



## **The Kingdom of Tonga**

# **Tonga Education Support Programme**

## **School Infrastructure Survey 2006**

Infrastructure Advisor for School Mapping

Report: September 2006

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## **BACKGROUND**

### **The Kingdom of Tonga**

Tonga is an independent kingdom consisting of an archipelago of 129 islands, of which only 39 are inhabited. It is unique in the Pacific as it is the only country with a constitutional monarchy. It has a population of 102,000 with 39% of its population aged 14 or under. Approximately 70% of the population resides on the main island of Tongatapu. Tonga has a per capital GDP of USD1,595. Its human development outcomes, including under-five mortality rate, life expectancy, and literacy, are among the best in the Pacific, and on a par with its Middle Income Country status. It has a narrow economic base and material reliance is placed on inward remittances from relatives living overseas. A number of reform efforts have enjoyed limited success and the overall economic position continues to deteriorate. In 2005, a civil service strike was settled with pay rise commitments that cannot be financed within a business as usual framework.

### **Education**

The country has a long-standing tradition of providing virtually universal access to six years of compulsory, free primary education. Despite its relatively strong human development indicators and commendable strides in achieving universal primary education, the Government of Tonga (GoT) recognizes the need to improve the quality of education it is delivering in order to meet the challenges of a globalised market economy as well as the aspirations of its large proportion of unemployed youth. Accordingly, the Government has recently developed, through a three year long consultative process, an Education Policy Framework 2004-2019 (EPF) to provide a vision and strategy for undertaking comprehensive reform and improvement of its education system over the medium to long term.

### **Development partner assistance**

NZAID and the World Bank have jointly entered into contractual arrangements with the Government of Tonga (GoT) to partly finance the Ministry of Education (MoE) annual and rolling three year plans. These arrangements are known as the Tonga Education Support Program (TESP). Annual Joint Reviews (AJR) of the TESP will agree the activities to be financed by the donor partners.

## **THE ASSIGNMENT**

A component of TESP involves the development of Minimum Service Standards for schools (MSS) these standards will provide a benchmark for schools to identify possible deficiencies in service delivery. Each school will develop a rolling three year development plan which will outline the measures required to attain or supersede the MSS. Through the Tonga School Grants Program (TSGP), TESP will provide grants to schools to finance the inputs necessary to improve the quality of services they provide so that the standards are achieved. Aside from creating an environment in which

resources available to a school can be used to finance locally (school and community) determined needs, the Program provides the Government with the opportunity to establish a 'level playing field' particularly across government and non-government schools, by providing a disproportionate amount of funds and project support to disadvantaged or underserved schools.

It is expected that school rehabilitation will be an important feature of many schools' three year development plans and it is intended that specific guidelines for rehabilitation will be developed for schools so that they are able to expend grants wisely, ensuring that civil works undertaken meet all required standards.

## **TERMS OF REFERENCE**

The Infrastructure Advisor for School Mapping's terms of reference are to co-ordinate the gathering and analysis of data related to schools' infrastructure from the 124 primary schools and 38 secondary schools in Tonga so that the Ministry of Education and school communities are enabled to determine and prioritize the interventions required to improve schools' infrastructure. See Annex 8 for the detailed terms of reference for the assignment.

## **SCHOOL VISITS**

Three primary schools were visited on September 28<sup>th</sup> 2006 in order to assess the condition of the schools and compare this to the ratings given to the school buildings by the infrastructure survey engineers. Details of the school visits are given in Annex 6.

## **MEETINGS**

The Infrastructure Advisor met with members of staff of the Ministry of Education, Women's Affairs and Culture (MEWAC) and of the TESP management team, with a consultant working on the school grants programme, with a consultant working on the school information database and with the manager of the civil engineering firm that has carried out the school infrastructure survey and his staff.

## **SUMMARY OF REPORT**

### **School Infrastructure Survey**

#### **Findings**

The school infrastructure survey has now been completed and the information is being entered into the MEWAC school infrastructure data base. At the time of writing this report the information on some of the schools is still being updated and edited and the data base is not therefore complete. However all of the primary school survey reports have been reviewed and preliminary

conclusions have been arrived at based on these reports which are as follows and which are given in greater detail in Annex 1.

### ***Condition of the Buildings***

The overall picture of the current state of primary school buildings given by the infrastructure survey is of a general state of disrepair in many if not most buildings caused in some cases by the initial poor quality of construction and in all cases by the more or less complete lack of maintenance after construction.

The most common problems affect the roofs and roof structures which are the most vulnerable elements in a cyclone.

Other structural problems highlighted by the survey include inadequate foundations and foundation bracing, a lack of adequate connections between the floor structure and the foundations, inadequate bracing of walls, particularly timber walls, cracked floors and earthquake damage to floors and walls. In an earthquake the foundations, floor and walls are particularly vulnerable and of course if any of these requires replacement then it means in effect that all or most of the building has probably got to be replaced as well.

Quite a large number of buildings are in such poor condition due to either poor construction, lack of maintenance, earthquake damage or a combination of all three factors, that they require demolition and replacement as soon as possible as they pose a safety risk to students and teachers.

### ***Furniture***

A significant finding of the survey is that few if any schools have sufficient numbers of furniture and what furniture there is, is generally in poor condition and not really appropriate especially if teaching methods are to be improved. If more modern teaching methods are to be introduced then furniture that is more flexible in use, such as desks with separate chairs must be supplied to schools. The furniture must also be sized to fit the range of sizes of students.

### ***Sanitation and Water Supplies***

In terms of sanitation and water supplies the survey has identified a number of serious problems. Many schools do not have a dependable water supply all the year round whether they receive their water from a town supply or from rainwater storage tanks. This means that school children in many schools do not have a safe source of drinking water for at least part of the year.

Large numbers of primary schools have either no toilets or insufficient numbers of functioning toilets and many schools have flush toilets which will not function when there is no water supply and therefore have to close when there is no water for the toilets.

## **Site Works**

There are a number of general problems affecting school sites. These include a lack of fencing (required to keep pigs and other animals out); broken or missing storm drains; broken paths and septic tanks that are damaged or full.

## **Facilities**

A significant finding of the infrastructure survey is that few schools have office accommodation for principals and teachers or stores for the storage of school materials and equipment. There is also a lack of libraries or library space at many schools and a lack of teachers' housing especially in the outer islands.

There seems to be no standardisation of classroom sizes and classrooms vary widely in size from school to school. There also seems to be a problem with donors building more classrooms than required at small primary schools.

There are also significant numbers of very small primary schools (i.e. those with fewer than 30 students) mainly in the outer islands and these schools generally have more facilities than the number of students justifies.

There are also probably more small primary schools than the primary school age population justifies and MEWAC should use the completion of the survey together with the other school data such numbers of students, etc as an opportunity to close down unnecessary schools. This will of course be difficult to do but if it can be shown that a school is not really needed in terms of student population, that its buildings are in a very poor state and require expensive renovations and that there is another school nearby, then this could make it easier to do. Locating all existing primary schools on the digital maps that the Ministry of Lands and Surveys already have would also assist in this process.

## **Maintenance**

The survey highlights the fact that there has been an almost complete lack of maintenance of primary school buildings and it must be realised that unless the buildings that will be renovated or constructed under TESP are properly maintained, then the investment that will be made in these buildings will be largely wasted as they themselves will require further renovation or even replacement in a few years time. An Indonesian example showing the cost of not maintaining schools is given in Annex 7.

## **Recommendations**

### ***Selection of Schools for Renovation***

A review of the school survey results indicates that most primary schools in the country require renovation or maintenance work to a smaller or larger degree. The funds available under TESP however will only be sufficient to

cover the cost of the renovation of a small number of schools given the very high construction costs in the country.

The school profiles being developed using the school survey indication will indicate what schools have buildings that are in really bad condition. See Annex 2 for details of a typical school profile and how the survey information was used to rate the buildings. There are likely to be many more schools that have buildings in a bad condition or problems with water supplies and sanitation than there are funds to renovate them.

A policy decision has to be taken therefore as to whether to spend a small amount of money at a large number of schools or a larger amount of money at a smaller number of schools. If the former approach is taken then no school will be completely renovated and all schools will be left with at least some buildings that are either unsafe or require significant amounts of renovation work and some schools will also be left without a dependable water supply or inadequate numbers of functioning toilets.

It is recommended therefore that a small number of schools are completely renovated with any buildings that require replacement being demolished and replaced, with other existing buildings being renovated to an acceptable level and with the provision of dependable water supplies and adequate numbers of appropriate toilets. These schools will then provide models for the future renovation of the remaining schools in the country when further funds become available. Some of the criteria that could be used in selecting the schools to be renovated are set out in Annex 1.

### ***Standard of Renovation***

All of the schools selected for renovation under the TESP programme should be renovated to a similar standard. Any new buildings constructed to replace existing buildings should be simple and economic in terms of design and construction. All buildings, whether renovated or new should however be cyclone and earthquake resistant. See Annex 4 for details of proposed designs and types of construction.

The number and type of facilities to be provided at any school to be renovated should comply with the proposed minimum standards for primary school facilities in terms of numbers of classrooms, offices, stores and libraries. They should also have adequate numbers of appropriate toilets and a dependable drinking water supply. See Annex 3 for details of the proposed minimum standards for primary schools.

### ***Maintenance***

If the Ministry wishes to introduce school-based management into primary schools, then one of the most important aspects of school management that the school and its community will have to take responsibility for is the maintenance of the school buildings.

School principals, staff, students and communities will all have to be instructed in their various roles in maintaining their school's facilities and training in school maintenance will also have to be given. A primary school maintenance handbook will have to be developed that all involved at the school can use in maintaining their facilities.

### **Management of the Renovation Process**

The TESP documentation proposes that the renovation of school facilities to be carried out by the programme will be implemented and managed by the schools or PTAs. It seems that some construction is already being carried out by the PTAs but that this is happening on a very ad-hoc basis with no technical assistance and the quality of the buildings constructed this way has been very poor.

It has to be remembered that school facilities in Tonga have to be constructed to a very high standard in order to withstand cyclones and earthquakes and at present this is not generally the case. The school infrastructure survey has shown that the majority of the school building stock in the country is in a very poor state and many school buildings require major renovations if not replacement. It is not considered realistic therefore for schools and communities to carry out the renovation and construction work themselves.

It is recommended therefore that local contractors are used to carry out the renovation and replacement work and if the schools and PTAs are used to manage or assist with the management of the work then they should receive a great deal of technical assistance in order that the facilities are constructed to an acceptable standard and are capable of resisting both cyclones and earthquakes. See Annex 5 for details of the proposals.

