, both sets require additional information and details in order to be fully comprehensive.

There are issues with the design and construction of both school types and these are set out in detail in the reviews below.

Designs for staff quarters and classroom furniture were also reviewed.

Design Review:

Standard Primary School: ACE Planning and Consulting Group

Design and Construction:

The drawings, which are dated April 2005, were prepared for the [redacted] project and are for a typical 9-classroom school (although [redacted] only constructs 6 classrooms) and consist of a schematic site plan, a larger scale site layout that also has a schematic electrical layout for a classroom, (neither of these drawings have north points), 2 larger scale layouts of all the buildings, elevations, sections (plus a few construction details), 2 roof framing plans, roof sections and details, 2 foundation plans with details and a toilet plan and section.

The facilities provided consist of 9 classrooms, (including 3 pre-school classrooms), an outside kitchen, a small office and two small stores, and 4 student toilets (two for boys and two for girls) and two staff toilets (one male and one female). The buildings are arranged on three sides of a central courtyard and the buildings are connected by covered ways with quite complicated roofs. All buildings have access verandas 7' 11'' wide. It should be noted that in the [redacted] school projects visited

only 2 buildings containing 6 classrooms have been constructed and that the pre-school classrooms have not been built.

The internal classroom size is 18' 0'' x 32' 0'' giving a classroom area of 576 ft² (53.33m²) or 13ft²/pupil (1.2m²/pupil) assuming 44 pupils per classroom. This is similar to the standard for Nigerian primary schools which is also 1.2m²/pupil and larger than that for Sierra Leonean primary schools (1.16m²/pupil), Ghanaian primary schools (1.13m²/pupil), Eritrean primary schools (1.11m²/pupil) but smaller than that for South African primary schools (1.5m²/pupil).

The buildings are constructed of fair-face stabilised soil blocks with concrete block foundation walls sitting on concrete strip foundations. The buildings also have 6'' x 8'' RC columns at the corners and centres of the classrooms with a 5'' x 8'' ring beam all round supporting the roof structure. The roof along the veranda is supported on a 5'' x 8'' RC ring beam on fair-face stabilised soil block columns 11'' x 11''. The roof structure consists of timber trusses at 8' 0'' centres with intermediate braced rafters both supporting 2'' x 1'' purlins and sitting on timber wall plates. There are trusses adjacent to all end and cross walls. The roof finish is shown as concrete tiles but the actual roof finish provided is corrugated steel sheets and the purlin size is 2'' x 2'' which is still small. The roof pitch is approximately 17½º with a 3' 0'' overhang over the rear wall and the veranda. Floors are of 4'' concrete with a steel float finish on an 8'' bed of sand. There is no DPM. Hardboard ceilings (thickness not specified) are fixed under the roof trusses at a height of 10' 2''. There are no windows; light to rooms is provided by panels of open blockwork. External doors are shown as timber panel doors and internal doors as plywood-faced flush doors.

The only electrical supply is to the classroom buildings. Classrooms have four light points in the ceilings, there is light point in the office and there are lights in access verandas, one outside each classroom. No power supply outlets are shown on the drawings.

Issues:

As stated above, the buildings are arranged on three sides of a central courtyard and this means that at least one building (possibly two depending on the actual site layout) will be facing east/west. This in turn means that some classrooms will have the sun shining into them in the morning causing discomfort to pupils and teachers and if the schools are used for two shifts then some classrooms will also have sun in them in the afternoon. It is always good practice in tropical countries such as Liberia to orientate the buildings so that the window walls face north/south to reduce the amount of direct sunlight entering the classrooms.

The proportions of the classrooms are not very good being narrow and long. The classroom shape would be better if it was wider and shorter as this would mean that

the children at the back of the class are closer to the teacher and it would also provide more flexibility for the furniture layout.

Two classrooms are shown divided by a folding timber screen. At the schools visited where these have been built they were all badly constructed and none of them functioned properly if at all. If this type of space is to be provided then it would be better to have simple timber screens that could be moved around. There will of course be a problem of sound transmission when the space is used as two classrooms.

The width of the verandas at 7' 11'' is excessive and could be reduced to a maximum of 6' 6'' which would reduce the cost. As these are primary schools and the pupils are based in one classroom and do not move around the school for lessons, it is also considered that the connecting covered ways with their complicated roofs could be omitted which would greatly reduce costs, simply the arrangement of the buildings on the site and enable all buildings to be oriented north/south. It would also mean that additional buildings could be easily provided as and when necessary or when funding is available.

The RC columns at 6'' x 8'' are small and difficult to construct properly especially by local contractors in rural areas who will probably get minimal supervision and are probably structurally suspect in most cases. The same applies to the ring beams (5'' x 8'') which have very long spans (nearly 16' 0'') and are probably structurally ineffective. There are no ties shown to tie the walls to the columns and without these the columns will be ineffective. It is considered therefore that the columns and beams could be omitted without affecting the structural integrity of the building. In fact this will probably increase it! It will also simplify construction, reduce costs, obviate the need for shuttering and reinforcement and reduce the amount of cement required for the building. This latter consideration is very important given the present supply situation in Liberia.

The RC columns could be replaced by soil-stabilised block columns as shown for the verandas which will provide stiffness and stability to the window walls and support the roof trusses.

The roof structure as designed is over-complicated and could be simplified which would reduce costs. The trusses next to the end and cross walls could be omitted and the walls could be used to support the purlins. The braced rafters could be omitted and the purlins could be supported on two trusses spaced equally in the classrooms. The size of purlins should be increased but the wall plates could be omitted.

It would be more cost-effective if the flat ceilings were omitted and the ceilings fixed to the underside of the roof purlins following the slope of the roof. This would have three advantages in that it would: 1) simplify the fixing of the ceilings; 2) increase the

volume of the classrooms and 3) allow the height of the window walls to be reduced from 10’ 2’’ to 9‘0’’/9’ 6’’ all of which would help to reduce costs.

It is doubtful whether flush doors will last very long in primary schools and timber panel doors or simple ledged and braced doors should be used throughout to reduce maintenance costs.

It is understood that primary schools, especially in the rural areas are only used in the mornings from around 8.00 to 13.00/14.00 hours. A way of reducing costs would be to omit the electrical installation which would not be required in the mornings. If necessary an electrical installation could be provided in the future and it might be worth investigating the use of solar power for lighting at least to the large, 2 classroom space, if for instance school buildings are to be used by communities in the evenings.

It is not clear how the toilets, as designed will function. The toilet compartments are over a pit which has solid walls which will not allow seepage and this will only happen through the base of the pit. There is no ventilation of the pit and when the pit is full it will be virtually impossible to empty it. The holes through the floor slab are 8’’ in diameter and this is not an ideal shape; the holes should be longer and narrower to prevent fouling. It would be much better to provide simple VIP latrines or even better, double-pit VIP latrines which could be emptied but remain in use.

Standard Primary School: Division of Educational Facilities

Design and Construction:

The drawings, which are dated November 2007, are for a standard 9-classroom primary school and consist of a site development plan (which does not have a north point), floor plans, foundation plans, roof framing plans, elevations and electrical plans for the individual buildings; foundation details; door and window schedules; a typical cross section; roof truss details; kitchen details and details of the well. There are separate toilet drawings.

The facilities provided consist of 9 classrooms, (including 3 pre-school classrooms); an outside kitchen; a cafeteria, store and service area; a reading room (including a librarian’s office); an administration unit with an entrance, registrar’s office, small store, production room, teachers’ lounge and principal’s office; and pupils’ and staff toilets (put in numbers). The buildings are arranged on four sides of a central courtyard and all buildings are connected by covered ways with quite complicated roofs. All buildings have access verandas 8’ 0’’ wide. The toilets are separate from, but are connected to the main buildings. There are two buildings; one for girls and one for boys. Three toilets are provided for boys plus a urinal and a male teachers’ room. Four toilets are provided for girls plus a female teachers’ room. The toilets as

designed are a sort of pour-flush toilet with a small concrete bowl connected by a pipe to a septic tank. There are no traps in the pipes.

The internal classroom size is 20' 0'' x 28' 9'' giving a classroom area of 575 ft² (53.24m²) or 13ft²/pupil (1.2m²/pupil) assuming 44 pupils per classroom. See notes above on standards in other countries in the region.

The buildings are constructed of fair-face stabilised soil blocks with concrete block foundation walls sitting on concrete strip foundations. The buildings have 6'' x 8'' RC columns at 9' 9'' centres at the corners and centres of the classrooms with a 6'' x 8'' ring beam all round supporting the roof structure. The roof along the veranda is supported on a 6'' x 8'' ring beam supported on 8'' x 6'' RC columns at 9' 9'' centres. The roof structure consists of timber trusses at 9' 9'' centres with trusses above the cross walls between classrooms and inside the end walls and half-trusses over the verandas. The trusses support 4'' x 2'' purlins at 3' 9'' centres and the roof finish is aluminium roof sheets but no gauge is shown for the sheets. The roof pitch is approximately 16º with a 4' 4'' overhang over the rear wall and the veranda. Floors are of 4'' concrete with a steel float finish on an 8'' bed of sand. There is no DPM. Flat plywood ceilings ⅜'' thick are fixed under the roof trusses at a height of 10' 0''. There are no windows in the classrooms; light is provided by panels of open blockwork. Louvre windows are provided to the library and the administration rooms. External doors are shown as timber panel doors and internal doors as plywood-faced flush doors.

There is an electrical supply to all rooms. Classrooms have four light points in the ceilings (50watt bulbs are specified) and four socket outlets and the other rooms and the verandas have similar lights and some socket outlets.

Issues:

As stated above, the buildings are arranged on four sides of a central courtyard and this means that two buildings will be facing east/west. This in turn means that some classrooms will have the sun shining into them in the morning causing discomfort to pupils and teachers and if the schools are used for two shifts then some classrooms will also have sun in them in the afternoon. See notes above on the orientation of buildings.

The proportions of the classrooms are better than in the previous design. The 20' 0'' width of the classrooms is probably the minimum acceptable width.

The width of the verandas at 8' 0'' again is excessive and again could be reduced to a maximum of 6' 6'' which would reduce the cost. See notes above on the advantages and implications of omitting the connecting covered ways between the buildings.

The RC columns at 6'' x 8'' are again small and difficult to construct properly and the same applies to the ring beams which are also 6'' x 8'' and the comments made on the previous design also apply here. There are no ties shown to tie the walls to the columns and therefore the RC columns again could be omitted and replaced with stabilised soil block columns and piers. This would again obviate the need for shuttering and reinforcement and reduce the amount of cement required for the building.

