CHAPTER 1. BACKGROUND OF THE PROJECT

Chapter 1. Background of the Project

(1) Grant Aid Application: Background and Summary

After it became independent in 1964, Zambia prospered with copper exports, the underpinning of the economy. The national finance however rapidly deteriorated resulting from events that occurred afterwards such as a drop in the international copper price and droughts. While the government is carrying out the economic restructuring plan that was launched in 1989 under agreements with the IMF and the World Bank, the situation remains unchanged with many problems piling up; accumulating foreign debts, inflation, increasing unemployment ratio, deteriorating social security, high infant mortality rate, and the proliferation of AIDS.

In order to resolve these problems, the Zambian government is attempting to rebuild the country by focusing on improving the basic education. Among others, the guideline for education plan, the "Education Our Future (1996)," and the programme established in 1998 for its implementation, the "Basic Education Sub-Sector Investment Programme" (BESSIP), are aimed to provide by 2005 all children an opportunity to enter grade 1 and to achieve by 2015, the acceptance to grade 8 of all pupils who finished Grade 7. Towards this end, efforts for a better educational environment are continuing.

However, the country's high population increase and the decline in the government's ability to finance the educational sector have annually lowered the attendance of primary education, Grades 1-7 until its gross enrollment ratio was down to 77.9 percent in 2000. Particularly in Lusaka, the Zambia's capital, there is continuing inflow of people from the rural areas, raising the population growth rate to 5 to 6 percent. Coupled with this, vandalism including stealing of pieces of equipment is seen, and the Lusaka's educational environment has been worsening, resulting in its enrollment ratio becoming far below the national average. The government recognizes this situation as an educational crisis in Zambia. The elimination of a shortage of educational facilities in Lusaka is prioritized as a critical issue and efforts were being made to improve school facilities with the assistance from the World Bank and other donors.

Japan also extended grant aid for "The Project for Construction of Basic schools in Lusaka District" from 1999 into 2000. This provided Lusaka with 8 new schools along with educational equipment and materials, which contributed to the human resource development of Zambia.

Yet, the ongoing move of people from the countryside to urban areas is increasing the number of children in cities, and ever-growing demand for education is outpacing the supply of classrooms. The educational environment in Zambia thus still needs improvement. Under these circumstances, the Zambian government has requested from Japan grant aid for the new construction project of 20 basic schools in three cities of the provinces of Lusaka and Copperbelt.

(2) Content of request

1) Before the site survey for basic design study

The initial request for grant aid by the Zambian government in September 1999 was as follows.

(1) Requested sites

Lusaka Province (Lusaka):	12 sites
Copperbelt Province (Ndola):	4 sites
Copperbelt Province (Kitwe):	4 sites
Total:	20 sites

All the schools requested at the sites are new schools.

(2) Requested school facilities (per school)

Twenty-eight regular classrooms, seven special classrooms, lavatories, caretaker's house, administration block, and water supply/drainage facilities

(Special classrooms: two home economics rooms, two industrial arts rooms, one environmental science room, one library and one SEN [Special Education Needs] room)

(3) Furniture

Furniture for classrooms and administration blocks

(4) Equipment

Teaching equipment for regular classrooms, home economics rooms and industrial arts rooms

2) Changes during the site survey for basic design study

The initial request was the construction of schools at 20 sites. However, considering the project scale being too large, the decision to limit construction to 12 sites in Lusaka District where the increase in population is large and the priority is so high was explained to the Ministry of Education, and a basic understanding was reached. After the result of it, the Zambia side submitted new 12 requested sites and the study team did the survey according to the new request.

CHAPTER 2. DESCRIPTION OF THE PROJECT

Chapter 2. Description of the Project

2-1 Project Summary

2-1-1 Master Plan and Project Objectives

In its socioeconomic development policies, the Zambian government considers education to be a top priority. The government outlined its education policy in 1996 under the title "Educating Our Future–National Policy on Education." This plan altered the former emphasis on universities and other higher education institutions to an emphasis on providing all children with a good quality basic education. As a medium-range strategy plan to embody this policy, in 1998, the government enacted the "Basic Education Sub-sector Investment Programme" (BESSIP), which ranked basic education as a subject of the highest priority and specifically targeted the development of the school infrastructure as an area to which efforts should be concentrated. To achieve the objective of the Programme to enable all children to receive at least seven years of good quality education by 2005 and to enable every pupil who completes Grade 7 to advance to Grades 8 and 9 by 2015, a change is underway regarding basic schools by expanding the existing primary schools and forming a full basic school (Grades 1-9) . Nearly half of the 91 basic schools in the Lusaka District are still middle basic schools, grades1-7. The number of schools is low and there is an increasing need for upgrading these middle basic schools to full basic schools. In the Lusaka District where population inflow is increasing, there is a serious lack of school facilities. This project of constructing basic schools under the Programme will allow enrollment of children who are currently refused admittance as well as ease the overcrowded conditions at neighboring basic schools by absorbing them in the new schools. In addition, the project will raise the possibility of upgrading the neighboring middle basic schools to full basic schools.

As mentioned above, the objective of the project is to "expand opportunities for basic education and improve educational environment in Lusaka District by constructing 12 new basic schools."

2-1-2 Project Summary

Under this project, twelve new basic schools will be constructed in Lusaka District in order to achieve the aforementioned objectives. These schools will admit the children in the district who are currently not enrolled in school, and they will also ease the overcrowded classes and the two and three session routines being used at existing schools. Further, it is expected that the existing middle basic schools will be upgraded to full basic schools.

The target of the grant aid will be the construction of 276 regular classrooms, 12 home economics rooms, 12 administration blocks, 24 lavatories and 12 guardhouses as well as the provision of furniture for the classrooms and administration blocks and teaching equipment at 12 schools in the Lusaka district. In addition, the construction of water supply/drainage facilities for water borne toilets and borehole for water supply is included in the project.

2-2 Basic Design

2-2-1 Design Policy

2-2-1-1 Basic Policy

(1) Selection of sites

1) Criteria for site selection

As the criteria for selection of target sites from the requested sites, the following nine standards were established to confirm that school facilities to be constructed would be used continuously and effectively and maintained properly, safety would be ensured during the construction of the facilities, and would enable the construction to be carried out without any problem. After conferring with the Ministry of Education, it was confirmed that the target sites would be selected based on the following criteria.

① There is an obvious need for construction of schools based on demographic data, etc.

② Employment of teachers, budgetary measures, etc., and suitable operation and maintenance is possible.

③ Land ownership at construction sites are clear and construction of schools will pose no problems.

④ There are no problems with topographical features and the size of land is suitable.

⑤ There are no squatters or other impediments to construction at the target site.

⑥ There are no problems with construction vehicle accessing the site.

⑦ There is no particular danger of a natural disaster occurring.

⑧ There are no problems with public safety.

⑨ No request for construction has been made to other donors, etc., there is no construction planned, and there is no construction work in progress.

2) Site survey

A site survey for target sites and interviews with relevant institutions were conducted, and judgments made on the following survey items. After comparing the results of the survey with the site selection criteria, it was determined that all sites met the planning requirements. The results of the survey are shown in Table 2.2.

① Land ownership

To confirm that the land ownership of the proposed sites is clearly established and that the construction of schools can be carried out without any problems, an investigation was carried out at the Ministry of Education, Lusaka City Council, and the Ministry of Land. In addition to the land under the ownership of the Ministry of Education, there are some lands

of which the ownership was transferred from Lusaka City Council or the Ministry of Land to the Ministry of Education. It was confirmed that all the land at the proposed sites is under the ownership of the Ministry of Education.

② Squatting

A site survey was conducted to check whether there were any unlawfully occupied houses at the project sites that could become an obstacle to the construction of schools. In Jack, one of the target sites, a house standing next to the site partly crosses the lot boundary line. However, this was judged to present no problem with the construction of the school because the site is large enough to construct the school. At other sites, it was confirmed that there was no unlawful occupation.

③ Landform

To confirm that landform at the requested sites is suitable for the construction of schools and that the land has sufficient area, a rough measurement was made by the team and the gradient of the sloping ground was measured by a local surveyor. It was confirmed that the land at each requested site was large enough to construct schools (approximately 10,000-78,000 m^2). At five projects sites of Mutendere, Kabanana, Ng'ombe, Chelstone, and Chazanga where the ground at the sites is sloped, the gradient was measured to collect basic data needed to prepare a layout plan of buildings. (Contours are plotted on Appendix 6 Layout Plan of Schools at Project Sites.)