The renovation of any school should not take place until the necessary technical assistance, management and supervision structures have been set in place together with all the documentation necessary to renovate or re-construct that school. It is also proposed that the process should start slowly with only one or two schools being renovated probably on Tongatapu Island so that they can be more easily managed and supervised. See Annex 5 for details of the management proposals for the renovation process.



## **Annex 1: Significant Findings based on the Infrastructure Survey Reports**

### **Condition of the Buildings**

The overall picture of the current state of primary school buildings given by the infrastructure survey is of a general state of disrepair in many if not most buildings caused in some cases by the initial poor quality of construction and in all cases by the more or less complete lack of maintenance after construction.

The most common problems affect roofs: damaged or rusty roof sheets, a lack of cyclone screws and washers, inadequate sizes of structural members and a lack of cyclone fixings, bracing, etc in the roof structure and a lack of adequate fixing of the roof structure to the walls or columns. There are also other problems caused by timber rot, termite attack, etc. The roof is the most vulnerable element in a cyclone and in many buildings the complete roof covering and roof structure requires replacement.

Other structural problems highlighted by the survey include inadequate foundations and foundation bracing, a lack of adequate connections between the floor structure and the foundations, inadequate bracing of walls, particularly timber walls, cracked floors and earthquake damage to floors and walls. In an earthquake the foundations, floor and walls are particularly vulnerable and of course if any of these requires replacement then it means in effect that all or most of the building has probably got to be replaced as well.

More general problems highlighted by the survey include fair-face block walls that allow rainwater to pass through, rotten or termite-damaged window and door frames, broken or missing glass louvre blades and louvre mechanisms that are no longer functioning, poor quality and broken doors and door hardware, damage to wall coverings both inside and out, damaged ceiling panels (usually caused by roof leaks) or a lack of ceilings altogether, damaged or rotting fascia and verge boards, veranda floors that require replacement, etc. Nearly all buildings (except those that have been very recently constructed) require the painting of walls and ceilings (internally and externally) and of windows, doors and frames, roof timbers, etc.

Quite a large number of buildings are in such poor condition due to either poor construction, lack of maintenance, earthquake damage or a combination of all three factors, that they require demolition and replacement as soon as possible as they pose a safety risk to students and teachers.

It should be noted that included in these buildings, especially in the outer islands, are many staff houses. A policy decision needs to be made by the Ministry on whether to renovate existing staff houses or provide new ones and this decision awaits a review of education act/ public service commission policy on staff housing.

It should also be noted that new buildings being funded by donors are in many cases not being constructed to the standards required to enable the buildings to stand up to the severe earthquakes and cyclones that regularly affect the Kingdom.

## **Furniture**

A significant finding of the survey is that few if any schools have sufficient numbers of furniture for the students and what furniture there is, is generally not in good condition and is not really appropriate especially if teaching methods are to be improved.

The furniture usually consists of a double bench (often used by more than two students) with either a loose or an attached fixed bench for seating. This sort of furniture while cheap to make is not appropriate for modern teaching methods in that it is very inflexible. It more or less forces the teacher to adopt the 'chalk and talk' method of teaching. If more modern teaching methods are to be introduced then furniture that is more flexible in use, such as desks with separate chairs must be supplied to schools.

It should also be noted that there are no different sizes of furniture being used in primary schools. Children at a primary school range in age from 6 years to 12 years or even older if children start late or repeat classes. The children therefore vary greatly in size and primary schools should probably have at least three different sizes of furniture to accommodate this range of sizes. If children are not comfortable then it will be difficult for them to concentrate and the learning process will be impeded.

The only way to establish the correct range of sizes of furniture required in schools in Tonga will be to carry out an anthropometric survey of a sample of children of school going age. This is not difficult and UNESCO has published a number of publications setting out how this should be done and how the results can be used to determine the sizes of furniture required.

## **Sanitation and Water Supplies**

In terms of sanitation and water supplies the survey has identified a number of serious problems. Many schools do not have a dependable water supply all the year round whether they receive their water from a town supply or from rainwater storage tanks. This means that school children in many schools do not have a safe source of drinking water for at least part of the year. Many water storage tanks are broken or are leaking and many of the gutters and downpipes that feed water tanks are also broken.

A further finding from the infrastructure survey is that large numbers of primary schools have either no toilets or insufficient numbers of functioning toilets. In many cases, especially in the outer islands where there are no dependable water supplies, flush toilets which will not function when there is no water supply have been provided to schools. Many schools therefore have to close when there is no water for the toilets.

As well as the problems of water supply, those schools that have flush toilets also have problems caused by the use of poor quality fittings (ceramic toilets are fairly fragile and easily broken by school children), poor installation and the lack of maintenance such as emptying of septic tanks, replacement of broken sanitary-ware, taps, etc, repair of broken and leaking pipes, etc.

### **Site Works**

There are a number of general problems affecting school sites. These include a lack of fencing (required to keep pigs and other animals out); broken or missing storm drains; broken paths and septic tanks that are damaged or full (how are septic tanks emptied particularly in the outer islands?).

### **Facilities**

A significant finding of the infrastructure survey is that few schools have office accommodation for principals and teachers or stores for the storage of school materials and equipment. This means that in many schools classrooms are being used for one or more of these functions thus reducing the number of classrooms available for teaching. All schools require some space for teachers to prepare and mark lessons, hold staff meetings, etc and for the secure storage of books, school materials and equipment.

There is also a lack of libraries or library space at many schools and a lack of teachers' housing especially in the outer islands.

There seems to be no standardisation of classroom sizes and classrooms vary widely in size from school to school. There also seems to be a problem with donors building more classrooms than are required at very small primary schools. It must be realised that all new buildings will eventually require maintenance and it is important therefore to keep the size and number of school buildings to the minimum in order to reduce future maintenance costs.

The infrastructure survey has shown that there are significant numbers of very small primary schools (i.e. those with fewer than 30 students) mainly in the outer islands. If possible these schools should be merged with the nearest larger primary school within walking distance but if this is not possible because for instance the school is the only one on the island or for other reasons then they will have to be retained but the facilities provided should be reduced to a minimum in order to reduce both capital and recurrent costs.

There are also probably more small primary schools than the primary school age population justifies and MEWAC should use the completion of the survey together with the other school data such numbers of students, etc as an opportunity to close down unnecessary schools. This will of course be difficult to do but if it can be shown that a school is not really needed in terms of student population, that there is another primary school nearby, that its buildings are in a very poor state and require expensive renovations then this could make it easier to do. Locating all existing primary schools on the digital

maps that the Ministry of Lands and Surveys already have would also assist in this process.

## **Maintenance**

The almost complete lack of maintenance of most primary school buildings has been commented on in some of the sections above. It must be realised that unless the buildings that will be renovated or constructed under TESP are properly maintained, then the investment that will be made in these buildings will be largely wasted as they themselves will require further renovation or even replacement in a few years time. An example showing the costs of not maintaining primary school buildings is attached as Annex 7.

## **Recommendations Arising from the Findings of the School Infrastructure Survey**

### **School Profiles and the Selection of Schools for Renovation**

The school profiles that are being developed using the information gathered during the school survey (see Annex 2) will highlight a number of factors to be taken into account when selecting the primary schools that are to be renovated using funds from TESP.

It should be stated here that a review of the survey results indicates that most primary schools in the country require renovation or maintenance work to a smaller or larger degree and that the funds available under TESP will only be sufficient to cover the cost of the renovation of a small number of schools given the very high construction costs in the country.

A policy decision has to be taken as to whether to spend a small amount of money at a large number of schools or a larger amount of money at a smaller number of schools. If the former approach is taken then no school will be completely renovated and all schools will be left with at least some buildings that are either unsafe or require significant amounts of renovation work and some schools will also be left without a dependable water supply or inadequate numbers of functioning toilets.

The most cost-efficient strategy would seem to be to spend the funds available on completely renovating a smaller number of schools, providing them with a safe and comfortable learning environment.

It is recommended therefore that the selected schools are completely renovated with any buildings that require replacement being demolished and replaced, with other existing buildings being renovated to an acceptable level and with the provision of dependable water supplies and adequate numbers of appropriate toilets. These schools will then provide models for the future renovation of the remaining schools in the country when further funds become available.

The main criteria to be taken into account when selecting the schools eligible for renovation grants should be some or all of the following:

1. Classroom/student ratio: schools with insufficient useable classrooms to accommodate all existing students at a ratio of 30 students to a classroom should be considered. These numbers should not take into account any classrooms that should be demolished and replaced.
2. Poor quality classroom buildings: schools with one or more classroom buildings rated at 2.5 (see school survey results) or above should be considered.
3. Poor quality or insufficient numbers of toilets: schools with less than 1 useable and reliable toilet for 40 students and/or with no separate provision for boys and girls should be considered.
4. Non-existent or unreliable water supply: schools with no water supply or an unreliable one should be considered.

It is also proposed that a mix of schools should be renovated: these should include some large schools in urban areas together with a number of smaller schools on isolated islands where there are no alternative schools. Both types of schools should however comply with some or all of the above criteria.

Other schools that comply with some of the above criteria but that it is impossible to renovate under the TESP programme will have to wait until further funds for renovation become available either from government or from other donors. The same criteria as used for TESP should however be used when selecting other schools for renovation in the future.

### **Standard of Renovation**

All of the schools selected for renovation under the TESP programme should be renovated to a similar standard. Any new buildings constructed to replace existing buildings should be simple and economic in terms of design and construction. All buildings, whether renovated or new should however be cyclone and earthquake resistant. See Annex 4 for details of proposed designs and types of construction.

The number and type of facilities to be provided at any school to be renovated should comply with the proposed minimum standards for primary school facilities in terms of numbers of classrooms, offices, stores and libraries. They should also have adequate numbers of appropriate toilets and a dependable drinking water supply. See Annex 3 for details of the proposed minimum standards.

### **Maintenance**

Construction costs in Tonga are very high because of both its geographical location and its almost complete lack of local building materials and if the Ministry does not start to take the maintenance of school buildings seriously then large sums of money that could otherwise be spent on improving the

standard of education will continue to be required for the renovation and replacement of school buildings. See Annex 6 for an Indonesian example of the cost of maintaining or not maintaining school facilities.

If the Ministry wishes to introduce school-based management into primary schools, then one of the most important aspects of school management that the school and its community will have to take responsibility for is the maintenance of the school buildings.

School principals, staff, students and communities will all have to be instructed in their various roles in maintaining their school's facilities and training in school maintenance will also have to be given. A primary school maintenance handbook will have to be developed that will assist all involved at the school in maintaining their facilities.