The roof pitch at 16º is very low and could lead to roof leaks through the end and side laps of the roof sheets and, because of the low pitch, some of the roof truss members seem to be redundant. It would be structurally much better if the roof pitch was increased and this would also help to stop roof leaks. The roof overhangs, which are 4' 4'' long and are unsupported, are excessive and should either be reduced or be propped. If the width of the veranda is reduced, there would be no need for the half-truss over the veranda. The veranda roof could be supported on a simple rafter which would reduce costs.

There are roof trusses over the dividing walls between classrooms but no details are shown of how they are finished. Presumably they are clad in plywood or a similar material but there must be still an issue of sound transmission between classrooms. It would be better if the trusses were omitted and the cross walls taken up to support the roof. This would prevent sound transmission between the classrooms and also reduce the cost of the roof.

Again it would be more cost-effective if the flat ceilings were omitted and the ceilings fixed to the underside of the roof purlins following the slope of the roof and this would have the advantages set out above.

As stated above, it is doubtful whether flush doors will last very long in primary schools and timber panel or simple ledged and braced doors should be used throughout to reduce maintenance costs.

The electrical installation could again be omitted for the reasons given above. It should be noted that the four 50 watt bulbs specified for the classrooms will provide very low light levels and if lights are to be provided then higher wattage lights should be provided.

There are a number of issues raised by the toilet design: 1) the concrete bowls are bound to be rough and will be very difficult if not impossible to keep clean; 2) because there are no traps foul air from the septic tank will enter the toilets; 3) the septic tank as designed will not operate properly (there should be two chambers) and 4) how will the septic tanks at rural schools be emptied when full? Again it would be much better to provide simple VIP latrines or even better, double-pit VIP latrines which could be emptied but remain in use.

Staff Quarters

The standard design for staff quarters consists of a semi-detached house with an entrance at the front through a small veranda, a sitting room, a dining room, an inside kitchen and small store, two bedrooms, a bathroom and a small veranda at the rear accessed from the kitchen.

Construction is of 6'' sandcrete blocks with 6'' x 6'' RC columns at most wall junctions, concrete footings, a concrete floor slab, a flat ceiling and a very low pitch roof with corrugated steel roof sheets.

Issues:

There are a number of issues with both the design and construction of these houses. With regard to construction, the RC columns could be omitted which would save on costs. It should be noted that there are no details given of any ties tying the walls to the columns and these were not seen in any of the school buildings. If the walls are not tied to the columns then there really is no point in having the columns! Secondly the roof pitch is very low and the roof will be susceptible to leaks through the end and side laps. The side windows to the bedrooms should have some protection in the form of small projecting roofs over them to keep out both the sun and the rain.

On the design side, while these houses might be appropriate for schools in urban areas with mains electricity, drainage, etc. Would it not be better in a remote rural situation to have an outside wood fired kitchen? It might also be more appropriate to have a VIP latrine as well with either an inside or an outside shower room.

Classroom Furniture

Until recently, the standard classroom furniture for primary school pupils was a desk with an attached bench to seat three pupils. This was rightly thought not to be appropriate because it is uncomfortable for pupils and inflexible in use and an alternative furniture design is now being used. This is a chair with an attached writing arm similar to that used in tertiary educational facilities. It is being produced locally and is made in timber in two sizes.

Issues:

There are a number of issues with this design: 1) the design is quite complicated with a large number of joints and it is considered that there will be a high rate of breakage (which was confirmed during the school visits) and 2) it is not considered that this type of design is really appropriate for primary school pupils.

It was also noted that the seat heights for the two sizes are both relatively high. The seat height for the smaller size is 16'' and for the large size it is 17''. These are almost adult sizes. There is also an anomaly in that the writing arm height for the

smaller size is 24'' (a difference between seat and arm of 8'') but the height of the writing arm for the larger size is 28'' (a difference between seat and arm of 11'').

What is required in a primary school classroom is a worktop where the pupil can place a book for reading or writing or carry out other activities such as drawing or painting. In developed countries a single desk and chair is usually provided for each pupil but this is obviously expensive and the most common compromise in developing countries is a double desk with two chairs for two pupils. This provides space for reading and writing and for other activities. It also provides flexibility in the use of the classroom in that the desks can be re-arranged as necessary for more pupil-centred, activity based teaching. They can for instance be brought together to form a larger worktop for group activities or arranged in a U-shape for class discussions. The present design of a chair with a writing arm provides a very small useable space and can only be used in one way and it is suggested that the provision of this type of chair is re-considered at least in the long-term.

At least two sizes of furniture should be provided: one to suit pupils in Grades 1 to 3 and one to suit pupils in Grades 4 to 6. At present there is also a need for larger furniture to fit the many overage pupils (some of whom are almost adults) in the system.

ANNEX 2: AGENCIES INVOLVED IN PRIMARY SCHOOL CONSTRUCTION

Besides the MOE, which has a very small government-funded school construction programme, a number of other agencies are or have been involved in the renovation or construction of schools. These include the [redacted] which is a para-statal organisation and NGOs such as ZOA, Plan International, Peace Winds, International Rescue Committee (IRC), etc. USAID has renovated schools through the Liberia Community Infrastructure Programme (LCIP) and other agencies such as UNDP and UNHCR and also construct or renovate schools (sometimes using [redacted]) or provide funding for school construction in a fairly ad-hoc manner. A number of schools were visited that were constructed by some of these agencies and for details of these visits see Annex 3.

[redacted]***:*** This is the most important of the agencies presently involved in school construction and it also constructs markets, water supplies, toilets, etc all with a high degree of community involvement. Since its establishment by the government in 2005 it has constructed nearly 60 schools and intends to build more schools this year. It uses the first design described above and this school has been costing in the region of US$60/70,000 (US$10/12,000 per classroom). Costs have been rising however and it is now estimated that the standard school cost will be around US$90/100,000 (US$15/17,000 per classroom) this year. A number of schools constructed by [redacted] were visited and the standard of construction is quite high although there were a few issues concerning quality. [redacted] intends to continue constructing schools and could be involved in the MOE's programme. However they are now engaged in a large number of projects and their capacity to manage and supervise additional schools is limited. They are however very keen to be included in the MOE primary school construction programme.

ZOA: This is a mainly Dutch-funded NGO that has constructed more than 50 schools and it has also been using UNHCR funds to construct schools. It does not seem to use any standard plans for school construction but the organisation's engineer designs the schools to fit the sites. Several schools were visited and the standard of construction is not very good and the size of the classrooms is quite small. ZOA intends to continue to construct schools and would like to be involved in any MOE programme but this would mean a step-change in their management and supervision capacity and the MOE would have to ensure that any schools managed by them are constructed to the MOE's standards in terms of classroom sizes, provision of other facilities and quality.

Peace Winds: This is a mainly Japanese-funded NGO that has been involved in community-based school renovation in Lofa County using funds from UNHCR. Peace Winds provides the construction materials and the communities provide skilled and unskilled labour. The MOE is not involved or consulted in the process of

school selection. They use Liberian engineers for supervision together with unqualified monitors. They plan to renovate 1 more school and construct 2 new schools this year using Swiss government funds. The new schools will have six classrooms (same size as LACE designs), a principal's office, a teachers' office, a small store, toilets and a well. The schools will be constructed of concrete blocks and the estimated cost (which has probably gone up) was US$50,000 in February 2008. They would be interested in renovating or constructing more schools if they had the funds but would need to recruit more technical staff and would also require funding to pay the additional staff, transport and other overheads.

IRC: IRC have been constructing and renovating primary schools funded by individual donors in Lofa and Nimba Counties since the end of the civil war. They hire local contractors to work with communities on school construction and have one civil engineer who supervises the work. Their budget per school is only US$18,000 and they construct 4 classrooms (the same size as the [redacted] classrooms), an office and a teachers' office. They do not build toilets or a water supply. With this level of budget the standard of construction cannot be very good. At present the MOE is not involved in the school selection process and they are renovating or constructing the some of the schools selected by the County Education Officers in the County Development Agendas. They have had discussions with the MOE about further school construction but the MOE wants them to construct complete schools as shown in their latest school designs and they cannot afford to do this. They do however intend to renovate or construct a further 18 schools this year and hope to get Peace Winds involved in the construction process.

LCIP: LCIP was started in 2004 and is funded by and at present only carries out work for USAID. It has renovated some primary schools (9 schools in 2005) using USAID funds. All work is contracted to Liberian-owned firms and while LCIP has its own architects, engineers and project managers most if not all design and supervision of construction projects is sub-contracted to local Liberian consulting firms. Renovation costs are estimated at between US$15/30ft² (US$162/324m²). LCIP is also managing the procurement of primary school furniture (using the new design) again funded by USAID.

[redacted]***:*** [redacted] have been managing construction work for UNDP and UNHCR using documentation provided by local consulting firms much of which has been so poorly prepared that they have had to re-do it themselves. There experience has shown them that there are few competent contractors around and few competent and experienced engineers. They estimate that single-storey construction costs are in the order of US$480m². At present they have two expatriate engineers who manage projects and they employ Liberian engineers as site supervisors. Their present contracts are closing and they are looking for other projects. They would like to be involved in the MOE school construction programme and/or with capacity building in the DEF. Their costs are however very high. They charge 8% of the

construction cost of the project plus all direct costs such as salaries, cost of staff holidays, plane fares, vehicle and transport costs and administration costs. Salaries of international staff are based on the UN salary scale. [redacted] estimate therefore that the total cost for the management of the construction of ten schools would be 31% i.e. if the construction cost was US$800,000 then their management costs would be in the order of US$248,000!

ANNEX 3: SCHOOL VISITS

General

Eight schools of different kinds around Monrovia were visited on September 29th and October 1st 2008 accompanied on the first day by a civil engineer and an architectural assistant from the MOE Division of Educational Facilities and on the second day by the Country Director of ZOA, a Dutch-funded NGO and the same architectural assistant as on the first day. The schools visited were one existing primary school that is being extended using government funds and the latest DEF designs; three schools that have been constructed by [redacted]; two schools that were constructed by an AfDB project in the early 1980s and a UNHCR-funded school and a small school built using private Dutch funds that were both managed by ZOA. Details of the school visits are given below.