④ Ground conditions

To confirm the ground and soil conditions, which are necessary to formulate a foundation plan for buildings at the project sites, trial excavation was carried out. A hole was dug at each site to a depth of 1.0 m below the ground (to a depth of 0.6 m in Northmead because it was difficult to dig a hole in the consolidated clayey layer.) At every site, it was possible to dig plumb holes without the walls collapsing, and therefore it was judged that the ground and soil conditions were good.

Table 2.1 Site Foundation

Site		Trial Excavation	Excavation Depth	Excava-tion Time	Soil	Soil Condition	Flooding	Notes
1	Mutendere	Yes	1.00	1:00	Red soil	Good	No	Mixed with many fist-sized stones
2	Chunga	Yes	1.00	1:10	Red soil	Good	No	Exposed rocks near GL-0.6m
3	Kabanana	Yes	1.00	1:00	Red soil	Good	No	Many boulders
4	Northmead	Yes	0.60	1:30	Clay	Good	No	Extremely hard-packed clay; excavation so difficult it was halted at 60 cm
5	Ng'ombe	Yes	1.00	1:00	Fine sand mixed with gravel	Good	No	
6	Libala Stage III	Yes	1.00	0:45	Red soil	Good	No	
7	Chilenje South	Yes	1.00	0:50	Sand	Good	No	Exposed rocks
8	Chelstone	Yes	1.00	1:00	Clay (mixed with gravel at the bottom)	Good	No	
9	Chazanga	Yes	1.00	1:00	Gravel	Good	No	Extremely large amount of coarse gravel
10	Chawama/John Howard	Yes	1.00	1:10	Hard-packed sand	Good	No	
11	Marapodi/ Mandevu	Yes	1.00	1:00	Sand mixed with gravel	Good	No	
12	Jack	Yes	1.00	0:40	Sand	Good	No	Many exposed rocks within the site

⑤ Accessibility

To confirm that construction vehicles can access the sites, a survey was conducted on the road widths and conditions around each site. At the sites around which roads are constructed, the road width is 4 m or more, and present no problem with the accessibility of construction vehicles. At the sites around which road is not yet constructed, there is no obstruction to the access of construction vehicles. It was judged that construction vehicles can accessevery site.

⑥ Natural disasters

Site surveys and interviews with the residents were conducted to determine whether the sites would suffer natural disasters such as floods during and after construction. As a result, it was judged that there is no risk of natural disasters occurring at any of the sites.

⑦ Public safety

Site surveys and interviews with the residents were conducted to ascertain that public safety will be ensured during construction and after opening of the schools. The site survey confirmed that there are police stations around the seven proposed sites and that there are

no indications of vandalism. According to the interviews with the residents, there is no site where public safety is poor. And almost all of the existing schools surveyed were fenced.

⑧ Duplicate requests

An interview was conducted at the Ministry of Education to confirm that there is no request of school construction project by other donors, planned or implemented, at any of the requested site.

⑨ Conditions of infrastructures

To check the conditions of infrastructures, such as water supply, drainage, and power supply systems, a survey was conducted around the proposed sites, at Zambian Electricity Supply Company (ZESCO), and Lusaka Water and Sewerage Company (LWSC). The results of the survey indicate that it is possible to use city water in Northmead and Libala Stage III and there is no need to dig boreholes. Electricity is supplied to the vicinity of proposed sites other than Chilenje South, Marapodi/Mandevu and Ng'ombe, and at the above 3 sites it is possible to run overhead power supply cables from around the adjacent districts.

The details of the site surveys on items ① to ⑨ above are described on the pages that follow. In comparison with the site selection criteria, all sites met the planning requirements.

Table 2.2 Site Survey Results

	Site	Date of Survey	Land ownership				Squatters (yes/no)	Geographical Features								Access		Natural Disasters (yes/no)		Public Safety			Duplicate requests	Judgment	Neighboring primary schools	Status of infrastructure (○: exists, ×: nonexistent, △: exists (but at a distance)									
								Area			Foundation status															Power		Water				Roadside ditches to drain rainwater		Sewer system	
			Owner	Letter	Lot Number	City Planning Diagram Survey Map		m × m	Area (m^2)	Levelness	Test excavation	Depth (m)	Excavation time	Foundation status	Flooding (yes/no)	Road width (m)	Road condition	Yes/No	Notes	Public safety status	Boundary walls with nearby schools to prevent vandalism (yes/no)	Notes				Present/not present	Notes	Nearby public water supply	Borehole on site	Nearby borehole	Notes	Present/not present	Notes	Present/not present	Notes
1	Mutendere (in existing compound)	6/4	MOE	Yes	4062/ 7925	No	No	103 × 152	15,656	1/37 gradient in southeast direction	Yes	1.00	1:00	Satisfactory fist-sized stones	No	6.00	Commutable	No	—	No problems	Yes	Police station in neighborhood market (1 km)	None	○	Chitukuko P. S. (on land adjoining existing school)	○	—	×	×	○	Neighboring school (Chitukuko B. S.) D = approximately 60 m (18/03/02BESSIP new construction)	○	–	×	–
			○				○	○ (Must be considered when planning school building layout)								○		○		○			○											
2	Chunga (in existing compound)Chunga (in existing compound)	6/5	MOE	Yes	45/ 398	No	No	92.5 × 116.5	10,776	level	Yes	1.00	1:10	Satisfactory red soil	No	5.00	Commutable	No	—	No problems	Yes	Police station present	None	○	Chung M. B. S. (on land adjoining existing school)	○	—	×	×	○	Community borehole constructed through Japanese assistance located near site Time restrictions (8-9/14-15)	○	–	×	–
			○				○	○								○		○		○			○											
3	Kabanana (suburban site)Kabanana (suburban site)	6/5	MOE	Yes	1139-21	No	No	115 × 150	17,250	Gently sloped in north-south direction (5/100)	Yes	1.00	1:00	Satisfactory gravel layer with many boulders; red soil	No	5.40	Commutable	No	—	No problems	Yes	Construction of nearby police station planned	None	○	Kabanana B. S. . (on land adjoining existing school)	○	Power lines leading within site (can be moved)	×	×	○	Neighboring school (Kabanana B. S.) D = 72 m Local resident use prohibited on Saturdays and Sundays (because pump not installed)	○	–	×	–
			○				○	○ (No problem for school building layout)								○		○		○			○											
4	Northmead (built-up area)	6/4	MOE	Yes	3487	Layout map of neighboring school	No	163.7 × 112.2	18,367	Gently sloped in north-south direction (contoured)	Yes	0.60	1:30	Satisfactory clay	No	6.00	Paved	No	—	No problems	Yes	Police station nearby	None	○	Northmead B. S. . (on land adjoining existing school)	○	Power lines along road on north side and in residential area on south side	○	×	–	Valve on northwest corner; main pipe along road on north side; pool at neighboring school; sufficient water quantity; linked directly to public water supply	○	Drain pipe along road on north side (some parts under construction); open side ditches along road on south side	○	–
			○				○	○ (No problem for school building layout)								○		○		○			○											
5	Ng'ombe (within district planning site)v	6/6	LCC ↓ MOE	Yes	26811	City planning diagram	No	94 × 270	25,380	Slopes toward valley	Yes	1.00	1:00	Satisfactory fine sand mixed with gravel	No	Not yet constructed	Commutable	No	—	No problems	No buildings nearby	Police station nearby	None	○	None	○	Stringing wires from power lines within district necessary (approximately 200 m)	×	×	△	Natural borehole located a considerable distance from site	×	–	×	–
			○				○	○ (Construction possible but face buildings in direction of north-south axis)								○		○		○			○											
6	Libala Stage III (built-up area)Libala Stage III (built-up area)	6/4	LCC ↓ MOE	Yes	386	City planning diagramv	No	107 × 174	18,618	Level	Yes	1.00	0:45	Satisfactory red soil	No	5.00	Commutable	No	—	No problems	Yes	Police station nearby; patrols conducted 24 hours a day	None	○	None	○	Meter system (neighborhood residences)	○	×	–	Valve along road to northwest; water quantity insufficient (learned through interview with residents) 11,000Kw/month	○	–	○	11,000 Kw/month
			○				○	○								○		○		○			○											
7	Chilenje South (within district planning site)	6/7	LCC ↓ MOE	Yes	13425	City planning diagram	No	130 × 265 ～15	18,200	Level	Yes	1.00	0:50	Satisfactory sand with exposed rocks	No	Not yet constructed	Commutable	No	—	No problems	No buildings nearby	—	None	○	None	×	Stringing wires from power lines within district necessary (approximately 300 m)	×	×	×	—	×	–	×	–
			○				○	○								○		○		○			○											
8	Chelstone (within district planning site)	6/11 6/12 6/19	MOL ↓ MOE	Yes	1922	City planning diagram	No	250 × 230 ～0	28,750	Gently sloped in southeast direction	Yes	1.00	1:00	Satisfactory clay (mixed with gravel at the bottom) *4	No	4.00	Commutable	No	—	No problems	Yes	—	None	○	None	○	—	△	×	–	Pipe small; water quantity not sufficient	○	–	○	–
			○				○	○ (Must be considered when planning school building layout)								○		○		○			○											
9	Chazanga (suburban site)	6/11 6/14	MOL ↓ MOE	Yes	27356	No	No	96 ～70 × 127	10,541	Gently sloped in northeast direction	Yes	1.00	1:00	Satisfactory gravel	No	6.00	Commutable	No	—	No problems	No buildings nearby	Adjoins highland	None	○	None	○	Power lines along adjoining road	×	×	△	No borehole in neighborhood No borehole in neighborhood	×	–	×	–
			○				○	○ Must be considered when planning school building layout								○		○		○			○											
10	Chawama/John Howard (adjoining existing compound)	6/12	LCC ↓ MOE	Yes	2439	No	No	388 × 201	77,988	Level	Yes	1.00	1:10	Satisfactory hard-packed sand	No	4.00	Commutable	No	—	No problems	Yes	—	None	○	None	○	—	×	×	○	Private borehole in neighboring house	×	–	×	–
			○				○	○								○		○		○			○											
11	Marapodi/Mandevu (within district planning site)	6/6	MOL ↓ MOE	Yes	19759	City planning diagram	No	220 × 200	44,000	Level	Yes	1.00	1:00	Satisfactory sand mixed with gravel	No	Not yet constructed	Commutable	No	—	No problems	No buildings nearby	Two police stations in neighboring region	None	○	None	△	Power lines along nearby roads in the district (wire stringing approximately 500 m necessary)	×	×	×	—	×	Natural drainage to northwest (rainwater storage pit needed)	×	–
			○				○	○								○		○		○			○											
12	Jack (neighboring existing compound within district planning site)v	6/12 6/18	LCC ↓ MOE	Yes	4790	No	Western boundary adjoins private home	150 × 300	45,000	Level	Yes	1.00	0:40	Satisfactory sand	No	4.00	Commutable	No	—	No problems	Yes	—	None	○	None	○	Along eastern boundary	×	×	△	—	×	–	×	–
			○				○	○								○		○		○			○											