## **Annex 2: School Profiles: A Typical Example**

### **School Buildings: Survey Information**

A large amount of information on each building at each school has been collected during the school infrastructure survey. This information together with the photos of each building will be an invaluable resource for the Ministry and donors to use when plans are being made to renovate any school.

The information has been entered into a database and the information has then been manipulated into a form more accessible and more useful for generating the school profiles. The information on each building has now been divided into six categories:

1. Structural Elements
2. External Elements
3. Internal Elements
4. Finishes
5. Services
6. Furniture

Only Category 1, Structural Elements has been used to assess the condition of the school buildings in the School Profiles, the reason for this being that it will only be economic to renovate a building if its structural condition is good. Other elements such as windows and doors can be replaced or upgraded as necessary as can the finishes, services and furniture.

The condition of each building in the School Profiles is assessed as being 1: Good; 2: Average; 3: Poor and 4: Needs Replacement and any building with a score of 2.5 or more should be considered for significant renovations or replacement.

### **Details of the Six Categories**

- 1. Structural Elements:**
- 1.1 Roof Finish
  - 1.2 Roof Structure
  - 1.3 Walls
  - 1.4 Wall Columns and Beams
  - 1.5 Floor
  - 1.6 Foundations

Note: All buildings are rated in the School Profiles using the results of the six categories above.

- 2. External Elements:**
- 2.1 Veranda Floor
  - 2.2 Veranda Foundations
  - 2.3 Veranda Columns and Beams
  - 2.4 Veranda Ceilings
  - 2.5 Windows and Fittings
  - 2.6 Doors and Fittings

- 2.7 External Paving
- 2.8 Storm Drains
- 2.9 Fascias, Eaves and Verge Boards

- 3. Internal Elements:**
  - 3.1 Ceilings
  - 3.2 Internal Walls
  - 3.3 Internal Doors
  - 3.4 Chalkboards
  - 3.5 Sinks
  - 3.6 WCs
  - 3.7 Science Labs
  - 3.8 Workshops
  - 3.9 IT

- 4. Finishes:**
  - 4.1 Paint: Fascias, Eaves, etc
  - 4.2 Paint: Walls
  - 4.3 Paint: Ceilings
  - 4.4 Paint: Doors and Windows
  - 4.5 Floor Finish
  - 4.6 Chalkboards

- 5. Services:**
  - 5.1 Electricity
  - 5.2 Water
  - 5.3 Soil and Waste
  - 5.4 Gutters
  - 5.5 Water Tanks

- 6. Furniture:**
  - 6.1 Shelves and Cupboards
  - 6.2 Teachers' Desks and Chairs
  - 6.3 Students' Desks and Chairs

### **School Profiles**

A typical School Profile is attached for GPS Tu'neivale, Vava'u Island.



**School profile 1**

Rural/Urban: Urban  
 Village: Tu'aneKivale  
 Island: Vava'u  
 Island group: Vava'u

Telephone  
 email

**Basic School Data**

Year Established: 0  
 Number of existing classrooms: 5  
 Classroom:Student ratio: 22.0

	2005	2006
Students:	121	110
Teachers:	6	6
Student:Teacher Ratio	20.2	18.3

PTA meetings per annum: 3

**General comments:**

Demolish 2 classroom & 3 classroom buildings. Strengthen roof of other classroom building, plus minor repairs and maintenance.

Construct new 3 classroom/admin building, minor repairs to toilet, new water tank.

Do not renovate staff house



*Building Quality*

<i>Block A</i>		<i>Quality</i>	<i>AreaRooms</i>	
Staff House	concrete block structure		27	1
	Structural elements	3.0		
	External elements	3.0		
	Internal elements	2.8		
	Finishes	2.7		
	Services	3.0		

*General comment:* Do not renovate

<i>Block B</i>		<i>Quality</i>	<i>AreaRooms</i>	
Classroom	concrete block with corrugated iron		34	1
	Structural elements	2.0		
	External elements	2.3		
	Internal elements	2.0		
	Finishes	2.3		
	Services	1.5		
	Furniture	2.7		

*General comment:* Provide cyclone screws

<i>Block C</i>		<i>Quality</i>	<i>AreaRooms</i>	
Classroom	concrete block structure		118	2
	Structural elements	3.3		
	External elements	2.7		
	Internal elements	3.0		
	Finishes	3.0		
	Services	1.0		

*General comment:* Demolish, due to earthquake damage

<i>Block D</i>		<i>Quality</i>	<i>AreaRooms</i>	
Classroom	concrete slab, timber structure, corrugated iron		196	3
	Structural elements	2.2		
	External elements	2.7		
	Internal elements	3.0		
	Finishes	2.8		
	Services	2.3		
	Furniture	3.0		

*General comment:* Do not renovate

<i>Block E</i>		<i>Quality</i>	<i>AreaRooms</i>	
Toilet block	concrete slab, timber structure, corrugated iron		20	0
	Structural elements	2.0		
	External elements	2.7		
	Internal elements	2.0		
	Finishes	2.0		
	Services	1.8		

*General comment:* provide cyclone screws

## **Annex 3: Proposed Minimum Standards for Primary School Facilities**

### **Introduction**

It is proposed that the Ministry of Education should develop a set of minimum standards for primary school facilities that should be followed by the Ministry or any other agency constructing or renovating primary schools. Preliminary proposals for the standards are given below.

It will not be possible to attain these standards in all schools immediately. However the schools selected for renovation under the TESP programme should be renovated in such a way that they comply with these standards and they can then be used as models for the Ministry and other agencies when renovating primary schools in the future.

### **Categorising Primary Schools**

It is proposed that all primary schools are categorised according to one of the following categories:

1. Category 1: very small primary schools: up to 30 students.
2. Category 2: small primary schools: from 31 to 90 students.
3. Category 3: medium primary schools: from 91 to 180 students.
4. Category 4: large primary schools: with more than 181 students.

All primary schools should also be categorised as either urban or rural schools using the following criteria:

Urban Schools: those schools with access to piped water, town power and waste disposal services (main sewers, septic tank pump-out and rubbish collection).

Rural Schools: all other schools.

### **Primary School Facilities**

The Ministry should establish minimum standards for the facilities to be provided to all four categories of primary schools. A proposal for the various types of facilities to be provided for each category is set out below.

#### ***Classrooms***

A standard classroom is proposed that will accommodate 30 students with an area of approximately 1.6m<sup>2</sup> per student. The size of this classroom will be 6.2 x 7.8 metres internally. These classrooms can be linked together to form units of 2 classrooms, 3 classrooms and 4 classrooms which can then be used to accommodate students at any category and size of primary school. All classroom buildings will have an access veranda 1.8 metres wide (see Annex 4 Drawing 1 for more details of the design of the classrooms).

### *Category 1 Schools*

It is proposed that at the very small, Category 1 schools, only one classroom is provided but that this classroom is larger than the standard classroom in order to give more flexibility in use as it will have to be used for multi-grade teaching for up to six classes. The size of this classroom will be 6.2 x 9.8 metres (see Annex 4 Drawing 1 for details).

### *Category 2 Schools*

At Category 2 schools, 3No standard classrooms will be provided to cater for a maximum of 90 students. This provision will mean that each classroom will have to accommodate up to two classes and teachers will have to be trained in multi-grade teaching.

### *Category 3 Schools*

At Category 3 schools, 4No, 5No or 6No classrooms will be provided depending upon the number of students enrolled i.e. if there are 120 students then 4No classrooms will be provided; if there are 150 students then 5No classrooms will be provided, etc. Classrooms will be provided through the construction of the appropriate number and type of standard classroom buildings.

### *Category 4 Schools*

At Category 4 schools, sufficient numbers of classrooms will be provided to accommodate the total number of students at a rate of 30 students per classroom using the various types of standard classroom buildings.

### **Classroom Furniture**

It is proposed that double desks of a modular size (100 x 50 centimetres of varying heights) with separate chairs are used. These can then be arranged in different ways in the classroom to suit different teaching modes. See drawings.

It is also proposed that primary schools should be supplied with three different sizes of furniture to accommodate the range of ages and sizes found in most primary schools. The actual sizes should be established by carrying out an anthropometric survey of a representative sample of children of primary school age from across the country.

All classrooms should be provided with a chalkboard and a pin-board on opposite ends of the classroom both at least 4.8 x 1.2 metres in size.

All classrooms should also have a teacher's desk and chair and a lockable cupboard for books and equipment.

## **Offices and Stores**

It is proposed that all schools should have some provision for offices and storage space. The proposed provisions are as follows:

### *Category 1 Schools*

No separate provision: the teacher will use the classroom when school is not in session and will have a secure cupboard for his/her own use in the classroom.

### *Category 2 Schools*

Provide a combined principal's office and store, 6.2 x 3.8 metres.

### *Category 3 Schools*

Provide a combined principal's office and store, 6.2 x 3.8 metres and a teachers' room, 6.2 x 3.8 metres.

### *Category 4 Schools*

Provide a principal's office, 6.2 x 3.8 metres, a separate store, 6.2 x 1.8 metres and a varying number of teachers' rooms 6.2 x 3.8 metres depending on the size of the school and the number of teachers.

## **Libraries**

It is proposed that only the largest Category 4 schools should have a dedicated room for a library and it is proposed that this room should be the same size as a standard classroom, 6.2 x 7.8 metres. All other primary schools could have 'library corners' in classrooms or shelves in stores for library books.

## **Staff Housing**

Staff houses are at present provided at many schools and many are in very poor condition and require renovation or replacement. A decision on whether to provide new staff houses will however have await a review of education act/ public service commission policy on staff houses.

## **Services**

### **Water Supplies**

It is proposed that all primary schools should have a dependable, year-round source of drinking water whether it is from a town mains water supply or from water tanks. If a dependable mains water supply is not available then water storage tanks should be provided at the rate of 2 litres per student and staff

for a period of 60 school days. The water storage tanks should be fed either from the mains or from roof gutters.

### **Sanitation**

It is proposed that all schools should have appropriate toilets provided at a rate of 1 toilet to 40 pupils. Separate toilets, set apart if possible, should be provided for boys and girls and except at the very small schools, separate provision should also be made for staff toilets. Urinals should not be provided for boys as these are very difficult to keep clean, block up, break down, etc.

It is also proposed that, except at schools where there is a year long dependable source of piped water and a septic tank emptying service, alternative types of toilets to flush toilets should be provided. These can either be VIP latrines (these are ventilated, improved pit latrines that should not smell), pour-flush latrines (these are pit latrines that are flushed with a small amount of water from a container or could also be lined pits that would require emptying), composting latrines, etc.