Sarah Barclay Elementary School

This is an existing school that is being extended using government funds. The original building was constructed as a market building in 1972 and has been converted into six classrooms, offices, etc. The school was extended at some point by GTZ who constructed a further six small classrooms. Behind the school there is a small open kitchen building and 10 latrines (not VIP latrines and 4 are flush toilets flushed with a bucket). At the front of the school there is a new lined well and hand-pump. Two new buildings are being constructed: one with a classroom, a library and staff offices and one with four classrooms. They are being constructed to the new DEF standard design. The buildings are arranged around a courtyard and two buildings face east/west. There is a large playing field next to the school that belongs to the school. There is a plan to build an auditorium in the central courtyard and additional primary school classrooms next to the playing fields.

The furniture being used is to the new standard design i.e. chairs with writing arms. There is however insufficient furniture for all the students and 50% of Grade 7 pupils said that they had brought their own chairs. It was noted that the joints of the chairs were not very strong and many chairs had loose arms, legs or other components.

The school provides accommodation for pre-school, primary school, junior secondary school and senior secondary school classes in two shifts. There are 220 pre-school pupils and 420 primary school pupils who attend the morning session together with a 780 secondary school pupils. A further 311 primary school pupils and an unknown number of junior secondary and senior secondary pupils attend the afternoon session. The average class size is 60-70 pupils.

Two new buildings are being constructed both to the new standard design. One contains a classroom, a library and offices for school staff and one contains four classrooms. The classroom/library building has been roofed and the classroom is

being used. The classroom is 29’ 9’’ x 20’ 6’’ and the height to the underside of the roof structure is 8’ 6’’ which means that this will be the ceiling height not 10’ 0’’ as specified. The veranda is 8’ 0’’ wide. Light and ventilation to the classroom is provided by concrete vent blocks on both sides. The building is very badly built. The concrete floor is very uneven, the RC columns and beams are badly constructed of poor quality concrete and the sandcrete block walls are badly built. The roof structure in particular is very badly built: timber rafters and purlins are not continuous pieces of timber but have poor quality joints where they should not be joined. The roof trusses are in fact not trusses at all and the roof pitch is very low. There is at present no ceiling and the roof covering is of 32 gauge corrugated steel sheets that will have a very short life.

Plate 1: Sarah Barclay Elementary School showing one of the new buildings: note the mud bricks and poor quality concrete

The other classroom building again has a very uneven concrete floor and the walls are constructed of mud bricks (with no cement) laid in cement mortar with very poor quality RC beams and columns. The building is complete up to ring beam level (with a course of sandcrete blocks on top of the beam) and there are no windows or doors. There is a wall plate on top of the top course of sandcrete blocks held down with ¼’’ diameter steel ties most of which pass through the blocks not the RC beam which means that in the event of a storm the roof will probably be blown off!

The contract for the work was let to a local contractor (contract value approximately US$100,000) who seems to have sub-let the work to another builder on a labour-only basis. This builder was on site and said that he was being paid US$6,000 for the labour contract for both buildings which would account in part for the very poor quality of the work. There seems to have been no supervision either from the main contractor or from the DEF and this again would account for the very poor quality of the work and for the changes in specification of materials such as the blocks and the roof sheets. At the very least, the roof structure and roof sheets should be replaced with roof trusses and sheets that are in accordance with the design and specification.

Oluremi Tinubu Elementary and Junior High School

This school was constructed in 2007/2008 and was funded by the New Era Foundation from Nigeria. The school has six classrooms, a laboratory, a teachers' toilet, and some offices and stores. There is a new lined well and pump fairly close to the school but no pupils' toilets. The school is built around three sides of a small courtyard which is roofed over forming a covered play space or 'auditorium'. The entrance to the school is at the front of the courtyard and there are three classrooms on each side, a laboratory (which is not yet in use and appears not to have any services) at the end with offices, stores, a teachers' room etc behind. The long sides of the courtyard face north-west/south-east. The school does not have any electricity (there is no electrical installation) and the corridors are very dark. The courtyard is ventilated just below the roof and the roof itself has some translucent plastic roof sheets. There is a large playing field next to the school that belongs to the school. The furniture that is being used is to the new standard design i.e. chairs with writing arms. The construction was carried out by URDC Contractors supervised and managed by [redacted].

A small temporary building next to the main building provides accommodation for pre-school pupils. It is constructed of mud blocks with a screed floor that is breaking up. The roof is of poor quality corrugated steel sheets on minimal bush-pole trusses with central supports and there are no windows only openings in the walls.

The school provides accommodation for pre-school, primary school and junior secondary school classes in two shifts. There are a total of 550 pupils in the morning session and 150 pupils in the afternoon session. There are two grades in each classroom with primary on one side and junior secondary on the other.

The classrooms are 22' 0'' x 26' 2'' wide (575ft²) i.e. wider than they are long and the light distribution is therefore not very good. The school is constructed of stabilised-soil blocks with RC columns and beams. The blocks are well made and well laid (all blockwork is fair-faced) but there are no vertical mortar joints between the blocks and daylight can be seen through the vertical joints! The floor is a concrete slab and windows in the outside wall are timber shutters with timber louvres. Ceilings are of poor quality hardboard (8' 0'' high) which are sagging slightly in the middle of the

panels. Windows to the inside walls are timber-framed openings with insect screening. Internal doors are poor quality plywood faced flush doors. The classrooms and offices have low, mono-pitch roofs with hips at the corners on timber half-trusses. The timber half-trusses are faced with timber panels on the front elevation. The roof sheets are not very well laid and the roof is not very level. There are a number of roof leaks. The timber trusses over the courtyard are exposed and although quite well made are sagging slightly; they are probably under-sized. There is no paving around the school and there is already some erosion of the surrounding ground. Apart from the above comments the buildings are quite well constructed.

Plate 2: Oluremi Tinubu Elementary and Junior High School showing internal covered space

There are a number of serious issues that should be raised concerning this design as it is proposed to replicate it in other new schools. See Annex 6 for a discussion of these issues and proposals for other ways to provide this type of space.

Kings Farm Public School: Accelerated Learning Programme

This school has been constructed on a sloping rural site. The [redacted] L-shaped design has been used with the result that one wing (which faces east/west) has had to be stepped down the site and the other wing is quite high out of the ground at the rear. There are six classrooms each of which has been divided into two with

temporary screens to accommodate two classes and an office and store. The two buildings have a connecting roof and another complicated roof connects the main buildings with a kitchen. This is not used for cooking as it smokes badly but is used as a small classroom. A temporary bush kitchen has been constructed behind the school next to a new lined well and hand-pump. There are four (unventilated) latrines, two for boys and two for girls that smell badly. The school provides accommodation for pre-primary and primary school pupils. There are 118 pre-primary and 743 primary school pupils in the morning and 116 primary school pupils in the afternoon. There are 12 teachers i.e. two per classroom. The furniture that is being used is to the new standard design i.e. chairs with writing arms. The buildings were constructed by a local contractor managed and supervised by [redacted].

Plate 3: Kings Farm Public School showing one building stepping down the hillside and incurring extra foundation and roof costs

The classrooms are 32' 0'' x 18' 0'' wide and 9' 3'' high i.e. they follow the drawings. The buildings are constructed of fair-face stabilised soil blocks with RC columns and beams. Veranda columns are of stabilised soil blocks with an RC beam over. Some of the stabilised soil blocks are deteriorating where they are exposed to heavy rain. The floors are of concrete with a very thin layer of screed which is breaking up in places. The quality of the RC beams is not very good in places. The roof finish is of corrugated steel sheets on timber trusses and rafters and the roof seems quite well built and finished. There are some roof leaks however. Light is provided to rooms

through panels of open blockwork. Two classrooms are divided by a sliding folding partition which is not very well made and does not function very well. All classrooms have 4No 3' 0'' fluorescent lights. The buildings are generally quite well constructed and the only serious criticism is of the site layout. If both buildings had been constructed along the contours parallel to each other and facing north/south (the best orientation) construction costs would have been much reduced.

Wein Town Public School

The school is on a flat 1½ acre site in a small township outside Monrovia. It was constructed between 1982 and 1984 under an AfDB funded primary school building project. The school consists of two buildings arranged in an L-shape with three classrooms in each wing and an office and store at the end of one wing. An outside kitchen is attached to the end of one wing by a covered way and a toilet block is similarly attached to the other wing. There are four unventilated pit latrines, two for boys and two for girls and a new lined well and hand pump. The school has 1,280 pupils in two shifts and accommodates primary, junior high school and accelerated learning programme pupils.

Plate 4: Wein Town Public School

The classrooms are 25' 6'' x 25' 0'' wide (637.5ft² or 59m²) and the flat hardboard ceilings are 9' 3'' high. The verandas are 7' 6'' wide. The buildings are constructed of sandcrete blocks rendered and painted inside and outside, with RC columns and

beams and concrete vent blocks for light. The floors are good quality concrete, self-finished. The RC veranda columns have a timber beam at the top supporting trusses and rafters. The roof is finished with good quality corrugated steel roof sheets on timber trusses and rafters. The roof purlins are quite small (2'' x 2'') especially for the large overhangs at the ends of the building. All doors are timber panel doors. There are some roof leaks and the roof sheets are starting to rust but considering the age of the buildings they are in very good condition. They were obviously built by a competent contractor who had professional supervision. The concrete floors are particularly good.

Kapakah Primary School, Perrytown

This school extension was constructed using UNHCR funds (US$14,000). The builder was the Liberia Reconstruction Corporation and it was completed one year ago. The school accommodates nearly 800 pre-primary, primary and junior secondary school pupils in two shifts; 505 in the morning and 300 in the afternoon. There were 8 existing classrooms and 3 new classrooms, an office and a teachers' room were constructed. A new 4-compartment latrine and well with a hand-pump were also constructed. The site is flat with buildings on three sides. The original building was constructed in 2001 by GTZ.

Plate 5: Kapakah Primary School showing part of large classroom space

The new school building is constructed of sandcrete block foundations with a concrete floor slab, rendered mud block (no cement) walls, small panels of concrete vent blocks for light and ventilation and small verandas with RC columns supporting the roof. The roof covering is 32 gauge corrugated steel roof sheets on very basic timber roof trusses with flat hardboard ceilings. Classrooms are approximately 19' 5'' x 19' 5'' and are separated by fairly crude timber partitions that can be moved. Ceilings are 8' 0'' high.

The building is not very well built or finished. The roof sheets are low quality and the roof is badly built. The concrete floors are breaking up in places due to a poor mix and a thin topping screed having been used. The ceilings are sagging and the finishes are not very good. The latrines are not ventilated and are built over the pit.