Notes: MOE : Ministry of Education
MOL : Ministry of Land
LCC : Lusaka District

(2) Study of the project scale

1) Determination of target grades

The subject grades of the requested basic schools are Grades 1-9 as stated in the national educational plan for the new school system. In promoting the national educational system reform, the middle basic schools have been upgraded to full basic schools; in Lusaka District, almost a half of the basic schools have been upgraded to a 9-year school system (full basic school). The Project Proposal plays a part in the objective, so the target grades for this project are Grades 1-9. The schools constructed under a former grant aid project were also full basic schools, so the number of pupils will be set by referring to the conditions used for recruiting new pupils at the time those schools were opened.

① For Grade 1, children selected from the community will be enrolled in the new schools.

② For Grades 2-7, some pupils attending neighboring schools will be transferred to the new schools because of distance, etc.

③ For Grade 8, because pupils will be accepted based on an examination for advancement to the next grade, the number of pupils will be decided by referring to the current advancement rate.

④ For Grade 9, although there will be no G9 classes in the first year, the pupils who entered Grade 8 a year before will be enrolled in new schools from the second year onward.

2) Assessment of number of pupils

There is no school district system approach in Zambia, and it is difficult to accurately predict the number of pupils or in what grade they should belong. For this reason, to calculate the number of pupils, assuming that the pupil commuting distance is 5 km,* the existing basic schools located within about five-kilometer radius of the target schools were assessed. To calculate the number of Grade 1 pupils not in school, however, about two-kilometer radius was assumed because all the existing basic schools in Lusaka will be targeted and the number of pupils will become huge if the five-kilometer radius is assumed.

* According to the Ministry of Education "Standards and Evaluation Guidelines," the pupil commuting distance is 5 km.

① Grade 1

To calculate the number of pupils in Grade 1, the number of children who were refused admittance in 2002 to existing neighboring schools because of overcapacity (the number of pupils not in school) was surveyed, considering the growth rate of population until the year of completion. The results of the survey is shown in Table 2.5 and summarized in Table

2.7. The children who were refused admittance to neighboring schools amounted to as many as 183-2,202 at each proposed site, or 14,596 in total. For reference, the number of pupils (age 7) not in school, which was obtained from a survey conducted in the community including the requested sites, is shown in the Table 2.7. As can be seen from the table, the number totals 600-6,000, backing up the data obtained from the survey on the existing neighboring schools.

Because the above-mentioned survey results are based on the number of children in 2002, the number of children not in school in 2006, when construction is expected to be completed, was calculated using the abovementioned survey results while taking into account the population increase.

- Population increase: 3.8% (rate of population increase in Lusaka Province according to 2000 statistics)

Accordingly, the proportion of population increase in 2006 is $1.038^{(2006-2002)} = 1.16$ times. As shown in Figure 2.7, the children who will not be able to enter existing schools amount to 214 to 2,556. This project absorbs these children into new schools.

② Grades 2-7

To estimate the number of pupils in Grades 2-7, from the balance between the number of classrooms and the number of pupils at neighboring schools within about five-kilometer radius of each proposed site, the size of the pupil overpopulation was assumed by the following conditions and the results are shown in Table 2.4 and summarized in Table 2.7. The number of pupils enrolled in existing schools exceeding their capacities amount to 1,356 to 4,372 on each proposed site, or 27,947 in total.

i) Based on the data from neighboring schools, the average number of session routine was established and the number of pupils who could be accommodated with the current number of classrooms (for a class size of 40 pupils) was estimated.
ii) The difference between the current number of pupils and the number of pupils who could be accommodated as determined in (i) was used as the pupil overpopulation.
iii) If the current number of pupils was fewer than the number of pupils who could be accommodated, the session routine was judged to have fewer than the average number of session routine, and the pupil overpopulation was considered to be 0.

③ Grade 8

The number of pupils in Grade 8 was estimated from the ratio of the number of pupils in Grades 8 and 9 to that in Grade 1 in existing schools in the Lusaka District. The ratio in the Lusaka District and the ratio in previous project are listed below.

All public schools in Lusaka* Grade 8: 42% Grade 9: 48%

Schools in previous project Grade 8: 74% Grade 9: 67%

Based on these data, the number of pupils in Grades 8 and 9 is 50%, or 60% of the number in Grade 1.

* Ratio of the number of all the pupils in Grades 8 and 9 to that in Grade 1 in the Lusaka District

3) Calculation of required number of classes

I. Establishment of preconditions

As preconditions for calculating the required number of classes, class size, session routine, repeat and dropout rates are established.

① Establishment of class size

The number of pupils in each class was set at 40 pupils in accordance with Ministry of Education guidelines. The results of the survey on the number of pupils in neighboring schools are as follows.

Averaged class size in basic schools in Lusaka: 49.4 pupils/class

Averaged class size in full basic schools: 52.6 pupils/class

Averaged class size in middle basic schools: 46.4 pupils/class

② Establishment of session routine

The session routine established based on the Ministry of Education guidelines, interviews with Ministry of Education officials and the results of the survey of neighboring schools is listed in Table 3-3. The reasons for the establishment of the session routines are described below.

i. Grades 1 to 4: 3 session routines

Although the number of session routines based on the results of the survey of neighboring schools is approximately 2.4, the 3 session routines permitted under the guidelines is adopted.

ii. Grades 5 and 6: 2 session routines

Although the number of session routines based the results of the survey of neighboring schools is slightly more than 1.5, the 2 session routines permitted under the guidelines is adopted. In addition, although the number of session routines based on the interviews with Ministry of Education officials is 3 for Grades 1 to 7, this figure is not adopted because in local regions, the 3 session routine is adopted for the schools with few number of classes.

iii. Grades 7 to 9: 1 session routine

Although the number of session routines based on the Ministry of Education guidelines is 2 for Grade 7 and 1 for Grades 8 and 9, the same 1 session routine as

for Grades 8 and 9 is adopted for Grade 7, because the averaged number based on the results of the survey of neighboring schools is 1.17 for Grade 7. The reason that the number of session routines is small for Grade 7 seems to be for the preparation of the examination for advancement to Grade 8.