It must be recognised that the provision of latrines on many islands in the Kingdom will be problematical because of the very high water tables. Pit latrines of any type need to be deep in order that they will not fill up quickly and this means that the pit could penetrate the water table and pollute the water source. This is a problem that needs further study in order to find the optimum solution.

Hand washing facilities should be provided close to all toilets. If there is a piped water supply then these should be provided at a rate of 1 basin for 40 students. If there is no piped water then rainwater storage tanks fed from the roofs of the toilets should be placed adjacent to all toilet buildings.

### **Design and Construction of Primary School Facilities**

All primary school facilities should be simply designed and should be simple and economic to construct while at the same time being able to withstand the cyclones and earthquakes that regularly occur in the Kingdom.

Classrooms should be designed to have adequate light and ventilation and windows/openings for ventilation should be a minimum of 15% of the floor area. Window openings should have storm shutters to protect them against cyclones.

All new buildings should if at all possible, be oriented so that the long axis of the building runs east/west. This together with large roof overhangs will give maximum protection to window openings and walls from solar radiation (and also protect window openings and walls from the rain) and help keep the buildings cool (see Annex 4 for more details of the design and construction of classrooms).

## **Security**

Primary schools should provide a secure and safe environment for both students and teachers.

Sites should be fenced where possible to keep out pigs and other animals. Storm drains should be provided where necessary to take excess storm water off the site and access paths should also be provided where necessary especially on sloping sites to provide safe access to buildings.

All school buildings should have solid lockable doors and security mesh to windows together with storm shutters to protect window openings in times of cyclones.



## **Annex 4: Design and Construction of Classrooms and other Primary School Facilities**

### **Classroom Design**

A standard classroom size is proposed for use at the majority of primary schools (Category 2, 3 and 4 schools) that will accommodate 30 students sitting at double desks with loose chairs. The classroom is 7.8 long x 6.2 metres wide internally which gives a classroom area of 48.36M<sup>2</sup> and an area per student of 1.61M<sup>2</sup> with 30 students. See Drawing 1.

The standard classrooms can be linked to form units of two, three and four classrooms which should provide enough variations to accommodate the majority of primary school sizes. See Drawings 2 and 3.

It is proposed that at the very small, Category 1 schools, only one classroom is provided but that this classroom is larger (6.2 x 9.8 metres) than the standard classroom in order to give more flexibility in use. See Drawing 1.

All classroom buildings will have a front access veranda and all classrooms will have simple openings for light and ventilation on both sides of the classrooms protected by wire mesh screens and shutters.

### **Classroom Construction**

Construction of permanent classroom buildings in Tonga is of two main types: reinforced concrete block walls on a concrete floor slab on ground or timber-framed construction with various wall linings on raised columns, usually of blockwork, with timber floors. All buildings have corrugated steel roof sheets supported by timber purlins and timber roof trusses with or without ceilings.

Given Tonga's geographical position, there are inherent problems with both types of construction. If the concrete block buildings are not constructed to the correct specification with the correct reinforcement and the blocks are not properly filled with concrete then the buildings will be vulnerable in an earthquake and because of the heavy construction could be dangerous.

Similarly, timber-framed buildings if not designed and constructed with adequate bracing to all walls and foundations will be vulnerable to both earthquakes and cyclones.

The roof structures to both types of building will also be at risk in cyclones if they are not properly constructed of the correct quality of timber fixed with cyclone fixings as will the roof sheets if they are not fixed with adequate numbers of cyclone screws and washers.

*Proposed construction:* Given the scattered nature of Tonga's islands, the problems and cost of transport and even more importantly the difficulty of supervising the construction of buildings to ensure that they are constructed properly, it is proposed that, certainly on islands other than Tongatapu Island,

school buildings are constructed of timber framed walls, lined with plywood ('Hardiply') externally, with timber floors raised above the ground on blockwork, steel or timber foundations with timber roof structures and corrugated steel roof sheets. See Drawing 4.

Construction and supervision of this type of building should be easier than for buildings constructed of concrete blockwork. A possible alternative would be to use timber-framed construction on a concrete floor and foundations. In this case the timber frame would have to be securely fixed to the concrete floor slab and foundations to prevent the buildings being blown away in cyclones.

*Structural module:* A 2-metre structural module is proposed with cross-walls and trusses on this module (see drawing). This will give a number of advantages: it will reduce the number of roof trusses to three per classroom rather than the five seen in most existing classroom buildings thus reducing costs; it will also enable the provision one module rooms (1.8 metres wide) or two module rooms (3.8 metre wide) that can be used for a variety of purposes. The larger classroom to be used at Category 1 schools will be five modules long (9.8 metres long) with four roof trusses. See Drawing 4.

The reduction of the width of the buildings from 7 metres to 6.2 metres will simplify construction of the roof trusses and greatly reduce costs.

*Roof construction:* The pitch of the roof should be as high as economically possible ( $22\frac{1}{2}^{\circ}$  minimum) to reduce uplift in high winds and cyclones and roof overhangs should be as large as possible (within the constraints of designing for cyclones) to give protection to windows from solar and rain penetration. The climate in Tonga is very corrosive because of the island nature of the country and galvanised roof sheets therefore have a comparatively short life. The roof sheets used on school buildings should therefore be the best quality possible to ensure that they have a reasonably long life and for this reason it is recommended that 'Colorbond' sheets, .55mm thick are used. Roof sheets should be fixed with cyclone screws and washers with additional fixings in a zone around all edges of the roof. Purlins should be at maximum centres again within the constraints of designing for cyclones.

*Light and ventilation:* Classrooms should be designed to have adequate light and ventilation: window openings for light and ventilation should be a minimum of 15% of the floor area. Window and door openings will have to be carefully designed because all walls will require bracing to withstand both earthquakes and cyclones.

It is proposed that windows should be simple openings with wire-mesh for security and timber-framed side-opening shutters (with 'Hardiply' facings) instead of the now almost universal louvre windows. The survey has highlighted the facts that the glass blades in louvre windows break easily and are rarely replaced because of the high cost of glass and that the louvre mechanisms quickly rust and become un-operable. It should also be noted that glass louvres offer little or no protection in cyclones and are in fact positively dangerous if the glass blades break and are blown around.

*Orientation:* All new buildings should if at all possible, be oriented so that the long axis of the building runs east/west. This, together with large roof overhangs, will give maximum protection to windows and walls from solar penetration and help keep the buildings cool.

### **Offices, Stores and Libraries**

The minimum standards for primary school facilities (see Annex 3) propose that all primary schools apart from the very small Category 1 schools should have some provision for an office or offices and storage spaces. It is also proposed that the largest primary schools should have separate libraries.

A room that is two structural modules wide (6.2 x 3.8 metres) is proposed that can be used as a principal's office, store or staff room in the larger schools and a room that is one structural module wide (6.2 x 1.8 metres) is proposed that can also be used as a separate store in larger primary schools. See Drawing 2.

The standard classroom unit (6.2 x 7.8 metres) can be used as a library in the largest primary schools with a store for books (6.2 x 1.8 metres) attached.

### **Toilets**

The infrastructure survey has highlighted the facts that many schools have toilets that are not functioning at all or that do not function when there is no water supply. Many of these toilets are flush toilets that require water to function and that also require regular maintenance.

It is proposed therefore that all schools that do not have a dependable piped water supply should be provided with a VIP latrine or similar toilet. As mentioned elsewhere there may be a problem with using VIP latrines on some islands where there is a high water table but it is not possible in this report to address this problem. All schools should however have adequate numbers of functioning toilets and the VIP latrine seems to be a better alternative than flush toilets. A proposal for a VIP latrine building is attached; see Drawing 5.

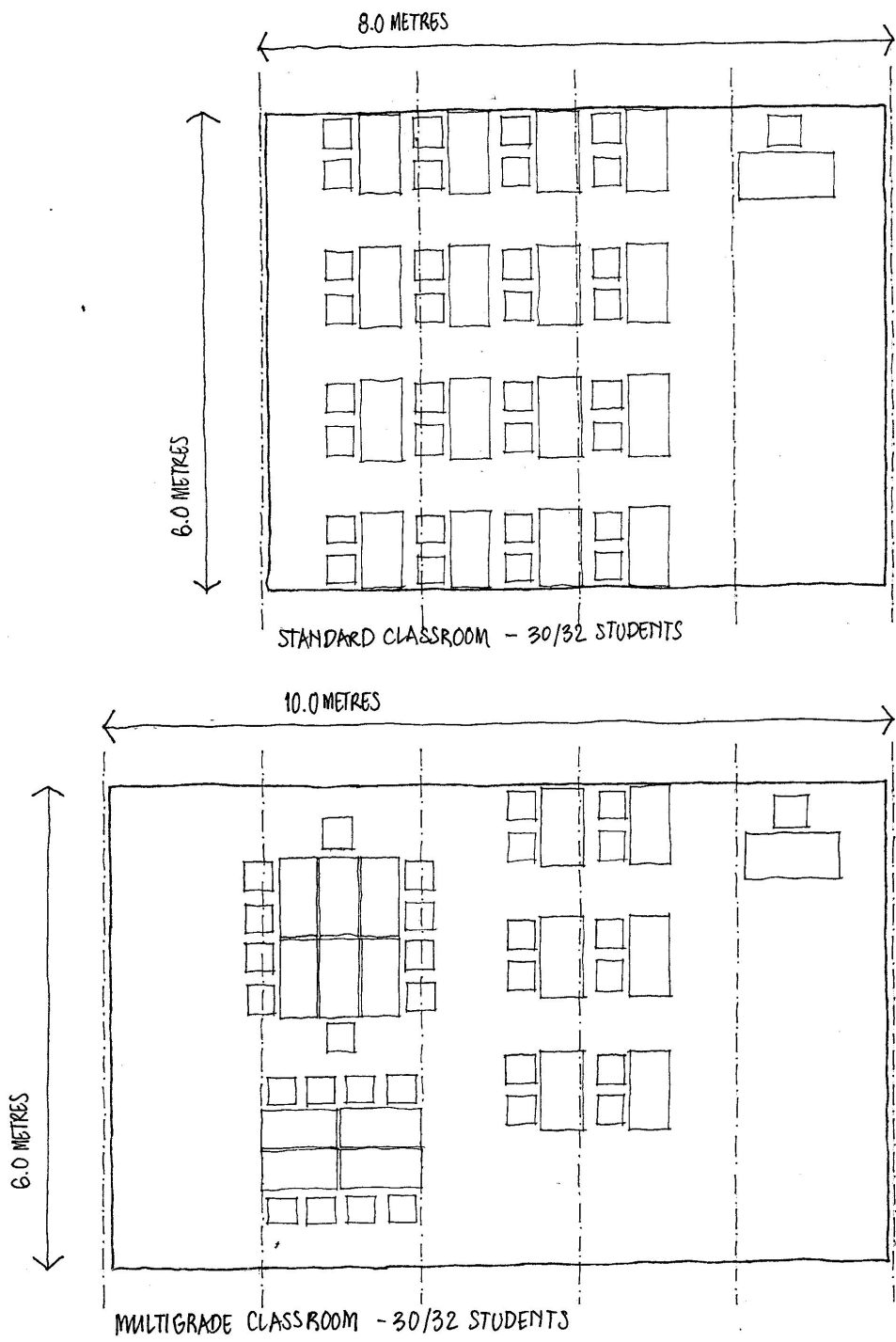
Toilets or latrines should be provided in the ratio of one toilet to 40 students with separate provision for boys and girls and also for teachers if the numbers require this. A source of water for hand washing (probably a water tank supplied by gutters on the toilet roof) should be located adjacent to the toilets.