Doris Dalieh Daycare and Elementary Community School

This school was constructed using privately donated funds from Holland between 2004 and 2006. The site is quite small and sloping and there is little room for expansion. The school building is L-shaped and is constructed around a small courtyard with a well in the centre. This is a privately run school with no government support. There are 80 pupils and most of the teachers are volunteers.

Plate 6: Doris Dalieh Daycare and Elementary Community School showing small classroom size

The design and the type of construction are similar to that in the last school but some of the classrooms have solid dividing walls. The building is U-shaped with two small offices in one wing, two small classrooms in the linking block and one very long classroom space with temporary partitions in the other wing. The roofs have been hipped on the corners. There is a similar toilet building as at the last school but because the site is very small this has been built very close to the classroom building. The two small classrooms are 14' 6'' x 20' 0'' wide and ceilings are 8'5'' high. The building materials and construction are as poor as in the last school.

Paynesville Community High School

This school was constructed as a primary school between 1982 and 1984 under the AfDB funded primary school building project. The school is now being used as a junior and senior secondary school. The school is constructed around 4 sides of a courtyard and the buildings all have front access verandas connected by covered ways. There are 9 classrooms, a library, a computer room and two offices for the principal and vice-principal. There are two standard toilet blocks and an outside kitchen (which is not being used).

Plate 7: Paynesville Community High School showing internal courtyard

The classrooms are 25' 6'' x 25' 0'' wide (637.5ft² or 59m²) and the height to the underside of the roof trusses (the ceilings have disappeared) is 9' 3''. The verandas

are 7’ 6’’ wide. The buildings are constructed of sandcrete blocks rendered and painted inside and outside, with RC columns and beams and concrete vent blocks for light. The floors are good quality concrete, self-finished. The veranda columns are made of large asbestos pipes filled with concrete and have a timber beam at the top supporting trusses and rafters. The low-pitch roof is finished with longspan aluminium roof sheets on timber trusses (which are very well made) and purlins. The roof purlins are larger here (4’’ x 4’’) than at the other AfDB school. All doors are timber panel doors. Again, considering the age of the buildings they are in very good condition. They were obviously built by a competent contractor who had professional supervision. The concrete floors were obviously well built originally but are now showing signs of wear.

Duazon Blind Centre

This consists of a school together with some dormitories situated on a large sloping semi-rural site. The school was built by [redacted] to their standard design probably in 2006 and the dormitories were constructed by ZOA. The school building is L-shaped with one building stepping down the slope. There is a standard toilet block and an outside kitchen that is not being used.

Plate 8: Duazon Blind Centre showing classrooms stepping down slope

The classrooms are 32’ 0’’ x 18’ 0’’ wide and the ceilings are only 7’ 9’’ high. The buildings are constructed of fair-face stabilised soil blocks, which have been painted inside and outside, with RC columns and beams. Veranda columns are of stabilised soil blocks, which have also been painted with an RC beam over. The floors are of concrete with a very thin layer of screed which is breaking up in places. The roof finish is of corrugated steel sheets on timber trusses and rafters and the roof seems quite well built and finished. There are some roof leaks however. Light is provided to rooms through panels of open blockwork. Two classrooms are divided by a sliding folding partition which is very poorly made and does not really function. All classrooms have 4No 3’ 0’’ fluorescent lights. The buildings are generally quite well although one classroom wall is about one inch out of plumb and the ceilings are not very flat. The timber trusses where visible are also not very well made. It was also noted that where the soil-stabilised blocks are in exposed positions that have started to degrade and have been rendered. It is not clear whether this is because there was insufficient cement in the mix. As in the other [redacted] school, if both buildings had been constructed along the contours i.e. parallel to each other and facing north/south construction costs would have been reduced and the orientation of both buildings would have been better.

The dormitories constructed by ZOA were not inspected due to lack of time but the construction standard was much better than at the two schools probably due to there having been a much larger budget.

ANNEX 4: MANAGEMENT & SUPERVISION OF SCHOOL CONSTRUCTION

General

There are a number of local firms of architectural and engineering consulting firms in Monrovia who have been or who would like to be involved in the MOE school construction programme. There are also employees of some international firms of consultants working in different agencies in the country whose organisations again might be interested in this programme.

Local Consulting Firms

Meetings were held with representatives of a number of local consulting firms including: AEP Consultants Inc., Ace Planning and Consulting Group, Finda Architecture and Construction Co. and Milton and Richards Inc, architects, engineers and planners. There are also a number of other smaller, one-man consulting firms with whom meetings were not held.

AEP Consultants Inc: The practice was started in 1986 and re-opened in 1997. It is owned and managed by an architect and an engineer and has a well constituted office and quite a large staff consisting of architects, structural and civil engineers, a quantity surveyor, a project manager, architectural and engineering technicians, 'AutoCAD' operators and clerks of works. The practice uses 'AutoCAD' for all design and drawing work and it is fully equipped for architectural, structural and civil engineering, project management and surveying and quantity surveying work. They stated that although there are few large construction firms there are a number of competent smaller contractors. They also stated that the contractors in the districts require a lot of management and supervision and that pre-qualification of this type of contractor in terms of their management and financial capacity and their previous work before any bidding process starts is essential if competent contractors are to be selected. The practice would be very interested in being involved in the MOE school construction programme and consider that they have enough qualified staff to carry out the preparation/documentation work and could find additional staff for the supervision of construction if necessary. If they cannot find experienced and qualified Liberian staff then they recruit from other countries in the region. The practice which is the largest in Monrovia has carried out work for LCIP, a lot of other agencies and for many commercial clients.

Ace Planning and Consulting Group: This practice is owned and managed by a Liberian architect. This company prepared the primary school design now being used by LACE in the construction of their schools. Although these drawings were hand-drawn, the practice now uses 'AutoCAD' and it has six or seven 'AutoCAD stations. The office is fairly run down and not very impressive. The firm has two architects, an electrical engineer, a civil engineer and an estimator on its staff. It

also uses on a part-time basis another electrical engineer, a sanitary engineer and a soils engineer. It employs site supervisors as and when necessary and can find additional staff if required. The practice has carried out design and supervision work for the American Embassy, LCIP, GTZ and many other clients. The practice would be interested in being involved in the MOE school construction programme.

Milton and Richards, Inc: This practice is now run by a Liberian architect, the other partner having died. It has what used to be a very impressive office which is now rather run down and old fashioned. The practise has architects, engineers (numbers not known) and a quantity surveyor but has no CAD capacity; all drawings are still hand drawn. The practice has carried out work for numerous clients in the past and would be interested in being involved in the MOE school construction programme. It could find additional staff if necessary.

Finda Architecture and Construction Co: This practice is owned and managed by an architect. The office was not visited. The practice has 4 architects, 2 civil engineers and 2 quantity surveyors and uses clerks of works for supervision. It uses 'AutoCAD' for the preparation of drawings and has just transferred the new MOE standard primary school design to AutoCAD (these drawings have not yet been seen). The practice is at present carrying out work for LCIP on the design and supervision of administrative buildings in the counties. It has carried out work for numerous clients and would be interested in being involved in the MOE construction programme.

International Consultants

A number of international consulting firms have staff members working in the country for the Ministry of Public Works, the Ministry of Health and for USAID and at least some of these would be interested in bidding for the supervision contract for the MOE school construction programme if this is allowed under the Government of Liberia procurement rules.

ANNEX 5: PROPOSALS FOR PRIMARY SCHOOL AUDITORIA

General

A primary school has been constructed in the suburbs of Monrovia (the Oluremi Tinubu Elementary and Junior High School; see Annex 3 for details) using privately donated funds from Nigeria that has a central 'auditorium' constructed between three classroom buildings with an entrance on the fourth side and there is now a proposal to extend this design to other new primary schools. There are a number of serious design and cost issues raised by this design that are discussed below.

Design and Cost Issues

The auditorium, which is in the form of a high, roofed space between the classroom buildings, has a number of disadvantages over a similar freestanding building:

- The lighting in the classrooms on both sides will be reduced and the lighting levels in the classrooms will be unequal because of the roofed space on one side.
- The cross-ventilation in the classrooms will be much reduced making them very hot during the dry season.
- The cost of both the classrooms and the auditorium itself will be much increased compared to similar freestanding buildings because the roofs to the classrooms will have to be the mono-pitch type and therefore very high on one side increasing both roof and wall costs; the auditorium itself will have to be higher than otherwise necessary because of the classrooms on each side and there will be complicated roof junctions that will require expensive flashings.
- Lighting is required to the auditorium space through plastic sheets in the roof which will add to solar gain especially during the dry season and increase the heat load in this and the classroom spaces.
- If the auditorium is used for large school or community gatherings it is likely to be hot and uncomfortable because of the lack of adequate cross-ventilation and the heat load through the roof.
- The building will only be suitable for large flat sites as it has to be on one level thus restricting the number of sites on which it can be constructed. If it was constructed one even a slightly sloping site the foundation costs would rise dramatically.

- It will not be possible to use the auditorium space for other activities, especially if they are noisy, because this would interfere with the use of the classrooms.

- It will be very expensive and unfeasible at this stage to provide auditoria to all the primary schools that are required in the country. It will also be unnecessary to provide them in small rural schools.

Proposals for the Provision of Auditoria

While the aim of providing a large covered space that could be used by the pupils for assembly, games and other activities and which also could be used by communities during non-school hours is laudable, it will be more cost-effective to provide this space where funding permits, through the provision of a simple, freestanding building. The advantages of a freestanding building are as follows:

- It can be constructed where and when necessary or when funding permits. It could therefore always be added at a later stage if for instance a small school grows in size and an auditorium is required.

- It will be possible to locate it on any site to suit the site conditions.

- It will be much more economic to construct as it will be simpler to build, will not require expensive flashings and need not be as high as the previous design.

- It will also be possible to vary the size of the auditorium to suit the size of the school; i.e. very large schools could have a larger auditorium.

- It will be possible to provide other facilities attached to the auditorium such as toilets, a stage, storage spaces, etc.

- If a kitchen was constructed adjacent to the auditorium it could also be used for dining purposes.

It is proposed therefore that a design for a freestanding auditorium is developed that could be used in any location and that a cost-estimate for this is provided by DEF. A sketch proposal is attached.

ANNEX 6: GUIDELINES ON SELECTING & LAYING OUT A SITE FOR A PRIMARY SCHOOL

SELECTING THE SITE

A site for a new primary school should have:

- A minimum area of 3,000m² with adequate space for the school buildings, for a playing area and for any future extensions that may be required.
- Easy access by foot for the majority of the children who will be attending the school.
- Easy access to a safe water supply.