Table 2.3 Establishment of Session Routine

Grade	Teaching Hours in Guidelines	MOE Interviews	Survey of Neighboring Schools	Session routines Established
1	3	3	2.45	3
2			2.44	
3			2.53	
4			2.41	
5	2	3	1.56	2
6			1.54	
7			1.17	1
8	1	2	1.28	
9			1.28	

③ Repetition and dropout rates

The largest proportion of pupils in the Lusaka District who repeat a grade or drop out are Grade 7 pupils, at 7.43% and 2.59%, respectively. This is equal to an increase of slightly less than 3 pupils and a decrease of slightly more than 1 pupil, respectively, and an increase of slightly less than 2 pupils on the average, in a forty-pupils class. However, even the actual number of pupils in each grade varied considerably. Therefore, these values were not taken into account in the assessment of the number of classrooms.

II. Establishment of appropriate scale of schools

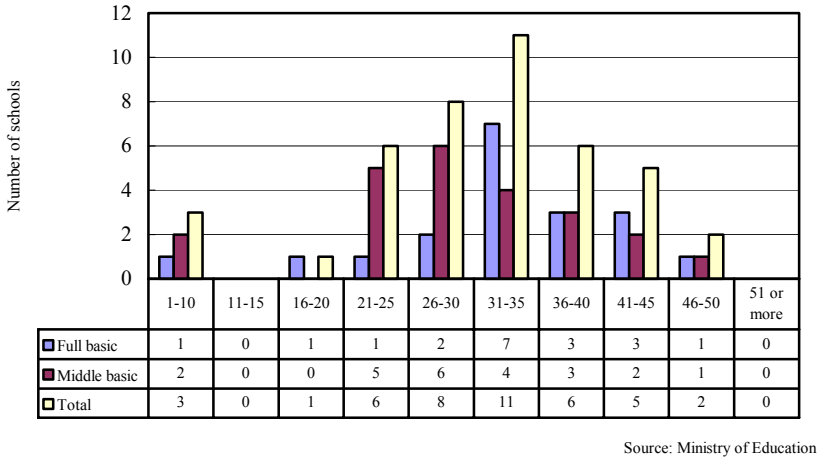
Calculating the number of classes that accommodate the total number of pupils in Grade 1 (214-2,556 pupils) as established in "2) Assessment of number of student," the scale of schools becomes extremely large. Accordingly, the appropriate scale for school administration was established based the Ministry of Education standards and the present status of existing schools.

① Establishment of upper limit for number of classes

There is no upper limit for number of classes in the Ministry of Education guidelines. However, considering the size of the schools and taking into consideration teacher assignment and other factors, the number of classes is expected to be 37-47 for even the largest scale (medium scale: 27-36 classes/small scale: 1-26 classes)

As shown in the figure below, the number of classes in the survey of neighboring schools peaked at 31-35 classes for full basic schools, with only one school having more than 46 classes. The average number of classes was 34.3.

From the standpoint of school administration as well, the 47 classes in the abovementioned Guidelines was made the upper limit.



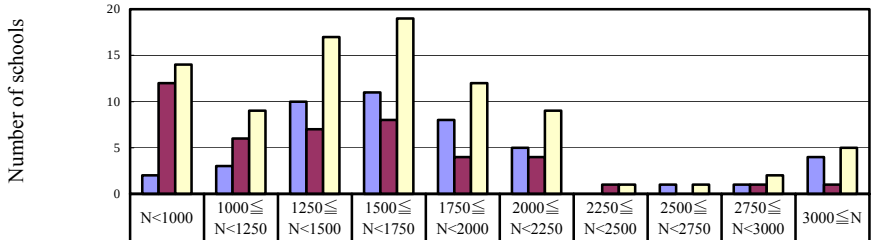
	1-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51 or more
Full basic	1	0	1	1	2	7	3	3	1	0
Middle basic	2	0	0	5	6	4	3	2	1	0
Total	3	0	1	6	8	11	6	5	2	0

Source: Ministry of Education

Figure 2.1 Number of Classes in Existing Schools in Lusaka District

② Establishment of upper limit for the number of pupils in each school

The distribution of full basic school's pupils in the Lusaka District peaked at 1,500-1,750. The average number of full basic school's pupils was 1,784. Assuming the upper limits for number of classes and pupils in each class to be 47 and 40 respectively, the number of pupils is 1,880. Accordingly, an upper limit of approximately 1,800 pupils was used.



	N<1000	1000≦ N<1250	1250≦ N<1500	1500≦ N<1750	1750≦ N<2000	2000≦ N<2250	2250≦ N<2500	2500≦ N<2750	2750≦ N<3000	3000≦N
Full basic	2	3	10	11	8	5	0	1	1	4
Middle basic	12	6	7	8	4	4	1	0	1	1
Total	14	9	17	19	12	9	1	1	2	5

Source: Ministry of Education

Figure 2.2 Number of Pupils in Existing Schools

III. Establishment of required number of classrooms

Table 2.4 shows the results of a calculation of the number of classrooms when the number of pupils in Grade 1 is changed from 160 (40 pupils/class x 4 classes) to 240 (40 pupils/class x 6 classes) in consideration of "I. Establishment of preconditions."

If the number of pupils in Grade 1 is set to 240, the required number of classes and the total number of pupils are 48 and 1,920, respectively, exceeding the upper limit of the number of classes and pupils, or 47 and 1,800, respectively, established in II. If the number of pupils in Grade 1 is set to 200 and the percentage advancement to Grade 8 to 60% (200 pupils x 60% = 120 pupils (3 classes)), the required number of classes and the total number of pupils are 41 and 1,640, respectively, satisfying the values set above. In this case, the required number of classrooms is 23.

Number of classes: 41 (<47)

Total number of pupils: 1,640 (<1800)

Number of classrooms: 22.7 → 23

Table 2.4 Number of Grade 1 Pupils and Maximum Required Number of Classrooms

No. of Grade 1 pupils		160				200				200				240			
No. of classes	Grade	1-7			8,9	1-7			8,9	1-7			8,9	1-7			8,9
	No. of classes	4			2	5			2	5			3	6			3
	Total no. of classes	32			○	39			○	41			○	48			×
Session routine		Grades 1-4	Grades 5,6	Grade 7	Grades 8,9	Grades1-4	Grades 5,6	Grade 7	Grades 8,9	Grades 1-4	Grades 5,6	Grade 7	Grades 8,9	Grades 1-4	Grades 5,6	Grade 7	Grades 8,9
		3	2	1	1	3	2	1	1	3	2	1	1	3	2	1	1
No of pupils	Grade	1-7			8,9	1-7			8,9	1-7			8,9	1-7			8,9
	No. of pupils	1120			160	1400			160	1400			240	1680			240
	Total no. of pupils	1280			○	1560			○	1640			○	1920			△
No. of classrooms	Grade	1-4	5,6	7	8,9	1-4	5,6	7	8,9	1-4	5,6	7	8,9	1-4	5,6	7	8,9
	No. of classrooms	1.3	2	4	2	1.7	2.5	5	2	1.7	2.5	5	3	2	3	6	3
	Total no.per grade	5.3	4	4	4	6.7	5	5	4	6.7	5	5	6	8	6	6	6
	Total no. of classrooms	17.3			○	20.7			○	22.7			○	26			△

IV. Comparison of required number of classrooms and established number of pupils

The number of pupils not in school and pupil overpopulation in 2) above were compared with the number of pupils calculated in the establishment of required number of classrooms (200 in Grade 1, 1,200 in Grades 2-7) in "III. Establishment of required number of classrooms," and the number of classrooms that could accommodate the pupils was established.

As shown in the results of establishment (Table 2.7), if the number of classrooms is set to 23 as established in III, the number of pupils not in school and the pupil overpopulation exceeded

the number of pupils that could be accommodated by the new schools, leading to the judgment that these schools will be used effectively from the first year of operation.