### **Water Supplies**

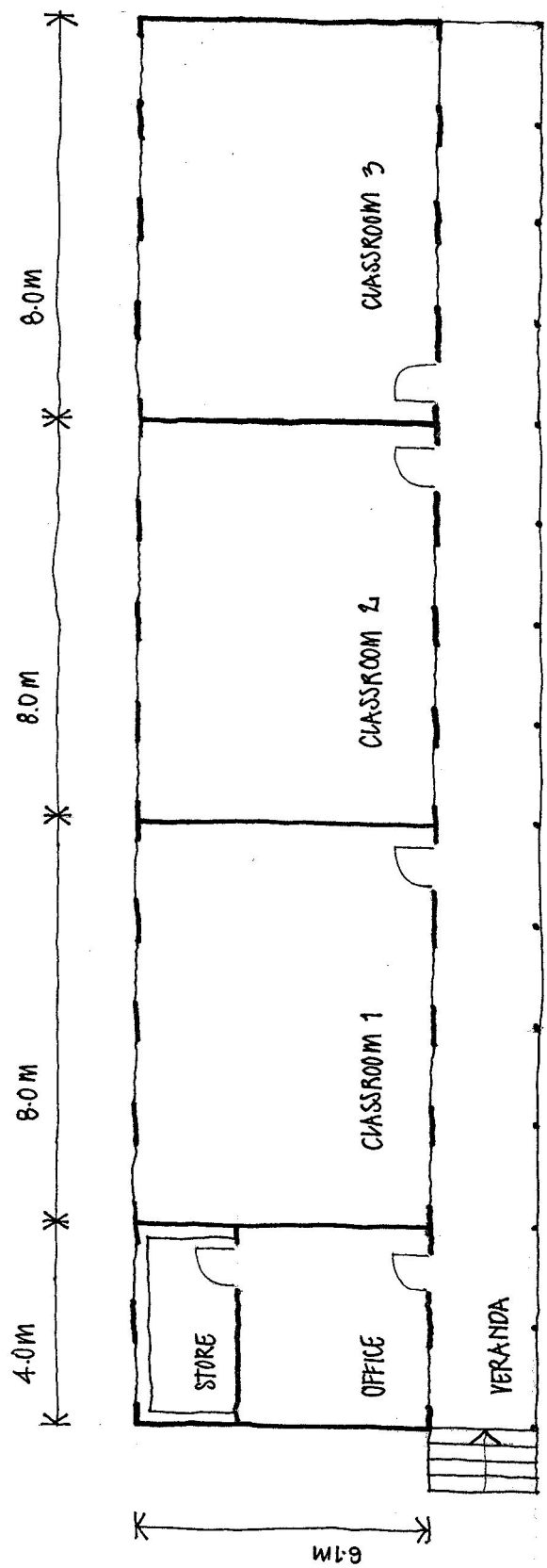
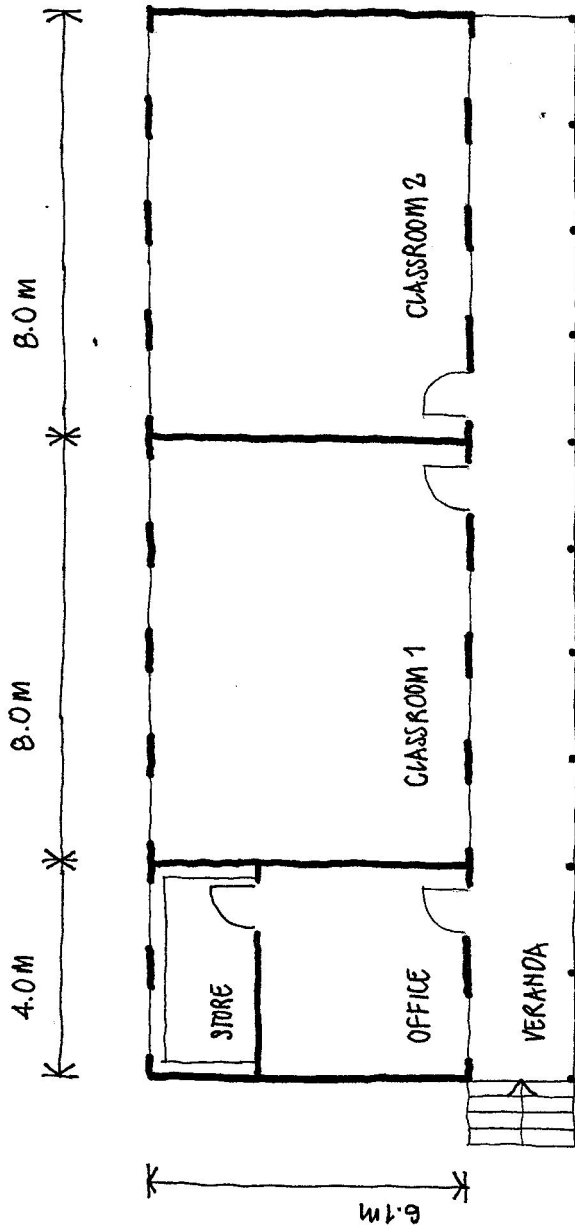
All primary schools should have a dependable source of drinking water and even in areas where there is a town supply there are often problems because it is not dependable or because it is so alkaline that it is unpleasant to drink.

It is proposed therefore that all new and renovated buildings are supplied with rainwater gutters to roofs which will supply water storage tanks, one per building. The gutters should be the best quality available because the

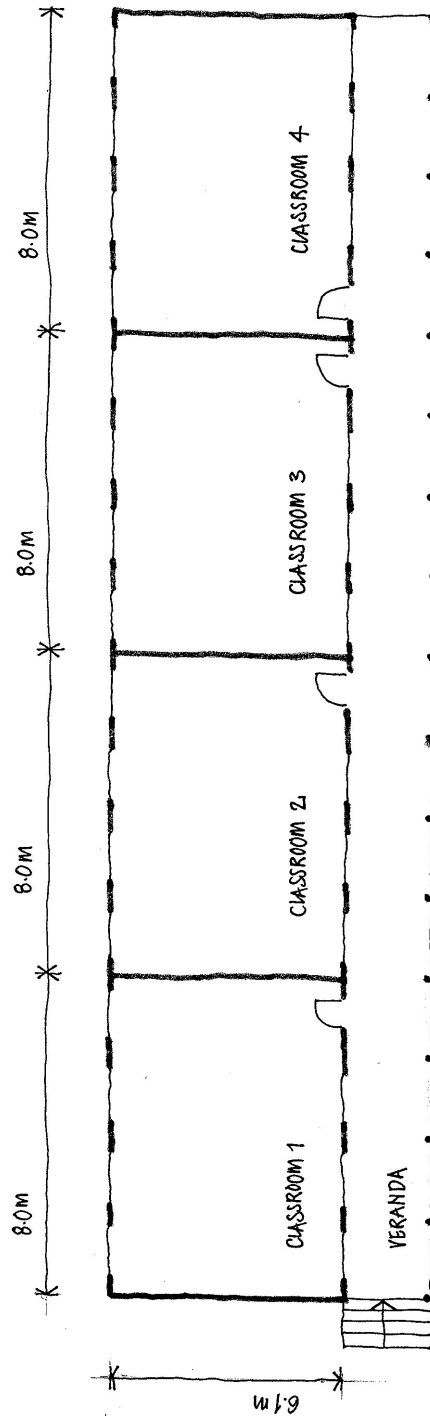
cheaper ones do not last very long and gutters should only be provided where they are supplying a water tank. The provision of gutters in other locations is a waste of resources and will add to the maintenance costs of running the school as they will require constant cleaning and repair. It is suggested that water tanks should be the ferro-cement type that can be manufactured on site.