The site should be:

- Level and not liable to flooding.
- Situated well away from roads carrying traffic.
- Well drained with good, uniform soil conditions and not marshy or rocky in order to avoid the need for special, expensive foundations.

A good site for constructing a new primary school will therefore: be large enough to construct at least two 3-classroom buildings; have space for future expansion; have space for a playing area; be set on the outskirts of a village and be well back from any main road.

The site should have firm ground; a large reasonably flat area for the buildings and a playing field and good natural drainage.

LAYING OUT THE SITE

When laying out the buildings on the site the following rules should be followed:

- Orient all buildings so that the windows face north-south (i.e. with the line of the roof ridge running east-west) to reduce to the minimum the amount of sunlight entering the classrooms. There should be no direct sunlight entering the classrooms between 8am and 4pm.
- Buildings should be positioned along the contour lines rather than across them in order to keep foundation costs to the minimum. A variation of 30º from the optimum east-west orientation is acceptable if this reduces the foundation costs.
- Place classroom buildings at the rear of the site with playing fields, gardens, etc at the front to give privacy and keep classrooms away from the source of any noise such as roads.
- Situate any well used to supply drinking water to the school at least 15 metres and preferably 30 metres away from the school toilets.
- Pay attention to the contours of the site and do not place the buildings across the contours; in a hollow where water will collect or on soft wet ground. It

should be possible to run storm drains away from the buildings to dispose of storm water and water from roofs.

- Do not place classroom buildings too close together so as to avoid noise from one building interrupting teaching in another building. A minimum distance of 20 metres should be adequate.
- Do not place buildings too close to trees whose roots could damage foundations or whose branches could damage roofs. As many trees as possible should be kept however to provide shade on the site.

PREPARING THE SITE

Clear the whole site of shrubs and vegetation in order that the buildings can be positioned and set out.

Retain any large trees that are well away from the buildings in order to provide shaded areas on the site.

Orient the buildings to face north-south. This is best done using a compass but if this is not available the person supervising the construction should stand on the site with his arms outstretched and with his left hand pointing to where the sun rises and his right hand pointing to where the sun sets. He will then be facing south and the veranda of the buildings should face in this direction. The roof overhangs will then keep the sun off the windows for most of the day.

The space to be occupied by each building together with an area all round at least 2 metres wide should then be stripped of all top soil and vegetable matter and the soil stockpiled for future use in a position where it will not interfere with the work. The area around the building will be required as workspace during construction.

It is very important that all roots and vegetable matter within the area of the building are removed. Any vegetable matter that is left will rot and cause subsidence of floors or even of foundations and the cost of remedial work will then be very high.

Any termite nests that are found must also be dug out and destroyed.

ANNEX 7: PROPOSALS FOR IMPROVED PRIMARY SCHOOL DESIGNS

General

A number of factors have to be taken into account when designing new school facilities in countries such as Liberia. These include climate and geography, teaching methods and furniture, available building materials, local construction methods and skills, maintenance and probably most crucially, cost.

Liberia has a large deficit of school facilities, especially at the primary level and therefore requires a major primary school building programme. In order to achieve this, costs have to be kept low whilst ensuring that minimum space and construction standards are met.

A number of factors have also to be taken into account when designing the actual teaching spaces including the maximum class size, type and layout of furniture, teaching methods, light levels, ventilation, thermal comfort, acoustics both within the classroom and between classrooms and if any such services such as water and electricity are required.

Another important consideration is whether any element of community participation is to be designed into the implementation of a school facilities construction programme. This is becoming increasingly common in many countries in order to increase the level of community ownership of school facilities and thus increase the level of responsibility of the community in managing and maintaining those facilities when complete and also of course to reduce construction costs.

Community participation can take the form of the community providing land, labour or materials or contributing to the cost of construction. It can also take the form of the school or community being given responsibility for managing the construction of new facilities using local craftsmen or builders. If communities are to be used to manage the construction of schools then the construction materials and methods need to be kept as simple as possible in order that the community and local craftsmen and builders can understand them.

Classroom Design

In order to make classrooms as comfortable as possible, they must be designed to cope with the hot humid tropical climate that prevails over most of the country for a large part of the year while still being comfortable in the rainy season and at higher altitudes in the country.

Buildings should be orientated so that the long walls containing windows or lighting openings are facing north/south in order to minimise the amount of sunlight that enters the classrooms. Windows or lighting openings should be as large as possible

to maximise light and ventilation but still be protected from direct sunlight. This means in practice that roof overhangs should be large enough to stop the sun shining through the windows or openings into the classrooms. When buildings are orientated north/south the critical sun-angle on the south wall in most of Liberia is 45° in December at 8am and 4pm. The critical angles for the north wall are 53° in June at 8am and 4pm. If an access veranda is provided to the building this should if possible be on the south side of the building to give maximum protection to the south wall.

Windows or openings should be opposite one another to increase cross-ventilation and ceilings should be provided, as high as possible to provide maximum volume in the classroom and decrease solar radiation from the roof.

The main determinants for the design of classrooms other than the climate are the number of students, the space allowed per student and the type of furniture. The government has set the maximum number of students per classroom at 45 and the present area per student seems to be around 1.2m² giving a minimum classroom size of 54m² (583.2ft²).

A standard classroom size should therefore be adopted and a proposal is made later for this. It is hoped that a large classroom construction programme aimed principally at those areas with large deficits of classrooms will reduce the amount of over-crowding seen at present in many areas.

There is possibly a problem of small class sizes in some of the more remote rural areas and this should be dealt with in other ways rather than reducing classroom sizes as this will cause problems if and when class sizes increase. One solution would be to provide small, 3-classroom schools with standard classroom sizes where two classes could be taught. This however has implications for teacher training (teachers would have to be trained in multi-grade teaching) and for the provision of furniture.

Very small schools, if they exist with up to 40 or so pupils should probably operate as one classroom, one teacher, multi-grade schools and they would require a larger classroom than the proposed standard one. There would again be the issue of training teachers in multi-grade teaching. This necessity for this type of school requires further investigation.

Ramps up to verandas should be provided to give access for disabled students in wheelchairs.

Furniture

While it is recognised that because there is at present a chronic shortage of classrooms for primary school children and there is therefore a need to squeeze as many pupils into a classroom as possible, the arm-chair type of furniture is probably

appropriate, it must also be recognised that in the longer term a more appropriate form of furniture should be introduced.

If different types of teaching methods are to be introduced such as more pupil-centred, activity-based methods then a more flexible type of furniture than the arm-chair type presently in use (see Annex 1: Review of Existing Designs for Primary Schools) must be introduced such as double desks with chairs. It will then be possible to re-arrange the furniture for small or large group work, discussion groups, etc. In the case of small rural schools the students can also be split into two groups of different classes, facing different ends of the classroom, etc.

A standard double desk that is 3' 8'' x 1' 10'' (i.e. a double square) is proposed for use in primary school classrooms at least in the long term and these could be used separately or together to form a variety of layouts (see proposals).

The furniture should be designed to be easy to make and also easy to repair in a rural village situation and this usually means that the furniture will be made of timber. UNESCO has published designs for simple timber furniture (Educational Building Documents No E2) that have been successfully used in other developing countries such as Sierra Leone and these could be experimented with in Liberia.

At present two sizes of furniture are being supplied to primary schools and it is not known on what basis the sizes of the furniture were determined but both sizes are quite large (see Review of Existing Designs for Primary Schools). A primary school should probably have two different sizes of furniture to cater for the different heights of the students; one for Grade 1 – 3 pupils and one for Grade 4 – 6 pupils. Given the large numbers of over-age pupils in the primary school system, there is also at present a demand for adult-size furniture. Children will be able to concentrate and learn better if they are comfortable and they will only be comfortable if the chairs and desks are suitable for their height.

If possible, an anthropometric survey should be carried out to determine the range of heights of primary school students in Liberia and the range of furniture sizes that are required. UNESCO has published a guide for carrying out such a survey (Educational Building Digest No18) and how to use the data collected and maybe one of the Development Partners can be persuaded to carry out such a survey.

Water and Toilets

No new schools should be constructed or existing schools renovated or extended without the provision of a drinking water supply and adequate numbers of toilets for boys, girls and teachers.

Adequate provision should be made for the provision of drinking water supplies and surveys should be carried out before the construction programme starts to establish

whether piped water supplies are available or whether bore-holes or wells need to be constructed and equipped with buckets or hand-pumps.

Similarly adequate numbers of toilets should be constructed in a ratio of at least one toilet to 40 students (one toilet to 20 students would be the ideal). In the rural areas these toilets should probably be VIP latrines and these must be properly designed and constructed or will not work. If pour–flush toilets are used then these must be good quality and vandal-proof or they will not last very long; squat toilets will probably last the longest.

Care must be taken to situate any latrines, septic tanks or soakaways at least 30 metres from any well or borehole. This distance will have to be increased in areas with high water tables.

Construction

As these classroom buildings are to be constructed in a variety of locations and by local contractors, small builders, craftsmen and even communities, they should be simple to construct and it should be possible to construct them out of a range of materials such as sandcrete blocks, soil-stabilised blocks or even mud blocks. The proposal shown uses soil-stabilised blocks (see below). If stabilised soil or mud blocks are used they will require protection in the form of rendering where they are exposed to the rain on gable walls or veranda columns for instance.

Buildings should be constructed so that future maintenance costs are as low as possible. This will mean using good quality materials (especially roof sheets) which will increase the initial cost but will reduce future maintenance costs.

There should be a minimum of concrete in the building as this is increasingly expensive and difficult to obtain in Liberia and there should if possible be no reinforced concrete at all as this is both expensive and difficult to construct properly. It should be noted that at present the walls in school buildings are not tied into the RC columns and the columns therefore have a minimal structural effect and can be omitted. The only concrete within the building should be in the footings, foundation walls, floor slabs and possibly in a nominal ring beam and concrete pads on top of the columns to support the roof trusses. The floor slabs should be self-finished with no screed or topping.

Light to classrooms should be provided through concrete vent blocks or perforated block walls. If any windows are required in say offices or libraries they should take the form of ledged and braced timber shutters. Doors should be ledged and braced timber doors and should be easy to construct and repair by local carpenters. Plywood-faced flush doors should not be used.

In order to reduce maintenance problems and costs, the roofs should be double-pitch, have as high a pitch as economically possible both to reduce the possibility of

leaks and also to reduce uplift and the danger of damage to the roof in high winds. The provision of large roof overhangs will protect external wall finishes and thus reduce maintenance costs. The roof sheets and roof structure especially at the overhangs will however have to be securely fixed to reduce the possibility of damage.