V. Change in the number of session routines in existing schools

If pupils in Grades 2-7 in existing schools (1,200 pupils/school x 12 schools = 14,400 pupils) transfer to the new schools, the average number of session routines will be reduced as follows because the number of pupils in Grades 1-7 in the existing schools will decrease. (Table 3.8)

Average number of session routines before the opening of the new schools:

Number of pupils in Grades 1-7 in 91 schools in the Lusaka District: 131,779

Number of classrooms in Grades 1-7 in 91 schools in the Lusaka District*: 1,456

Average number of session routines = 131,779/(1,456 x 40 $^{\text{pupils per class}}$) = 2.26

Average number of session routines after the opening of the new schools (based on the assumption that the number of classrooms in existing schools will remain unchanged):

Number of pupils in Grades 1-7 in 91 schools in the Lusaka District: 117,379 (= 131,779 - 14,400)

Number of classrooms in Grades 1-7 in 91 schools in the Lusaka District*: 1,456

Average number of session routines = 117,379/(1,456 x 40 $^{\text{pupils per class}}$) = 2.02

* The number of classrooms, excepting the number of Grades 8 and 9 classrooms in full basic schools

Table 2.5 Number of Pupils Not Enrolled (1/2)

	NAME of SCHOOLs	Applicants	Enrolled	Not Enrolled	SITE											
					MTENDERE	CHUNGA	KABANANA	NORTH MEAD	NG'OMBE	LIBALA STAGE III	CHILENJE SOUTH	CHELSTON	CHAZANGA	CHAWAMA/ JOHN HOWARD	MARAPODI MANDEVU	JACK
4	CHAISA BASIC	204	204	0											0	
5	CHAKUNKULA BASIC	249	249	0								0				
6	CHAMBA VALLEY BASIC	1000	200	800					800							
7	CHAWAMA BASIC	500	320	180										90		90
8	CHELSTONE BASIC	1085	175	910								910				
9	CHILENJE SOUTH	76	45	31						16	16					
10	CHIMWEMWE BASIC	358	358	0										0		
13	DAINA KAYIMBA BASIC(JICA)	55	55	0		0										
14	EMMASDALE	1000	264	736				736								
19	LIBALA BASIC (JICA)	238	151	87						87						
20	LILANDA BASIC	500	150	350		350										
21	LILAYI BASIC	200	200	0												0
25	MAHATMA GANDIH BASIC	1000	160	840	840											
30	MUYOOMA	1000	133	867							867					
31	NAMANDO BASIC	500	218	282		282										
33	NGOMBE BASIC (JICA)	400	160	240					240							
34	NGWELELE BASIC	350	140	210				210								
35	NORTHMEAD BASIC	500	200	300				300								
42	MULEYA BASIC	800	154	646				646								
44	OLYMPIA BASIC	341	261	80				80								
45	CHAINANA DAY CENTRE (SEN School)	N.R.	40	N.R.												
48	CHILENJE (B)	102	102	0						0						
49	CHIPATA	2400	480	1920									960		960	
50	CHISENGALUMBWE	358	358	0						0						
52	CHITUKUKO BASIC	500	266	234	234											
53	CHUNGA BASIC	190	190	0		0										

Table 2.5 Number of Pupils Not Enrolled (2/2)

NAME of SCHOOLs	Applicants	Enrolled	Not Enrolled	SITE											
				MTENDERE	CHUNGA	KABANANA	NORTH MEAD	NG'OMBE	LIBALA STAGE III	CHILENJE SOUTH	CHELSTON	CHAZANGA	CHAWAMA/ JOHN HOWARD	MARAPODI MANDEVU	JACK
54 DESAI BASIC	535	150	385		385										
57 HARRY MWAANGA NKUMBULA	250	150	100		100										
58 HIGHLAND	461	216	245			123						122			
59 HILLSIDE BASIC	300	204	96		96										
60 JUSTINE KABWE	270	270	0											0	
61 KABANANA	489	148	341			171						170			
64 KAMANGA	392	191	201								201				
65 KAMULANGA BASIC	1,000	781	219										109		110
67 KAMWALA SOUTH MIDDLE BASIC	200	180	20												20
68 KAPWELYOMBA	1,000	160	840								840				
70 LUSAKASA	136	70	66						66						
71 MAMBILIMA	412	250	162											162	
72 MATERO EAST	520	230	290											290	
73 MAKANDAWIRE	78	63	15						15						
74 MTENDERE	240	240	0	0											
75 MUTAMBE	1,000	210	790											790	
76 NELSON MANDELA BASIC	220	180	40		40										
77 REGIMENT	240	240	0						0						
78 ROMA GIRLS	100	40	60					60							
79 ST.FRANCIS OF ASSISS	37	37	0										0		
83 THORN PARK	350	310	40				40								
84 TWALUMBA	1,000	170	830		830										
86 TWATASHA	1,250	240	1,010										1,010		
88 VERA CHILUBA	500	275	225	225											
Number of pupils not enrolled in 2002			14,688	1,299	2,083	294	2,012	1,100	184	882	1,951	1,252	1,209	2,202	220
Number f applicants in 2002			24,926	2,280	3,550	476	3,341	1,500	1,190	1,038	2,726	1,674	2,395	3,606	1,150
Number of pupils enrolled in 2002			10,238	981	1,467	182	1,329	400	1,006	156	775	422	1,186	1,404	930

Table 2.6 Excess Number of Pupils at Neighboring Basic Schools (Number of Pupils to be transfered to New Schools) (1/2)

NAME of SCHOOLs	Number of Pupils			No. of Room	Pupils/ Room	Capacity of Pupils	Excess of Pupils	Mtendere	Chunga	Kabanana	Northmead	Ng'ombe	Libala Stage III	Chilenje South	Chelston	Chazanga	Chawama	Marapodi/ Mandevu	Jack
	G1	G2-G7	G8,G9																
1 ARTHUR WINA	112	815	248	25	47.0	1543	0				0	0							
2 BURMA ROAD	150	1069	261	20	74.0	1056	13				3	3		3			3		
3 CHAINDA	160	1053	143	21	64.6	1299	0								0				
4 CHAISA	204	1438	239	17	110.6	812	626		157					157		157		157	
5 CHAKUNKULA	160	1170	160	28	53.2	1868	0	0							0				
6 CHAMBA VALLEY	126	1139	82	17	79.2	1137	2			1	1		1		1				
7 CHAWAMA	320	2128	320	26	106.5	1299	829										414		414
8 CHELSTONE	115	1507	436	21	98.0	893	614	307							307				
10 CHIMWEMWE	363	2606	145	21	148.3	1137	1469										735		735
11 CHINIKA	320	2726	302	31	108.0	1786	940							470			470		
12 CHINGWELE	156	969	212	13	102.8	568	401		134							134		134	
13 DAINA KAYIMBA	107	421	132	21	31.4	1380	0		0									0	
15 JOHN LAING	243	1340	194	21	84.6	1137	203										203		
16 KABULONGA	80	671	438	18	66.1	650	21	21											
17 KAUNDA SQUARE	233	1550	86	20	93.5	1299	251	84					84		84				
18 KIZITO	200	1600	242	16	127.6	731	869		435									435	
19 LIBALA	103	921	206	21	58.6	1299	0				0	0					0		
20 LILANDA	236	1472	139	19	97.2	1137	335		168									168	
21 LILAYI	200	1344	149	15	112.9	812	532				133	133					133		133
22 LOTUS	197	1542	246	19	104.5	974	568				142			142			142		142
23 LUSAKA BOYS	145	1137	279	26	60.0	1543	0				0			0					
24 LUSAKA GIRLS	168	1437	270	30	62.5	1868	0				0			0					
25 MAHATMA GANDIH	160	1385	198	19	91.7	1056	329	165					165						
26 MATERO BOYS	192	1049	264	20	75.3	1056	0		0					0				0	
27 MUCHINGA	202	1340	76	16	101.1	974	366		366										
28 MUMANA	173	1275	193	21	78.1	1218	57	19					19		19				
29 MUMUNI	138	1137	125	18	77.8	1137	0				0			0			0		0
30 MUYOOMA	128	1240	242	14	115.0	650	590					590							
31 NAMANDO	119	747	95	14	68.6	893	0									0			
32 NEW KANYAMA	240	1450	160	18	102.8	974	476										476		
33 NGOMBE	158	1005	160	23	57.5	1462	0			0			0						
34 NGWELELE	205	1133	151	16	93.1	893	240							240					
35 NORTHMEAD	168	1333	254	25	70.2	1462	0							0				0	
36 PRINCE TAKAMADO	160	889	210	21	60.0	1218	0												
37 SIMON MWANSA KAPWEPWE	151	1245	237	12	136.1	406	839			280			280			280			
38 ST.PATRICKS	316	2900	124	21	159.0	1218	1682				336	336		336			336		336
39 ST.MONICA'S	233	1592	178	21	95.4	1218	374		94					94		94		94	
40 TUNDUYA	160	1232	160	16	97.0	893	339	113					113		113				
41 WOODLANDS (A)	254	2166	188	29	89.9	1786	380	127			127	127							
42 MULEYA	128	1234	172	17	90.2	974	260							130				130	
49 CHIPATA	230	1397	86	18	95.2	1137	260			260									
52 CHITUKUKO	160	1833	119	17	124.2	1056	777	389							389				
65 KAMULANGA	233	2388	448	30	102.3	1543	845				169	169			169		169		169
66 KAMWALA	240	1747	147	21	101.6	1218	529				106	106		106			106		106
76 NELSON MANDELA	129	1028	191	25	53.9	1624	0		0							0		0	