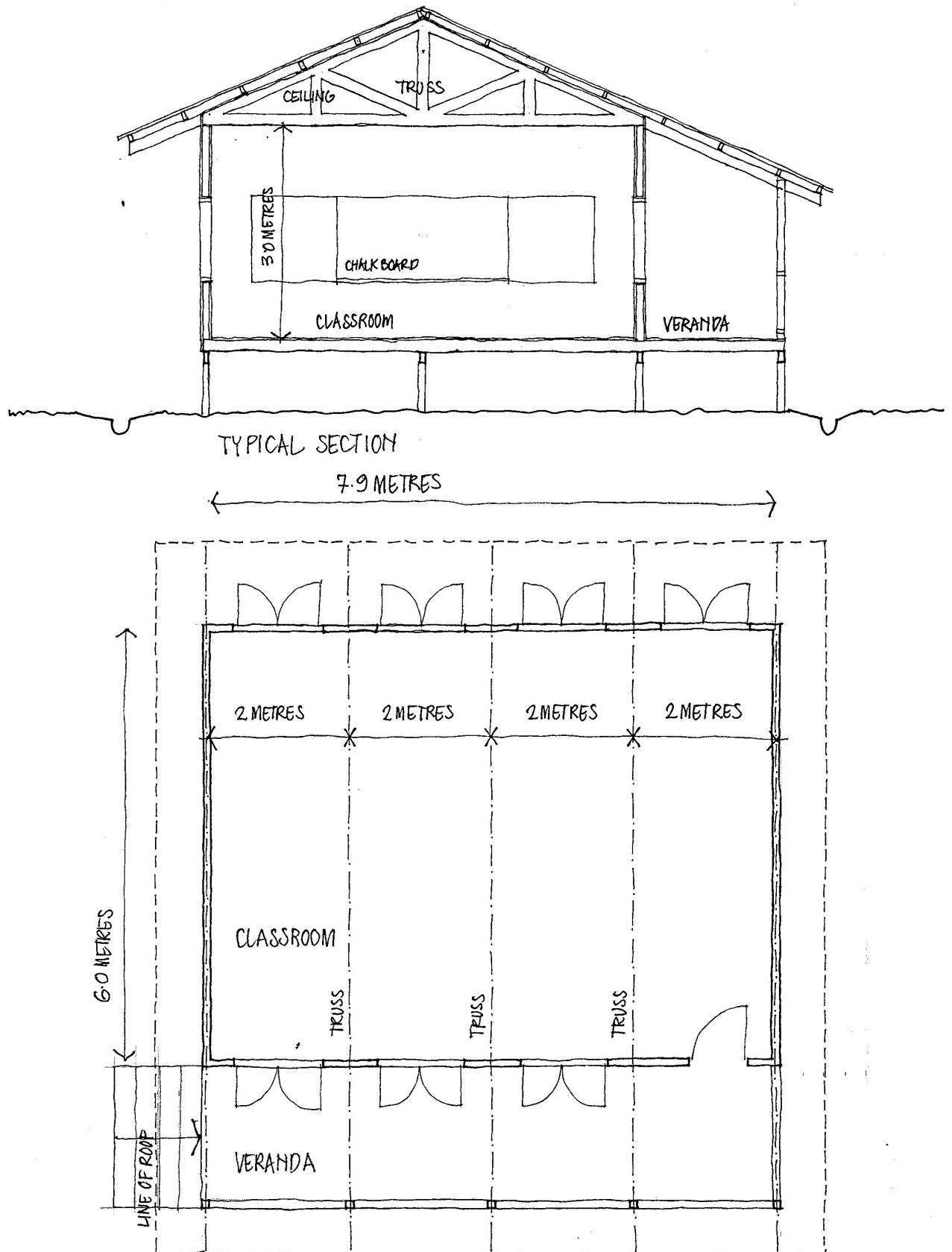
Drawing 1: Proposed standard classroom and multi-grade classroom



Drawing 2: 2-Classroom and 3-Classroom buildings both with office/stores

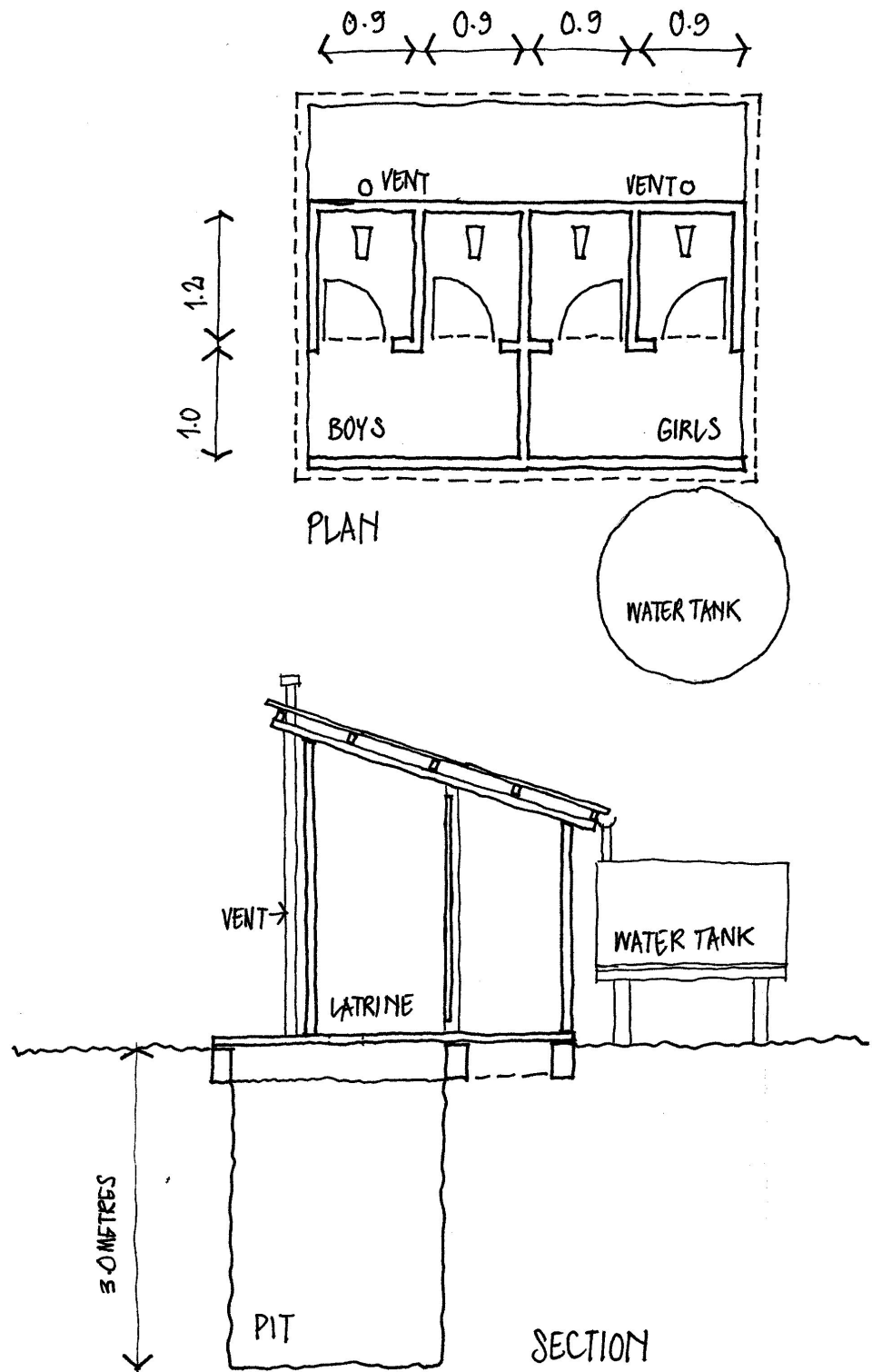


Drawing 3: 4-Classroom Building



Drawing 4: Floor plan of typical classroom showing structural grid and typical section through classroom





Drawing 5: Proposal for 4-compartment VIP latrine

## **Annex 5: Management of the Renovation Process**

### **School- Based Renovations**

The TESP documentation proposes that the renovation of school facilities to be carried out by the programme will be implemented and managed by the schools themselves. At present the only mechanisms available at the school level to do this are either the Principal or the Parent/Teacher Associations (PTAs). From discussions with staff at the schools visited it would appear that some PTAs already provide funds or labour for school maintenance or even the construction of school buildings. This is happening on a very ad-hoc basis however with no technical assistance and the quality of the buildings seen that have been constructed by PTAs has been very poor.

It has to be remembered that school facilities in Tonga, if they are to have long useful lives, have to be constructed to a very high standard in order to withstand cyclones and earthquakes and at present this is not the case even sometimes where facilities are being constructed by donors. The school infrastructure survey has shown that the majority of the school building stock in the country is in a very poor state and many school buildings require major renovations if not replacement. It is not considered realistic therefore for schools and communities to carry out the renovation and construction work themselves.

It is recommended therefore that local contractors are used to carry out the renovation and replacement work and if the schools and PTAs are used to manage or assist with the management of the work then they should receive a great deal of technical assistance in order that the facilities are constructed to an acceptable standard and are capable of resisting both cyclones and earthquakes.

From discussions with the Ministry of Works it would appear that they do not have the capacity to provide any meaningful level of technical assistance and MEWAC does not, at present have either the expertise or the capacity to do so. A mechanism will have to be found therefore through which technical assistance can be provided to the schools and PTAs to assist them with the renovation of their facilities.

### **Management of the Renovation Process**

In other countries in S E Asia where similar projects have been implemented, firms of civil works consultants have been employed to provide technical assistance to assist school committees with the management of the renovations and carry out the supervision of the renovation and construction work. In Tonga however there are however only two firms of consultants who are capable of carrying out this sort of work and they carried out the preliminary school infrastructure survey together as a joint venture.

There would seem to be two ways therefore of providing the technical assistance that will be required to assist schools in managing and supervising the process:

1. Employ a firm of engineers, either based in Tonga or from overseas to provide the necessary technical assistance to the schools on a framework basis i.e. using their services as and when required. It would be very difficult however to interest an overseas firm in this sort of arrangement and therefore the choice would probably be limited to one of the two local firms or to both working as a joint venture and the cost will be fairly high.
2. Employ an individual architect or engineer from the region to manage the whole renovation process from start to finish. This architect or engineer, who would have to be very experienced and preferably have experience of similar projects, would require a team of local engineers to carry out the actual supervision at the school sites. The number of local engineers would depend on the numbers of schools being renovated at any one time but would probably not exceed two or three.

The expatriate architect or engineer would be responsible for supervising the local team, providing any on-the-job training they might require and for managing the whole process. The local engineers would be based on a site (and if possible, given the geographic constraints be responsible for several sites in close proximity) and would supervise the construction process on that site and any adjacent sites.

### **MEWAC Property Management**

MEWAC however should not look at this programme in isolation. There is a post within the Ministry of Chief Education Officer, Property Management (CEOPM) that is at present not filled on a substantive basis. The CEOPM should be responsible for the management and maintenance of all properties that belong to the Ministry, including schools and should also be responsible for managing any future donor programmes or funding aimed at the renovation or construction of both primary and secondary schools.

It is proposed therefore that a local architect or engineer should be appointed as CEOPM and assume responsibility for all Ministry buildings and renovation or construction programmes. The CEOPM should be appointed as soon as possible so that he/she can work closely with the architect or engineer appointed to manage the TESP school renovation programme and gain from this experience.

### **Documentation of Renovations and New Construction**

Before any of the renovation work starts, the work at the selected schools needs to be documented. Although surveys of school facilities have taken place as part of the school infrastructure survey, these surveys are not

detailed enough to form the basis of a schedule of works or a tender document. Detailed surveys of the selected schools have to be undertaken therefore and schedules of work produced for the renovation of existing buildings, detailed drawings produced for any proposed new buildings together with tender documentation.

As two local firms of consultants have already undertaken preliminary surveys of all the school facilities in the country and are therefore familiar with the schools, it would seem sensible for one of them (or both working as a joint venture) to undertake detailed surveys of the selected schools and produce the necessary site and detailed drawings, schedules of works and tender documents. This could also include the detailed drawings of the new standard classroom and toilet buildings that will be constructed at some of the schools. It will not be possible however to extend their present contracts to include this work which will therefore have to be tendered again.