Roof gutters should not be provided (unless necessary for collecting rainwater) as they are easily broken, become blocked with leaves and rubbish and provide breeding places for mosquitoes.

Roof trusses should be exposed and there should be a maximum of two trusses per classroom with rafters fixed over the cross walls and timber purlins large enough to span between them. If the trusses are visible it will be obvious if they are well made or not.

Ceilings should be fixed to the underside of the purlins and follow the slope of the roof to provide the maximum volume in the classrooms.

If possible storm drains and paving around the buildings should be provided to dispose of storm-water and to protect walls and foundations from erosion.

Dust is a problem in the dry season and a simple way to reduce dust is to plant trees and shrubs around the buildings. These will also protect buildings to some extent from the sun and wind and provide external shade areas for pupils.

Maintenance

At present schools appear to be receiving no funding for maintenance and little or no maintenance or repair takes place with the result that most school buildings, even if constructed to a reasonable standard soon start to deteriorate and have short useful lives.

There is at present very little community or student involvement in school maintenance and this should be changed. If communities are involved in constructing or managing the construction of school facilities then it is to be hoped that they will take responsibility for the maintenance of those facilities. They will however require training and guidance and the preparation of maintenance handbooks and training in maintenance for school staff, school management committees and communities should be part of any construction programme. Pupils should also be actively involved in the day-to-day cleaning and maintenance of facilities.

Proposed Standard Classrooms

A proposal has been prepared for a standard classroom that would be suitable for use in all parts of the country and although the present proposal is designed to be

constructed out of soil-stabilised blocks it could equally well be constructed out of sandcrete or mud blocks with a minimum of alterations.

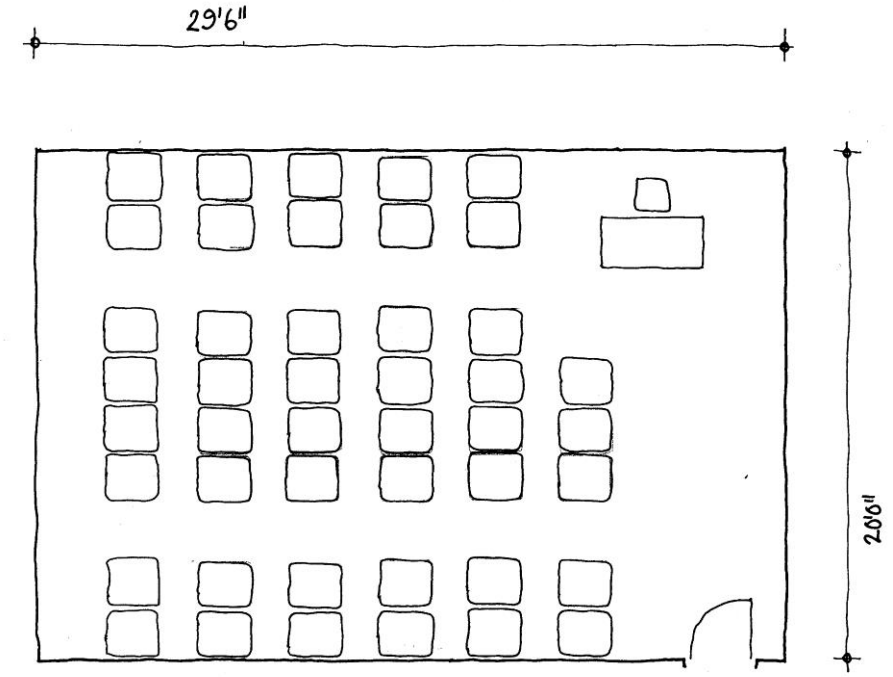

Figure 1: Standard classroom with 45 arm-chairs

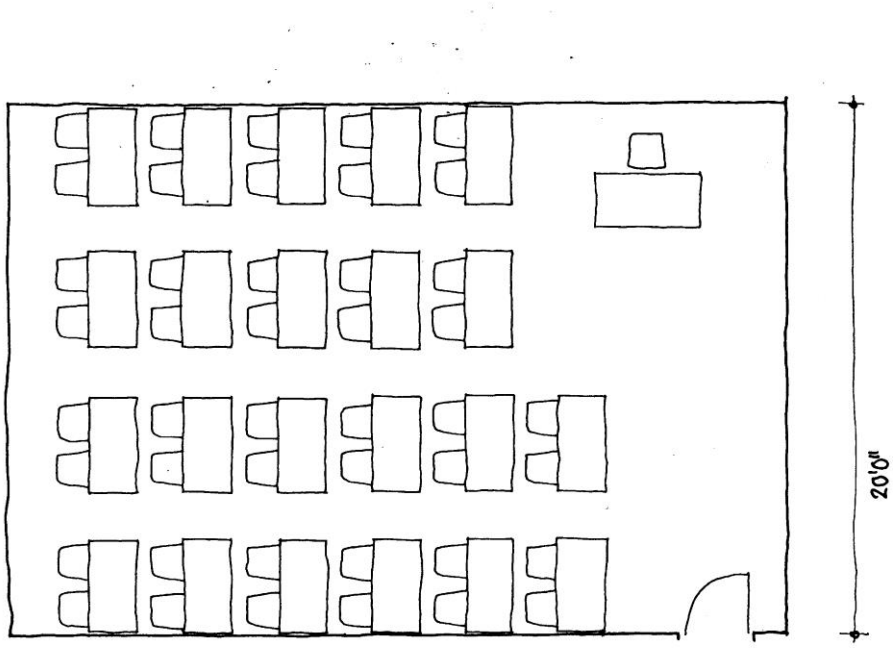

Figure 2: Standard classroom with 22 double desks

The classroom size is 20’ 0’’ x 29’ 6’’ and the side walls are 9’ 0’’ high (this is also the height of the underside of the truss). The classroom can comfortably seat 45 students using single arm-chairs or 44 students at double desks 3’ 8’’ x 1’ 10’’ which can be arranged in different layouts. The internal floor area is 590ft² (54.6m²) giving an area per pupil of 1.21m².

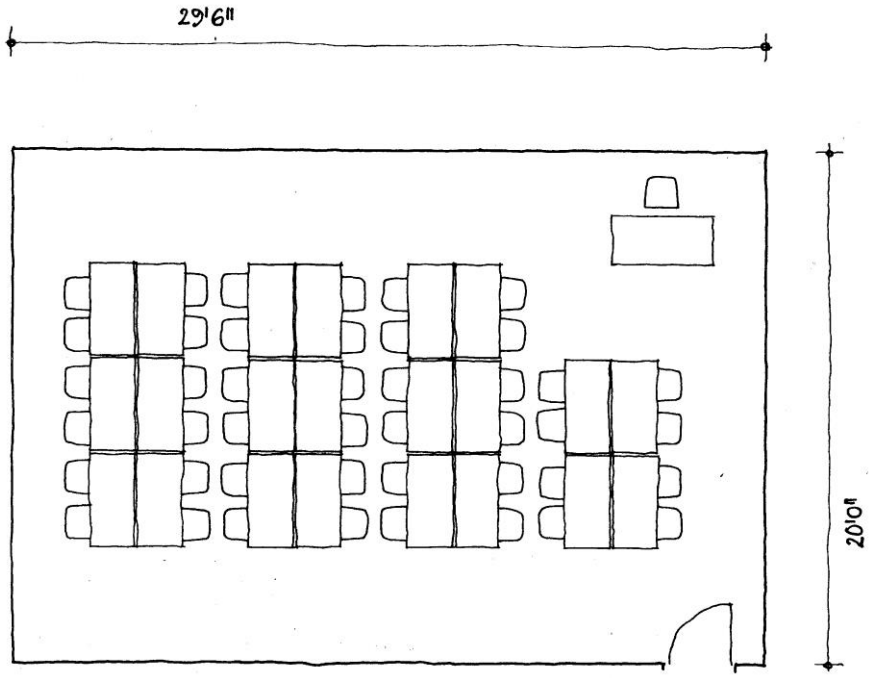

Figure 3: Standard classroom with double desks arranged for group work

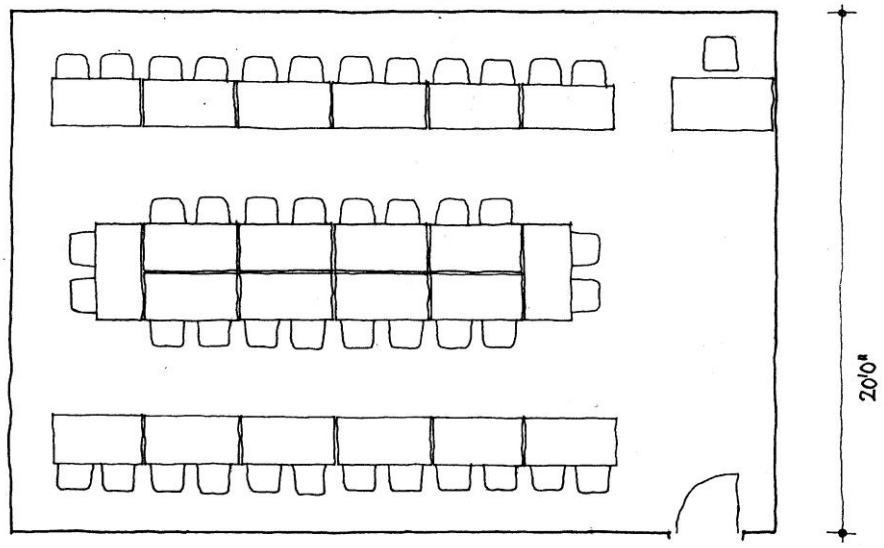

Figure 4: Standard classroom with double desks arranged for class discussions

The present proposal is designed to be constructed of standard 5½'' x 11½'' soil-stabilised blocks and all dimensions are calculated on the basis of using whole blocks with ½'' joints. Walls are formed into T-shaped piers under truss positions to give extra strength and stability. The blocks under trusses and rafters will have a concrete pad to provide bearing and holding-down bars will be built into the piers and fixed to the roof timbers to provide security to the roof during storms. Veranda columns, piers on the rear side of the buildings and gable walls will be rendered with a lean-mix render (1:6 maximum).