Table 2.6 Excess Number of Pupils at Neighboring Basic Schools (Number of Pupils to be transfered to New Schools) (2/2)

NAME of SCHOOLs	Number of Pupils			No. of Room	Pupils/ Room	Capacity of Pupils	Excess of Pupils	Mtendere	Chunga	Kabanana	Northmead	Ng'ombe	Libala Stage III	Chilenje South	Chelston	Chazanga	Chawama	Marapodi/ Mandevu	Jack
	G1	G2-G7	G8,G9																
9 CHILENJE SOUTH	75	457	0	12	44.3	823	0				0	0							
14 EMMASDALE	225	1365	0	23	69.1	1496	0		0					0				0	
43 JACARANDA	113	1294	0	18	78.2	1197	97				49			49					
46 CHIBELO	261	1489	0	24	72.9	1571	0	0			0								
47 CHIBOLYA	245	1803	0	16	128.0	972	831							415			415		
48 CHILENJE (B)	87	720	0	21	38.4	1496	0				0	0							
50 CHISENGALUMBWE	54	579	0	14	45.2	972	0				0	0							0
51 CHITANDA	140	1286	0	19	75.1	1272	14		7									7	
53 CHUNGA	225	742	0	15	64.5	898	0		0									0	
54 DESAI	146	1381	0	15	101.8	972	409		204									204	
55 GEORGE CENTRAL	265	1630	0	14	135.4	823	807		404									404	
56 EDWIN MULONGOTI	185	1357	0	17	90.7	1047	310		155									155	
57 HARRY MWAANGA NKUMBULA	160	1031	0	15	79.4	972	59		29									29	
58 HIGHLAND	217	1540	0	25	70.3	1646	0			0						0		0	
59 HILLSIDE	176	1163	0	20	67.0	1346	0		0									0	
60 JUSTINE KABWE	252	2554	0	18	155.9	1122	1432			477			477			477			
61 KABANANA	132	1019	0	10	115.1	598	421			105			105			105		105	
62 KABWATA	145	1012	0	21	55.1	1421	0				0	0					0		0
63 KALINGALINGA	229	1337	0	12	130.5	673	664	166			166		166	166					
64 KAMANGA	191	1386	0	17	92.8	1047	339	169					169						
67 KAMWALA SOUTH	180	1146	0	25	53.0	1720	0				0	0					0		0
68 KAPWELYOMBA	160	937	0	16	68.6	1047	0	0							0				
69 KASAMBA	237	1788	0	20	101.3	1272	516		172					172				172	
70 LUSAKASA	60	600	0	17	38.8	1197	0				0	0					0		0
71 MAMBILIMA	133	1182	0	14	93.9	898	284		71					71		71		71	
72 MATERO EAST	120	849	0	10	96.9	598	251		63					63		63		63	
73 MAKANDAWIRE	57	646	0	14	50.2	972	0				0	0					0		0
74 MTENDERE	235	1852	0	15	139.1	898	954	477							477				
75 MUTAMBE	240	1959	0	18	122.2	1122	837			419						419			
44 OLYMPIA	211	1411	0	12	135.2	673	738						184	184		184		184	
77 REGIMENT	240	1412	0	20	82.6	1272	140				47	47							47
78 ROMA GIRLS	40	255	0	7	42.1	449	0			0			0	0		0		0	
79 ST.FRANCIS OF ASSISS	37	237	0	nil	-		237												237
80 STATE LODGE (A)	66	379	0	4	111.3	224	155												
81 STATE LODGE (B)	64	556	0	6	103.3	374	182												
82 TIMOTHY MWANAKATWE	126	695	0	25	32.8	1720	0				0	0					0		
83 THORN PARK	163	1373	0	15	102.4	972	401							200				200	
84 TWALUMBA	166	1256	0	25	56.9	1720	0		0				0			0		0	
85 TWASHUKA	200	1693	0	25	75.7	1646	47										47		
86 TWATASHA	360	2642	0	20	150.1	1197	1445										723		723
88 VERA CHILUBA	240	2187	0	25	97.1	1646	541	180					180	180					
89 WOODLANDS (B)	118	979	0	13	84.4	823	156				78	78							
90 NYUMBA YANGA	160	905	0	29	36.7	2020	0	0			0	0							
91 BAULENI	170	1214	0	15	92.3	972	242												
Ground Total	15681	116098	9107	1654	85.2	100090	28524	2217	2457	1541	1356	1589	1943	3178	1558	1982	4372	2711	3042

Note 1. Asuumed Shift(Full Basic) : G1=2.65,G2-7=2.03,G8,9=1.28 2. Asuumed Shift(Middle Basic) : G1=2.30,G2-7=1.87 3.Number of pupils per 1 Classroom = 40

Table 2.7 Study of Number of Classrooms

Site			Mutendere	Chunga	Kabanana	Northmead	Ng'ombe	Libala Stage III	Chilenje South	Chelstone	Chazanga	Chawama/ John Howard	Marapodi/ Mandevu	Jack	Total
			Compound	Compound	Compound	Suburban	Compound	Suburban	Suburban	Suburban	Compound	Compound	Compound	Compound	
Priority*1			6	2	9	5	11	12	4	10	7	8	3	1	
Number of Pupils Not Enrolled (G1)	Neighboring Schools	Number of Schools*2	4	9	1	6	3	6.5	1.5	4	1.5	4	5.5	3	49
		Number of Candidates*3	2,280	3,550	476	3,341	1,500	1,190	1,038	2,726	1,674	2,395	3,606	1,150	24,926
		Number of Enrolled Pupils*4	981	1,467	182	1,329	400	1,006	156	775	422	1,186	1,404	930	10,238
		Number of Pupils Not Enrolled*5	1,299	2,083	294	2,012	1,100	184	882	1,951	1,252	1,209	2,202	220	14,688
	Community	Population of Community*6	150,000	89,000	30,000	15,000	50,000	26,000	30,000	20,000	30,000	200,000	60,000	60,000	760,000
		Population Ratio of 7-year-old*7	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	
		Number of 7-year-old children*8	4,350	2,581	870	435	1,450	754	870	580	870	5,800	1,740	1,740	22,040
		Number of Pupils Not Enrolled*9	6,000	2,000	2,000	-	3,500	-	2,000	600	-	3,000	-	2,000	21,100
	Number of Pupils Not Enrolled in 2002*10		1,299	2,083	294	2,012	1,100	184	883	1,951	1,254	1,210	2,202	220	14,692
	Ratio of Population Increase*11		3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	
	Assumed Fiscal Year		2006	2006	2006	2006	2006	2006	2006	2006	2006	2006	2006	2006	
	Proportion of Population Increse*12		1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	
	Number of Pupils Not Enrolled in 2006*13		1,508	2,418	341	2,336	1,277	214	1,025	2,265	1,453	1,405	2,556	255	17,053
G2-7	Number of Surplus Pupils in Neighboring Schools(in 5km)		2,217	2,457	1,541	1,356	1,589	1,943	3,178	1,558	1,982	4,372	2,711	3,042	27,946
Number of Classrooms the Site can accommodate			23	23	23	23	23	23	23	23	23	23	23	23	276
Established Number of Pupils	Grade 1		200 <1,508 OK	200 <2,418 OK	200 <341 OK	200 <2,336 OK	200 <1,277 OK	200 <214 OK	200 <1,025 OK	200 <2,265 OK	200 <1,453 OK	200 <1,405 OK	200 <2,556 OK	200 <255 OK	2,400
	Grade 2-7 (Admission or Transfer from Neighboring Schools)		1200 <2,217 OK	1200 <2,457 OK	1200 <1,541 OK	1200 <1,356 OK	1200 <1,589 OK	1200 <1,943 OK	1200 <3,178 OK	1200 <1,558 OK	1200 <1,982 OK	1200 <4,372 OK	1200 <2,711 OK	1200 <3,042 OK	14,400
	Grade 8,9(Recruitment by Promotion Test)		240	240	240	240	240	240	240	240	240	240	240	240	2,880
	Number of Pupils Accomodated		1640	1640	1640	1640	1640	1640	1640	1640	1640	1640	1640	1640	19,680
Scale	Number of Classrooms		23	23	23	23	23	23	23	23	23	23	23	23	276
	Number of Classes		41	41	41	41	41	41	41	41	41	41	41	41	492