### **Time-frame for the Renovation Process**

The time-frame in the TESP documentation suggest that the majority of the school renovations should take place during the first year of the programme.

As it is now proposed that the scope of the renovations will be larger than originally envisaged and take place at fewer schools, it is suggested that the renovation process should start slowly with renovations initially at only one or two schools, probably on Tongatapu Island so that they can more easily be managed and supervised. Renovations should also not take place until the necessary management framework and technical assistance has been set in place together with all the necessary documentation of each school in the form of detailed surveys, drawings for the renovation and construction of individual buildings, schedules of work, specifications, bidding documents, etc.

## ANNEX 6: SCHOOL VISITS

### General

Three schools on Tongatapu Island were visited on 28<sup>th</sup> September 2006 in order to assess the condition of the buildings and compare this assessment with the results of the survey for each school.

### School Visits

The following schools were visited:

#### **Government Primary School: Kahoua: School Code 307**

The school is situated on a small flat fenced site inside the village and there are two classroom buildings and two toilet buildings. The school has 152 students and 5 teachers. There is no space for a playing field. A small office has been constructed under the access veranda of one building. The school has electricity and a piped water supply from the village. When the village pump breaks down the water goes off and the school has to close.



Plate 1: General view of site showing small size and both classroom buildings

*Classroom Building 1 (Building A in survey documents):* The building has four classrooms (approximately 7.0 x 7.0 metres) and is constructed of timber framing with plywood cladding on a concrete floor slab. The roof over the classrooms is single-pitched. Roof construction is of corrugated steel roof

sheets fixed with nails to timber purlins on timber trusses (hidden by masonite ceilings). Windows are timber top-hung shutters and doors are framed and braced timber doors. The roof over the veranda is a single-pitch lean-to roof with corrugated steel roof sheets on timber purlins and rafters fixed to the wall and to steel posts. The building has plastic gutters feeding a steel water tank.

The building is built to a very low standard; the roof is badly built and there are lots of leaks and the floor slab has many cracks. This should really be considered a semi-permanent building which it would not be worth renovating. The survey engineers have stated that it should be demolished and the author is in agreement with this judgement.

*Classroom Building 2 (Building B in survey documents):* This building is of similar construction to the first but does not have an access veranda. It has two classrooms (approximately 7.0 x 4.8 metres wide).

This again is a very badly built, semi-permanent building which it would not be worth renovating. The survey engineers have again recommended demolishing it and the author is in agreement with this judgement.

*Toilets (Buildings C and D in survey documents):* There are two toilet buildings both having flush toilets. The student toilet has two compartments each with two flush toilets with no partitions and the staff toilet has two cubicles. Both buildings are very badly constructed and need replacing.



Plate 2: Classroom Building 2 showing very poor roof construction and top-hung shutters

**Recommendations:** The site is very small with no space for a playing field and both classroom buildings and the toilets should be demolished and replaced because of their condition. There is therefore a strong case for moving the school to another larger site if one can be found and constructing a completely new school. The school has 162 students and would therefore require six classrooms, an office/store for the principal and a teachers' office (see Annex 3). It would also require four toilets for students and two toilets for teachers; given the water supply problems these should preferably be VIP latrines.

### **Government Primary School: Fatai: School Code 303**

This school is situated on a large flat site on the edge of the village with space for a playing field. There are three classroom buildings with a total of 8 classrooms, a toilet building, a small library building and a derelict staff house. There are 145 students and 5 teachers. There is no store and no separate office accommodation for teaching staff or the principal and one classroom is therefore used as an office. The school has electricity but no town water supply. There are three 10,000 litre water storage tanks.



Plate 3: General view showing Classroom Buildings 1 and 2 and toilets at rear. Note low roof height of Classroom 2.

*Classroom Building 1 (Building D in survey documents):* The building has four classrooms (7.0 x 7.0 metres) and is constructed of timber framing with plywood cladding on a concrete floor slab. The roof over the classrooms is double pitched with the centre of the roof off-set from the centre of the

classrooms so that the wall to the veranda side is higher than that to the rear. Roof construction is of corrugated steel roof sheets fixed with nails to timber purlins on timber trusses (5 per classroom) fixed with cyclone straps with sisalation under the roof sheets but no ceiling. Windows are steel louvre carriers with glass blades in timber frames and doors are solid-core flush doors. The roof over the veranda is a single-pitch lean-to roof with corrugated steel roof sheets on timber purlins and rafters fixed to the wall and to timber posts. The building has plastic gutters feeding a GRP water tank.

The building was constructed by the Department for Natural Disasters and is quite well built. There are however a number of problems. The roof while being quite well constructed does not now meet the requirements of the new building code: the purlins are too far apart, the joints to the trusses probably need reinforcement and the roof sheets require fixing with cyclone screws and washers not nails as at present. The walls will also require bracing and it was not clear how well the timber framing is connected to the floor slab/foundation. The building also requires some minor repairs and maintenance: repairs to the wall cladding; repair and replacement of louvre blades; replacement of some fascias; painting and repair or replacement of gutters.

The survey engineers have recommended renovating this building and the author is in agreement with this. The roof would probably have to be replaced and the roof structure strengthened. The louvre windows should be removed and the windows reduced in size and replaced with shutters and the walls given extra bracing. The building would then require other minor repairs, maintenance and painting.

*Classroom Building 2 (Building C in survey documents):* This building has two classrooms (approximately 6.5 x 7.0 metres wide) and has a concrete floor, fair-face block end and cross walls with steel louvre carriers in timber frames along the window walls from 120cm upwards. It has a low, double-pitch roof of steel corrugated sheets on timber purlins and trusses and no ceilings and no veranda.

The building was quite well constructed but the roof trusses, purlins and fixings and fixing of wall timbers to block walls are inadequate and will not meet the new building code requirements. The floor slab is not high enough out of the ground on side, the roof sheets are fixed with nails and not cyclone screws and washers, some doors and louvres need changing and the building needs painting.

The survey engineers have recommended renovating this building but it really needs the whole timber roof and wall structure taking off and replacing. This together with the fact that the floor slab is very low in the ground makes it probably more economic to demolish it and construct a new building.

*Classroom Building 3 (Building A in survey documents):* This building was constructed using JICA funds in 2005 and has two classrooms (approximately 7.0 x 7.0 metres). It has a concrete floor, 15cm block walls rendered outside and fair-face inside, a double-pitch roof with corrugated steel roof sheets on



timber purlins and trusses, flat fibre-cement ceilings, steel louvre carriers in timber frames, a concrete veranda with timber posts and gutters supplying a water storage tank.



Plate 4: Rear elevation of Classroom Building 2; note timber frames supporting roof and sitting on top of block wall; these frames are not secured to the wall.

The building is quite well constructed but there are a few problems. The roof sheets are fixed with nails not cyclone screws and washers and it was not possible to see and check the construction and fixings of most of the purlins and trusses. At the ends of the buildings it could be seen that some purlins (which seem very small approximately 5 x 4cms) were fixed with cyclone straps and others were not. There is a very small roof overhang at the rear of the building.

The building requires very little work but the roofing nails should be replaced by cyclone screws and washers. The roof structure should also be checked (there is a roof access hatch in one room) and if the roof structure requires strengthening then this should be done.

*Library (Building E in survey documentation):* This is a small building with two mono-pitch roofs, one over the library and one over the veranda. It is constructed of 20cm fair-face blocks with timber rafters and purlins, corrugated steel sheets fixed with roofing nails, a concrete floor and louvre windows.

The survey engineers have recommended renovating the building but it is badly built and should probably be replaced.



Plate 5: JICA funded toilet building. The steel posts are only built into the 15cm walls and are not properly tied down.

*Toilet Building (Building B in survey documentation):* This building was constructed in 2005 using JICA funds and is a standard design that was seen at other schools. It is constructed of fair-face blocks with a concrete floor, steel louvre carriers in timber frames, steel corrugated roof sheets on timber purlins and timber trusses. There are four WCs for girls and three WCs and a urinal for boys and four wash-hand basins.

It seems well constructed but the roof sheets are fixed with nails not cyclone screws and washers. Some of the roof timbers are fixed with cyclone straps but the steel posts supporting the trusses over the verandas are just built into 15cm block walls. One wash-hand basin is missing and two are loose. There is no piped water supply so the toilets have to be flushed using buckets.

The building needs minor repairs and maintenance.

**Recommendations:** The school has 145 students and therefore should have six classrooms, an office/store for the principal and a teachers' room (see Annex 3). It is recommended therefore that Classroom Building 1 is renovated to provide 4 classrooms and Classroom Building 2 has its roof improved to provide 2 more classrooms. Classroom Building 3 could possibly be renovated to provide an office for the principal, a store and a teachers' room or these could be constructed as a new building which would probably

be more economic. The library should be left as existing as it would not be economic to renovate it.

### **Free Wesleyan Primary School: Kolovai: School Code 801**

The school is situated on a large slightly sloping site next to the main road in the centre of the village. There is room for a play space but not for a sports field. There is a single-storey building with six class rooms, a store, a teachers' room, a teachers' toilet and students' toilets. There is also a two-storey building that is open on the ground floor and that has an office and three classrooms on the first floor. There are also two staff houses on the site.



Plate 6: Badly constructed and poorly renovated single-storey classroom building.

*Single-storey classroom building (Building B in survey documents):* This building has a concrete floor; concrete block walls with RC columns at wide spacing, steel louvre carriers in timber frames and corrugated steel roof sheets fixed to timber purlins and trusses.

The building is quite badly constructed: the roof structure seems undersized, the roof sheets are badly fixed with roofing nails, the floor slab is cracked and the RC columns are too far apart. The survey engineers recommended that this building should not be renovated, and the author agrees with this but the church authorities have in the meantime spent P30,000 on renovating it although it is not yet in use. This building will not stand up to a full strength cyclone or to a strong earthquake.

*Two-storey Classroom Building (Building A in survey documents):* This building is constructed up to first floor level of a substantial reinforced concrete frame with concrete staircases at each end. The staircases go up to a timber floor and veranda with a timber-framed building with three classrooms and an office, sitting on top of the RC frame. This timber building has timber cladding, timber floors, louvre windows (set very high), timber trusses and a corrugated steel roof fixed with roofing nails.



Plate 7: Two-storey classroom building; note heavy RC frame to ground floor and water-damaged walls and rusting louvre windows to first floor.

The timber building although originally quite well built is now in very poor condition (it is also not properly fixed down to the RC frame) and the survey engineers recommend that it should be demolished, which the author agrees with.