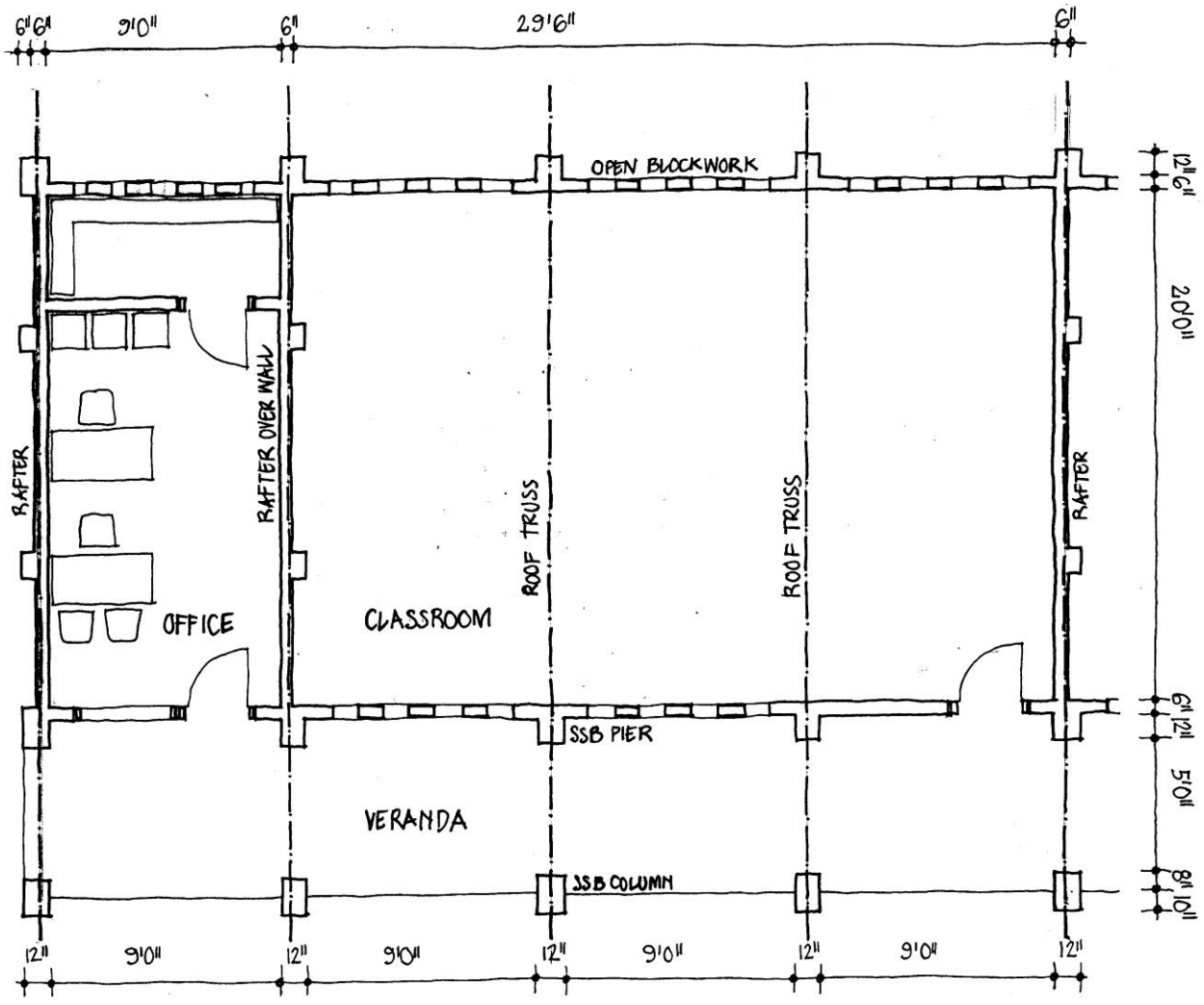

Figure 5: Plan of typical classroom and office showing basic construction

The floor is 4'' mass concrete with a steel float finish and with no screed. Footings to foundations are of mass concrete 8'' thick with 8'' and 6'' sandcrete block foundation walls. The ceiling (hardboard or plywood sheets) is fixed to the underside of the purlins and follows the slope of the roof. There are no external ceilings to reduce

maintenance costs. There is a gap over the side walls to provide ventilation under the roof.

Light to classrooms is provided through panels of open block-work. Windows to offices, etc are double timber shutters. Shutters and doors are made of ledged and braced timber with double frames at the top to support the block-work and avoid the need for concrete lintels thus simplifying construction and reducing costs.

The roof is double-pitch with large overhangs on all four sides. There are two trusses per classroom and timber rafters are fixed to the tops of dividing walls. Timber purlins span between trusses and rafters.

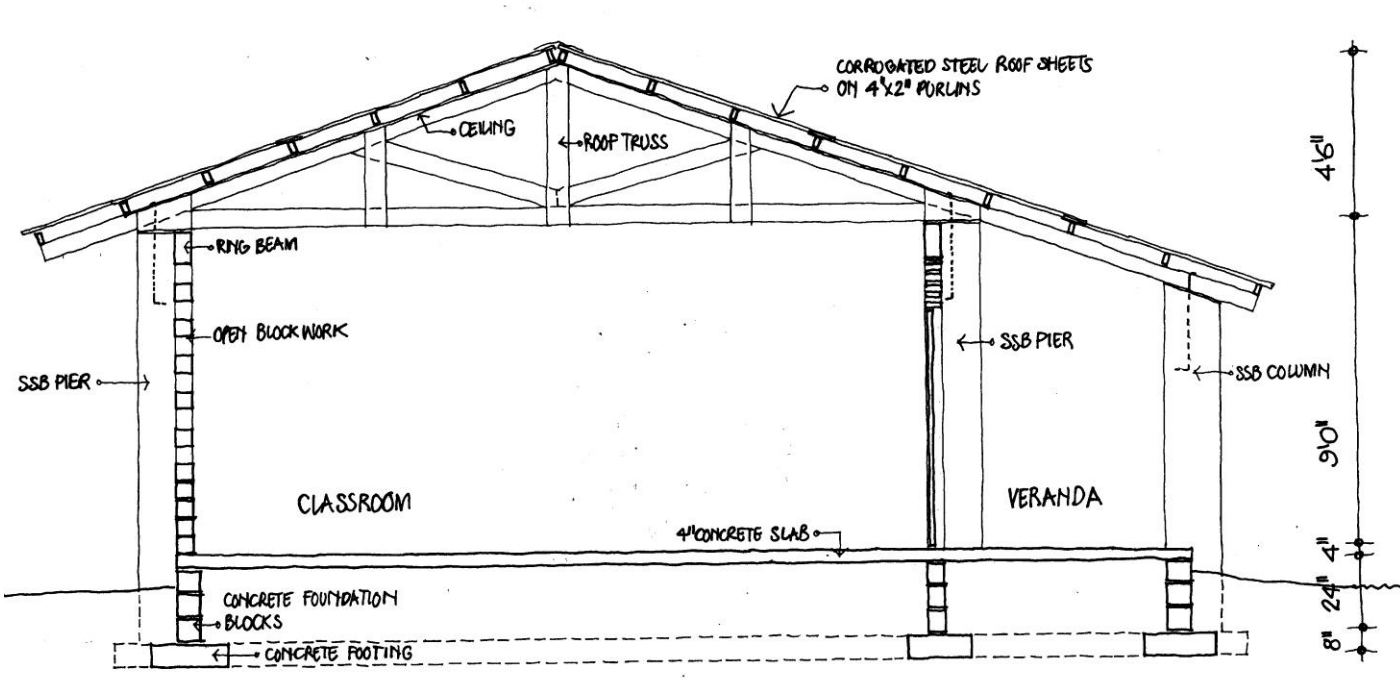

Figure 6: Typical section

There is a 6' 6'' wide access veranda in front of the classrooms and the buildings should if possible be surrounded by 3'' concrete paving and storm drains to protect walls and foundations.

Proposed Standard Buildings

A variety of standard buildings will be required to construct new schools and to extend existing schools that are being renovated and the following standard buildings are proposed:

- Building A with a principal's office and store; a teachers' room; a library and two classrooms.
- Building B with a principal's office and store; a teachers' room; a library and a multi-purpose room that can be divided into two classrooms.

- Building C with a principal's office and store; a teachers' room; a library and one classroom.
- Building D with four classrooms.
- Building E with three classrooms.
- Building F with two classrooms.
- Boys' VIP Latrine (3 cubicles plus one for male teachers for 6 classroom schools)
- Girls' VIP Latrine (3 cubicles plus one for female teachers for 6 classroom schools)