*1 Priority — The Priority specified by MoE

*2 Number of Schools — Number of Neighboring Basic Schools within a 2km radius of the site.（In case a school is included at the 2sites, the school is counted 0.5）

*3 Number of Candidates — Number of Candidates at Neighboring Schools in 2002（GRADE 1）

*4 Number of Enrolled Pupils — Number of Enrolled Pupils at Neighboring Schools in 2002 (GRADE 1)

*5 Number of Pupils Not Enrolled — Number of Pupils Not Enrolled at Neighboring Schools in 2002 (GRADE 1)

*6 Population of Community — The Results of Hearing from Communities.

*7 Population Ratio of 7-year-old — Population Ratio of 7-year-old in Lusaka Provincial （2000）

*8 Number of 7-year-old children — =（Population of Community）×（Ratio of 7-year-old)

*9 Number of Pupils Not Enrolled — Number of Pupils Not Enrolled of Findings at Communities

*10 Number of Pupils Not Enrolled in 2002 — =Number of Pupils Not Enrolled at Neighboring Schools

*11 Ratio of Population Increase — Statistical Ratio of Population Increase in Lusaka District (2000)

*12 Proportion of Population Increse — $= (1+ (\text{Ratio of Population Increase}))^{(2006-2002)}$

*13 Number of Pupils Not Enrolled in 2006 — =(Number of Pupils Not Enrolled in 2002*10) × (Proportion of Population Increase)

Table 2.8 Change in the Number of Shifts at Adjacent Schools Before/After Moving to New Schools (1/2)

NAME of SCHOOLs	Number of Pupils				No. of Rooms	Pupils/ Room	Number of Classrom			Change of Number of Pupils				Change of Shift(G1-7)	
	Total	G1	G2-7	G8,9			G1	G2-7	G8,9	Capacity G2-7	Excess G2-7	Transfer G2-7	After Transfer G1-7	Present	After Transfer
1 ARTHUR WINA	1,175	112	815	248	25	47.0	1	19	5.0	1,543	0	0	927	1.16	1.16
2 BURMA ROAD	1,480	150	1,069	261	20	74.0	1	13	6.0	1,056	13	8	1,211	2.18	2.16
3 CHAINDA	1,356	160	1,053	143	21	64.6	2	16	3.0	1,299	0	0	1,213	1.68	1.68
4 CHAISA	1,881	204	1,438	239	17	110.6	2	10	5.0	812	626	300	1,342	3.42	2.80
5 CHAKUNKULA	1,490	160	1,170	160	28	53.2	1	23	4.0	1,868	0	0	1,330	1.39	1.39
6 CHAMBA VALLEY	1,347	126	1,139	82	17	79.2	1	14	2.0	1,137	2	2	1,263	2.11	2.11
7 CHAWAMA	2,768	320	2,128	320	26	106.5	3	16	7.0	1,299	829	277	2,171	3.22	2.86
8 CHELSTONE	2,058	115	1,507	436	21	98.0	1	11	9.0	893	614	403	1,219	3.38	2.54
10 CHIMWEMWE	3,114	363	2,606	145	21	148.3	4	14	3.0	1,137	1,469	491	2,478	4.12	3.44
11 CHINIKA	3,348	320	2,726	302	31	108.0	3	22	6.0	1,786	940	306	2,740	3.05	2.74
12 CHINGWELE	1,337	156	969	212	13	102.8	1	7	5.0	568	401	205	920	3.52	2.87
13 DAINA KAYIMBA	660	107	421	132	21	31.4	1	17	3.0	1,380	0	0	528	0.73	0.73
15 JOHN LAING	1,777	243	1,340	194	21	84.6	3	14	4.0	1,137	203	56	1,527	2.33	2.25
16 KABULONGA	1,189	80	671	438	18	66.1	1	8	9.0	650	21	12	739	2.09	2.05
17 KAUNDA SQUARE	1,869	233	1,550	86	20	93.5	2	16	2.0	1,299	251	161	1,622	2.48	2.25
18 KIZITO	2,042	200	1,600	242	16	127.6	2	9	5.0	731	869	405	1,395	4.09	3.17
19 LIBALA	1,230	103	921	206	21	58.6	0	16	5.0	1,299	0	0	1,024	1.60	1.60
20 LILANDA	1,847	236	1,472	139	19	97.2	2	14	3.0	1,137	335	156	1,552	2.67	2.42
21 LILAYI	1,693	200	1,344	149	15	112.9	2	10	3.0	812	532	307	1,237	3.22	2.58
22 LOTUS	1,985	197	1,542	246	19	104.5	2	12	5.0	974	568	274	1,465	3.11	2.62
23 LUSAKA BOYS	1,561	145	1,137	279	26	60.0	1	19	6.0	1,543	0	0	1,282	1.60	1.60
24 LUSAKA GIRLS	1,875	168	1,437	270	30	62.5	1	23	6.0	1,868	0	0	1,605	1.67	1.67
25 MAHATMA GANDIH	1,743	160	1,385	198	19	91.7	2	13	4.0	1,056	329	191	1,354	2.58	2.26
26 MATERO BOYS	1,505	192	1,049	264	20	75.3	1	13	6.0	1,056	0	0	1,241	2.22	2.22
27 MUCHINGA	1,618	202	1,340	76	16	101.1	2	12	2.0	974	366	179	1,363	2.75	2.43
28 MUMANA	1,641	173	1,275	193	21	78.1	2	15	4.0	1,218	57	37	1,411	2.13	2.08
29 MUMUNI	1,400	138	1,137	125	18	77.8	1	14	3.0	1,137	0	0	1,275	2.13	2.12
30 MUYOOMA	1,610	128	1,240	242	14	115.0	1	8	5.0	650	590	446	922	3.80	2.56
31 NAMANDO	961	119	747	95	14	68.6	1	11	2.0	893	0	0	866	1.80	1.80
32 NEW KANYAMA	1,850	240	1,450	160	18	102.8	2	12	4.0	974	476	131	1,559	3.02	2.78
33 NGOMBE	1,323	158	1,005	160	23	57.5	1	18	4.0	1,462	0	0	1,163	1.53	1.53
34 NGWELELE	1,489	205	1,133	151	16	93.1	2	11	3.0	893	240	91	1,247	2.57	2.40
35 NORTHMEAD	1,755	168	1,333	254	25	70.2	2	18	5.0	1,462	0	0	1,501	1.88	1.88
36 PRINCE TAKAMADO	1,259	160	889	210	21	60.0	1	15	5.0	1,218	0	0	1,049	1.64	1.64
37 SIMON MWANSA KAPWEPWE	1,633	151	1,245	237	12	136.1	2	5	5.0	406	839	560	836	4.99	2.99
38 ST.PATRICKS	3,340	316	2,900	124	21	159.0	3	15	3.0	1,218	1,682	904	2,312	4.47	3.21
39 ST.MONICA'S	2,003	233	1,592	178	21	95.4	2	15	4.0	1,218	374	179	1,646	2.68	2.42
40 TUNDUYA	1,552	160	1,232	160	16	97.0	1	11	4.0	893	339	218	1,174	2.90	2.45
41 WOODLANDS (A)	2,608	254	2,166	188	29	89.9	3	22	4.0	1,786	380	276	2,144	2.42	2.14
42 MULEYA	1,534	128	1,234	172	17	90.2	1	12	4.0	974	260	106	1,256	2.62	2.41
49 CHIPATA	1,713	230	1,397	86	18	95.2	2	14	2.0	1,137	260	203	1,424	2.54	2.23
52 CHITUKUKO	2,112	160	1,833	119	17	124.2	1	13	3.0	1,056	777	510	1,483	3.56	2.65
65 KAMULANGA	3,069	233	2,388	448	30	102.3	2	19	9.0	1,543	845	520	2,101	3.12	2.50
66 KAMWALA	2,134	240	1,747	147	21	101.6	3	15	3.0	1,218	529	284	1,703	2.76	2.36
76 NELSON MANDELA	1,348	129	1,028	191	25	53.9	1	20	4.0	1,624	0	0	1,157	1.38	1.38