**Recommendations:** The school has only 52 students and therefore only requires two classrooms. The church authorities have renovated six classrooms, albeit very badly and so the school is already over provided. A more sensible line of action would have been to have demolished the single-storey building and re-built the timber part of the two-storey building. It should then have had three new toilets and a new water tank constructed.

## **Annex 7: The Economics of School Maintenance: an Indonesian Example**

If school buildings are to maintain their value and provide their pupils and teachers with a satisfactory learning and teaching environment, time, effort and money must be expended upon them regularly and effectively. Unfortunately, maintenance budgets are the easiest to cut in times of financial stringency as has happened in the case of Indonesian schools. The limited funds available are usually directed towards new buildings or the total renovation of existing ones rather than the upkeep of existing facilities which of course only increases the number of buildings requiring maintenance with ever decreasing resources.

The costs attributable to a building occur at different times in its life. These costs must be judged on a common basis before comparisons can be made. In this Annex which takes primary school construction in Indonesia as an example, the cost of maintaining school buildings over their useful life is compared with the cost of not maintaining them, using a cost alternative analysis.

The construction budgets used by the Indonesian government for estimating the cost of construction of new or renovation of existing schools are more than adequate for the construction of good quality facilities if they are properly built. For instance, the cost of a new 4-classroom primary school building was estimated at Rp88.256 million (US\$29,419 or US\$131 sq. metre) at 1997 rates. The major renovation of an existing 4-classroom building was estimated at Rp30 million (US\$10,000 or US\$45 sq. metre) at 1997 rates. Unfortunately, because of the generally low standard of construction a lot of this money is wasted, the full potential of the building is never realised and this, combined with the fact that very little is spent on maintenance, means that the useful life of most school buildings is very short.

The cost of constructing and maintaining a 4-classroom primary school building will be used as an example. If the building is well constructed and maintained, it should have a useful life of 25 years and probably longer. If the building is badly constructed and poorly maintained its life could be shortened to 10 years and possibly much less (some school buildings have been seen in Indonesia that have been built for 7 years or less and now need major reconstruction works). For the purpose of this exercise, it is assumed that a building that is well built and well maintained will last for 30 years before major works are required and contrast this with a building that has not been maintained and therefore requires replacing every 10 years.

The initial cost of constructing the building is assumed to be Rp88.25million. If it is assumed that annual maintenance costs are a fixed annual rate of 2% of the initial construction cost, this will give a maintenance cost of Rp1.765million for the first year after construction. If an inflation rate of 7% is also assumed, the cost of maintenance of the one school and of reconstruction of the other over the following years will be as set out in the table below:

It will be seen that the total cost of constructing a 4-classroom building properly, maintaining it regularly and reconstructing it after 30 years will be Rp870, 288,495. The total cost of a poorly constructed building however, which has no money spent on maintenance and so has to be reconstructed three times, will be Rp1, 197,567,180. There is a saving of Rp327, 278,685 (27%) on the overall cost of the well-maintained school building against that of the building that is not maintained.

There is therefore, a demonstrable financial advantage in embarking on a programme of preventative maintenance for school buildings. It must also be remembered that a building that is regularly maintained can be used productively and continuously during it's life while the building that is not maintained will gradually deteriorate and become unusable and will have to be closed for renovation, in this instance, twice during its life. It must be emphasised again however that this advantage will only be obtained if the building is properly built in the first instance and this will depend to a large extent on proper supervision of construction.

#### Table showing Construction, Maintenance and Reconstruction Costs

Note: The table assumes spending on maintenance of 2% of the construction cost per year and an annual inflation rate of 7%.

	School 1: Construction & Maintenance		School 2: Construction & Reconstruction	
Year	Cost		Cost	
0	88,256,000	Construction	88,256,000	Construction
1	1,765,120	Maintenance	Nil	
2	1,888,678	Maintenance	Nil	
3	2,020,885	Maintenance	Nil	
4	2,162,346	Maintenance	Nil	
5	2,313,710	Maintenance	Nil	
6	2,475,669	Maintenance	Nil	
7	2,648,965	Maintenance	Nil	
8	2,834,392	Maintenance	Nil	
9	3,032,799	Maintenance	Nil	
10	3,245,094	Maintenance	162,255,056	Reconstruction
11	3,472,250	Maintenance	Nil	
12	3,715,307	Maintenance	Nil	
13	3,975,378	Maintenance	Nil	
14	4,253,654	Maintenance	Nil	
15	4,551,409	Maintenance	Nil	
16	4,870,007	Maintenance	Nil	
17	5,210,907	Maintenance	Nil	
18	5,575,670	Maintenance	Nil	
19	5,965,966	Maintenance	Nil	
20	6,383,583	Maintenance	319,180,254	Reconstruction
21	6,830,433	Maintenance	Nil	
22	7,308,563	Maintenance	Nil	
23	7,820,162	Maintenance	Nil	
24	8,367,573	Maintenance	Nil	
25	8,953,303	Maintenance	Nil	
26	9,580,034	Maintenance	Nil	
27	10,250,636	Maintenance	Nil	
28	10,958,180	Maintenance	Nil	
29	11,725,952	Maintenance	Nil	
30	627,875,870	Reconstruction	627,875,870	Reconstruction
<b>Totals</b>	<b>870,288,495</b>		<b>1,197,567,180</b>	

## **ANNEX 8: Infrastructure Advisor for School Mapping: Terms of Reference**

### **Introduction to the assignment**

A component of TESP involves the development of Minimum Service Standards for schools (MSS) these standards will provide a benchmark for schools to identify possible deficiencies in service delivery. Each school will develop a rolling three year development plan which will outline the measures required to attain or supersede the MSS. Through the Tonga School Grants Program (TSGP), TESP will provide grants to schools to finance the inputs necessary to improve the quality of services they provide so that the standards are achieved. Aside from creating an environment in which resources available to a school can be used to finance locally (school and community) determined needs, the Program provides the Government with the opportunity to establish a 'level playing field' particularly across government and non government schools, by providing a disproportionate amount of funds and project support to disadvantaged or underserved schools.

It is expected that school rehabilitation will be an important feature of many schools' three year development plans and it is intended that specific guidelines for rehabilitation will be developed for schools so that they are able to expend grants wisely, ensuring that civil works undertaken meet all required standards.

The Technical Advisor will co-ordinate the gathering and analysis of data related to schools' infrastructure from the 124 primary schools and 38 secondary schools in Tonga so that the Ministry of Education and school communities are enabled to determine and prioritize the interventions required to improve schools' infrastructure.

**Outcome:** A report presenting an analysis of information generated from a survey instrument that informs the Ministry of Education, school principals and school communities about the status of schools' infrastructure.

### **Review of previous work**

A brief report titled Advisory Note on the Preparation of the Tonga School Grants Program (TSGP) was prepared in December 2005 by two consultants to the World Bank<sup>1</sup>.

### **Scope of work:**

1. Design a draft survey instrument to be used by civil engineers to collect information on schools' infrastructure. The survey instrument will also

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<sup>1</sup> Document prepared as an Annex to the Aide Memoire of the Annual Joint Review of TESP (December 2005). Written by Robert Scouller, World Bank infrastructure engineer and Stephen Baines, World Bank school grants specialist.

incorporate simple data pertaining to the schools' teacher population and student enrolment.

2. Ensure the survey instrument incorporates the infrastructure needs of those schools providing Year 7 and Year 8 education and include this as a variable in reporting procedures.
3. Incorporate changes to the draft survey instrument resulting from discussions between the MoE and civil engineers charged with carrying out the schools survey.
4. Provide a briefing to the key personnel within the Policy and Planning and Administration Directorates of the Ministry of Education regarding the import of each of the sections included in the survey instrument, the target questions used to illicit information and the implications of possible findings for the MoE.
5. Conduct a pilot test of the survey instrument with 15 selected schools on the island of Tongatapu and amend the survey instrument where necessary as a result of the pilot.
6. From the sample findings illustrate for the MoE how data from the finalised survey might be used to develop complete school profiles and illustrate how the information forthcoming from the pilot survey might also be used individually and collectively for planning and resourcing purposes.
7. Develop a survey manual for use by the civil engineers during visits to schools. The short manual will include basic information about TESP and explain the rationale for the research being conducted and it will also provide instructions on how to complete each questionnaire.
8. Liaise with the civil engineers responsible for completing the survey instrument to ensure that there is a common understanding regarding the expected outcomes of the survey.
9. Following completion of the data collection and entry, liaise with the national Education Management and Information System (EMIS) staff at the MoE to assist with the processing and analysis of the data and lead the generation of a report that will present findings and analysis of the information gathered as a result of the survey. As a component of this task oversee the production of school profiles and confirm that these are produced in the format that will be most useful for schools.
10. Prepare a short advisory note for the MoE on how best the information generated from the report should be conveyed to individual schools and their communities so that school principals and others may identify and prioritise infrastructure refurbishment needs.
11. Throughout the survey design and analysis phases of the work, maintain a close relationship with the Chief Education Officer, Property Management in the expectation that there will be a transfer of knowledge with the aim of improving the capacity of the MoE to conduct similar work in the future.



## **Reporting**

As the questionnaire is developed and as the data is analysed the Consultant reports to the Deputy Director of Education, Policy and Planning, whilst maintaining close interaction with the Deputy Director of Education, Administration.

## **Deliverables**

1. A survey instrument for the collection of schools infrastructure data.
2. An interview manual for the civil engineers who will undertake the survey.
3. A brief report (approximately 20 pages) indicating the significant findings of the survey analysis including a generalised overview of the priority areas to be addressed in order to improve the teaching and learning environment as well as an identification of infrastructure deficiencies according to categories of schools.
4. A short note advising the MoE how the information gathered could be shared with individual schools and their communities so that, where necessary, schools will incorporate school infrastructure requirements into their three year rolling development plans.
5. The preparation and delivery of individual school profiles to the MoE.
6. A brief report indicating the transfer of knowledge that has been acquired by the Technical Advisor's national counterpart, the Chief Education Officer, Property Management, during the period of time when the survey instrument was developed and as data was analysed.

## **Data and reports available**

1. Report of the Ministry of Education for the Year 2004. Ministry of Education. Kingdom of Tonga (2005).
2. Education Policy Framework 2004-2019. Ministry of Education. Kingdom of Tonga (2004).
3. Ministry of Education Corporate Plan 2005/2006 –2007/2008. Ministry of Education. Kingdom of Tonga.
4. Project Appraisal Document for a Tonga Education Support Project. World Bank. (2005).
5. Advisory Note on the Preparation of the Tonga School Grants Program (TSGP). Unpublished document World Bank (2006).

## **Location**

The Consultant will undertake the assignment based at an MoE facility in Nuku'alofa on the island of Tongatapu.