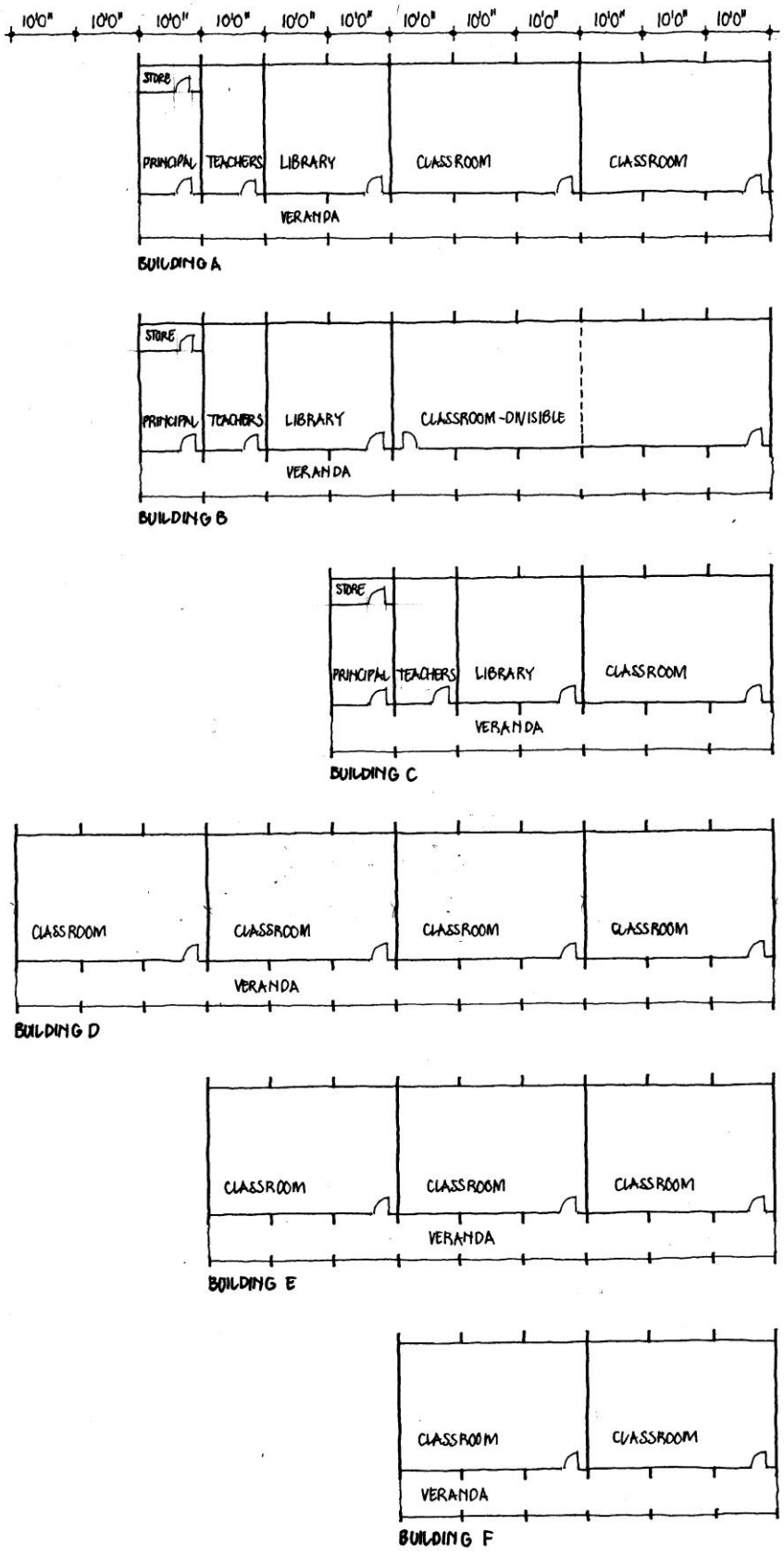

Figure 7: Proposed standard classroom buildings

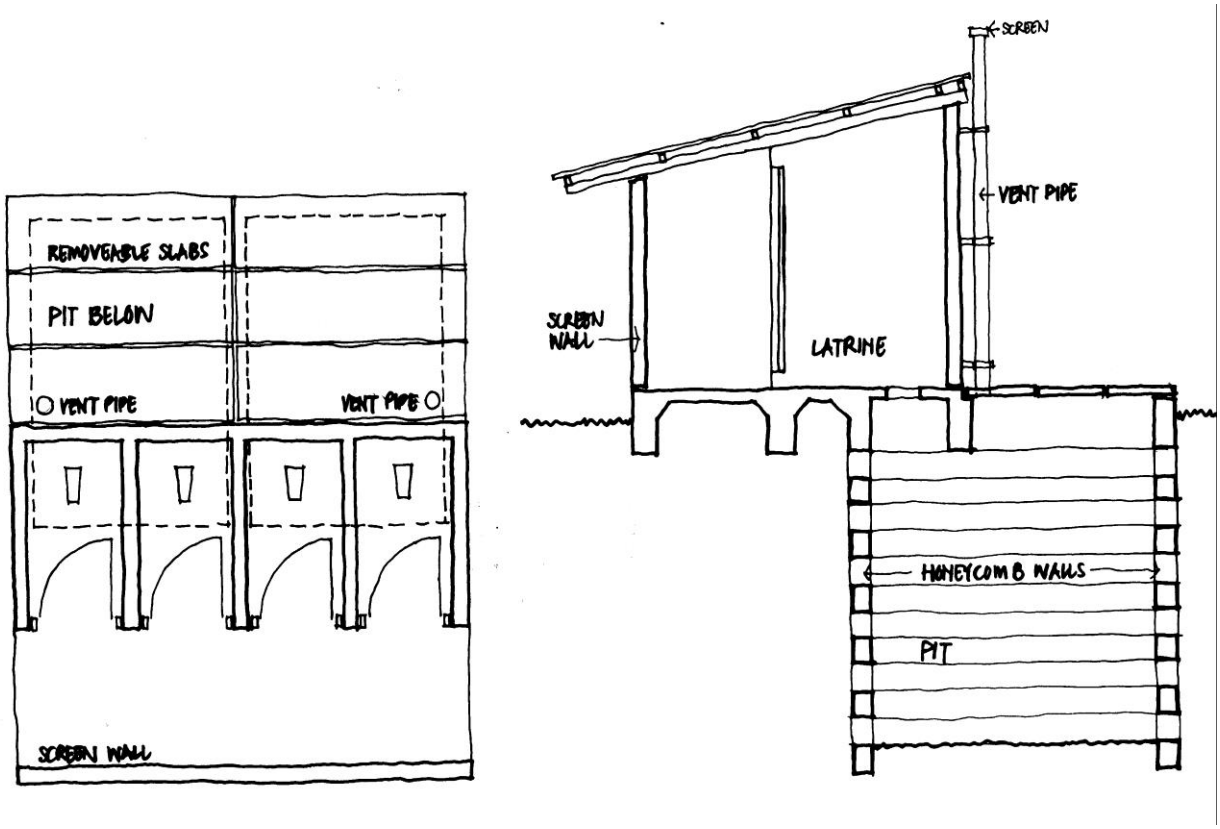

Figure 8: Typical VIP Latrine block

In very large schools it might be necessary to have more accommodation for staff and a larger library and additional standard latrine buildings can also be provided.

With these standard buildings it should be possible to construct new schools and extend existing schools no matter what the site conditions are. For instance a new one-stream grades 1-6 school could have Administration/Classroom Building A together with one 2-Classroom Buildings and one 3-Classroom Building or Administration/Classroom Building B together with one 4-Classroom Building depending on the size, shape and condition of the site. An existing school could be extended using the Administration/Classroom Buildings or 2-Classroom, 3-Classroom or 4-Classroom Buildings as required (if only one classroom is required it would probably be better to add it onto an existing building.

The buildings will be connected by paths but there will be no roofed links between the buildings and it will be simple therefore to arrange the buildings on the sites to suit the site conditions, levels, etc and to ensure that the buildings are oriented to face north/south. Assuming that the sites are large enough, it will also be quite simple to provide more buildings as and when required; if for instance the school population grows and additional facilities are required.

A typical site layout is shown to give an idea of how the buildings can be arranged on a site. During the first year's construction programme typical site layouts and

guidelines for setting out the school buildings on sites should be given to the civil works consultants and the [redacted] co-ordinating engineers and the NOGO engineers.

The guidelines should cover the location and orientation of the buildings; the use of paths to connect the buildings; the layout of the buildings in relation to the entrance to the site and to the site contours; the location of toilets in relation to the other buildings; the location of wells in relation to the toilets and the location of ‘bush kitchens’.

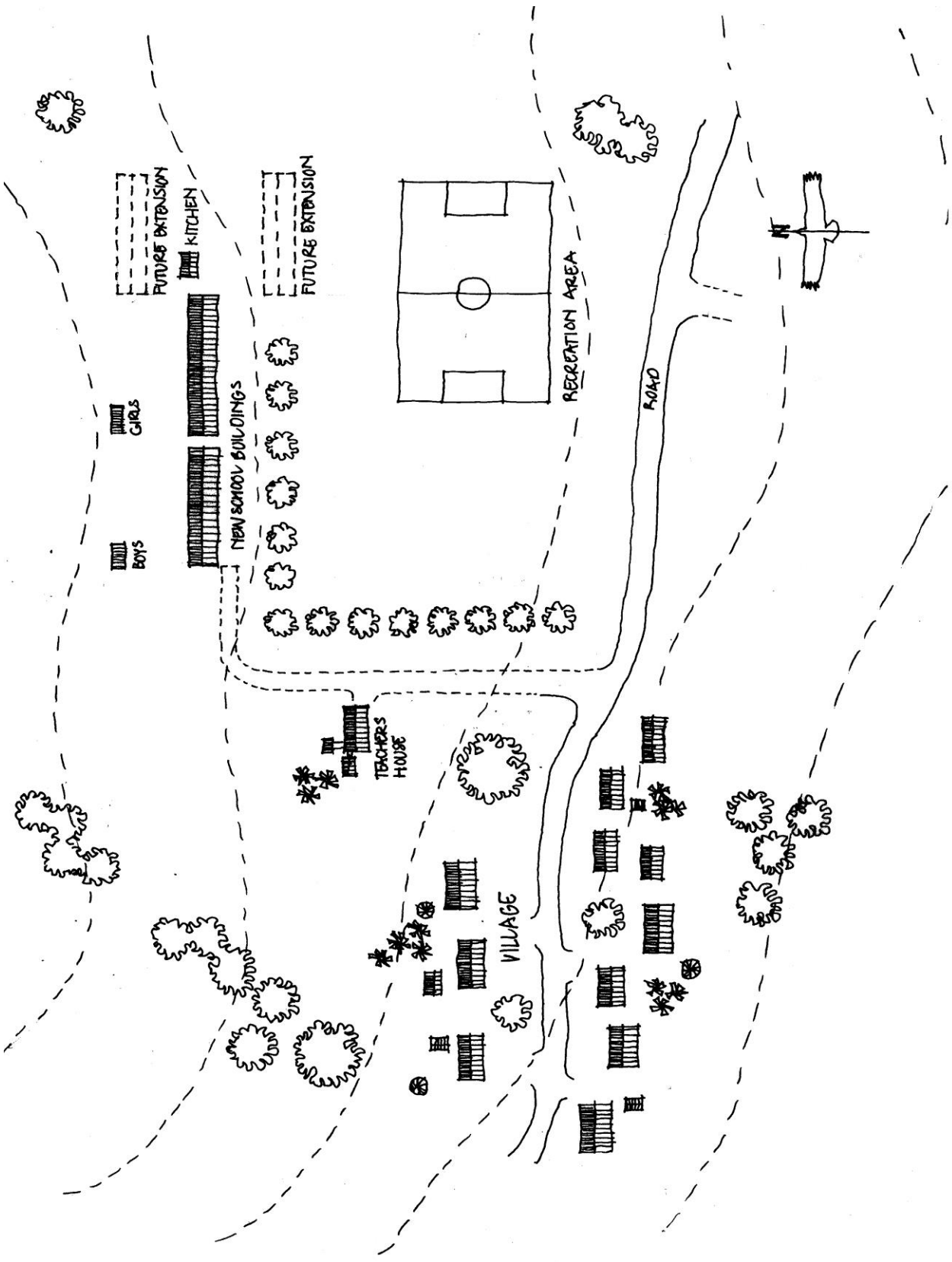

Figure 8: Typical primary school site layout