Table 2.8 Change in the Number of Shifts at Adjacent Schools Before/After Moving to New Schools (2/2)

NAME of SCHOOLs	Number of Pupils				No. of Rooms	Pupils/ Room	Number of Classrom			Change of Number of Pupils				Change of Shift(G1-7)	
	Total	G1	G2-7	G8,9			G1	G2-7	G8,9	Capacity G2-7	Excess G2-7	Transfer G2-7	After Transfer G1-7	Present	After Transfer
9 CHILENJE SOUTH	532	75	457	0	12	44.3	1	11		823	0	0	532	1.11	1.11
14 EMMASDALE	1590	225	1365	0	23	69.1	3	20		1496	0	0	1590	1.73	1.73
43 JACARANDA	1407	113	1294	0	18	78.2	2	16		1197	97	61	1346	1.95	1.87
46 CHIBELO	1750	261	1489	0	24	72.9	3	21		1571	0	0	1750	1.82	1.82
47 CHIBOLYA	2048	245	1803	0	16	128.0	3	13		972	831	271	1777	3.20	2.78
48 CHILENJE (B)	807	87	720	0	21	38.4	1	20		1496	0	0	807	0.96	0.96
50 CHISENGALUMBWE	633	54	579	0	14	45.2	1	13		972	0	0	633	1.13	1.13
51 CHITANDA	1426	140	1286	0	19	75.1	2	17		1272	14	7	1419	1.88	1.87
53 CHUNGA	967	225	742	0	15	64.5	3	12		898	0	0	967	1.61	1.61
54 DESAI	1527	146	1381	0	15	101.8	2	13		972	409	190	1337	2.55	2.23
55 GEORGE CENTRAL	1895	265	1630	0	14	135.4	3	11		823	807	376	1519	3.38	2.71
56 EDWIN MULONGOTI	1542	185	1357	0	17	90.7	3	14		1047	310	144	1398	2.27	2.06
57 HARRY MWAANGA NKUMBULA	1191	160	1031	0	15	79.4	2	13		972	59	27	1164	1.99	1.94
58 HIGHLAND	1757	217	1540	0	25	70.3	3	22		1646	0	0	1757	1.76	1.76
59 HILLSIDE	1339	176	1163	0	20	67.0	2	18		1346	0	0	1339	1.67	1.67
60 JUSTINE KABWE	2806	252	2554	0	18	155.9	3	15		1122	1432	955	1851	3.90	2.57
61 KABANANA	1151	132	1019	0	10	115.1	2	8		598	421	257	894	2.88	2.24
62 KABWATA	1157	145	1012	0	21	55.1	2	19		1421	0	0	1157	1.38	1.38
63 KALINGALINGA	1566	229	1337	0	12	130.5	3	9		673	664	402	1164	3.26	2.43
64 KAMANGA	1577	191	1386	0	17	92.8	3	14		1047	339	196	1381	2.32	2.03
67 KAMWALA SOUTH	1326	180	1146	0	25	53.0	2	23		1720	0	0	1326	1.33	1.33
68 KAPWELYOMBA	1097	160	937	0	16	68.6	2	14		1047	0	0	1097	1.71	1.71
69 KASAMBA	2025	237	1788	0	20	101.3	3	17		1272	516	225	1800	2.53	2.25
70 LUSAKASA	660	60	600	0	17	38.8	1	16		1197	0	0	660	0.97	0.97
71 MAMBILIMA	1315	133	1182	0	14	93.9	2	12		898	284	136	1179	2.35	2.11
72 MATERO EAST	969	120	849	0	10	96.9	2	8		598	251	120	849	2.42	2.12
73 MAKANDAWIRE	703	57	646	0	14	50.2	1	13		972	0	0	703	1.26	1.26
74 MTENDERE	2087	235	1852	0	15	139.1	3	12		898	954	626	1461	3.48	2.44
75 MUTAMBE	2199	240	1959	0	18	122.2	3	15		1122	837	579	1620	3.05	2.25
44 OLYMPIA	1622	211	1411	0	12	135.2	3	9		673	738	377	1245	3.38	2.59
77 REGIMENT	1652	240	1412	0	20	82.6	3	17		1272	140	95	1557	2.07	1.95
78 ROMA GIRLS	295	40	255	0	7	42.1	1	6		449	0	0	295	1.05	1.05
79 ST.FRANCIS OF ASSISS	274	37	237	0	nil	-	-	-			237				
80 STATE LODGE (A)	445	66	379	0	4	111.3	1	3		224	155	0	445	2.78	2.78
81 STATE LODGE (B)	620	64	556	0	6	103.3	1	5		374	182	0	620	2.58	2.58
82 TIMOTHY MWANAKATWE	821	126	695	0	25	32.8	2	23		1720	0	0	821	0.82	0.82
83 THORN PARK	1536	163	1373	0	15	102.4	2	13		972	401	164	1372	2.56	2.29
84 TWALUMBA	1422	166	1256	0	25	56.9	2	23		1720	0	0	1422	1.42	1.42
85 TWASHUKA	1893	200	1693	0	25	75.7	3	22		1646	47	13	1880	1.89	1.88
86 TWATASHA	3002	360	2642	0	20	150.1	4	16		1197	1445	483	2519	3.75	3.15
88 VERA CHILUBA	2427	240	2187	0	25	97.1	3	22		1646	541	277	2150	2.43	2.15
89 WOODLANDS (B)	1097	118	979	0	13	84.4	2	11		823	156	128	969	2.11	1.86
90 NYUMBA YANGA	1065	160	905	0	29	36.7	2	27		2020	0	0	1065	0.92	0.92
91 BAULENI	1384	170	1214	0	15	92.3	2	13		972	242	0	1384	2.31	2.31
Ground Total	140,886	15,681	116,098	9,107	1,654	85.2	173	1,283	198	100,090	28,524		117,199	2.26	2.02

4) Study of details of requested school facilities

Special classrooms agreed upon with the Zambia side are: one home economics room and one library, and school facilities other than classrooms including administration block, lavatory and guardhouse.

① Home economics rooms

Home economics room is a classroom for practical training of home economics as well as acquiring the basic competence required to be productive members of society, which is the main purpose of the revised curriculum.

In Standards and Evaluation Guidelines MOE, 1997 (hereinafter the Guidelines), home economics rooms are specified as special classrooms needed at new schools. In the Syllabus as well, 2 to 6 periods are set per week in Grades 1-9, and if there are 41 classes in all grades, home economics are taught in 41 periods per week. There are home economics rooms at 69%*[1] (61 out of 89*[2] schools, hereinafter expressed as 61/89) of all of the basic schools in the Lusaka District. The average number of home economic rooms per school is 1.52. The survey of neighboring schools showed that a specialist home economics instructor was on the faculty at 59% (26/41) of all basic schools. In home economics classes, male pupils take lessons together with female pupils, 20 in total number.

From the above, it can be determined that there is a need for home economics rooms, that they have a record of achievements, and that there is an organization for home economics instructions. However, although two home economics rooms were requested, since even at existing schools both the sewing and the cooking classes are conducted in the same room, only one room will be provided.

*1 Breakdown: Full basic schools: 78% (35/45) Middle basic schools: 60% (26/44)

*2 Out of the all basic schools of 91, the 89 schools not including 2 SEN schools are the subject for study.

② Industrial arts rooms

Industrial arts room is a classroom for training of woodwork and metalwork. As is the case with home economics room, the room is for acquiring the basic competence required to be productive members of society based on the main purpose of the revised curriculum.

In the Guidelines, industrial arts rooms are specified as special classrooms needed at new schools. In the Syllabus as well, 2 to 6 periods are set per week in Grades 1-9, and if there are 41 classes in all grades, industrial arts are taught in 34 periods per week. The survey of neighboring schools found that there were industrial arts rooms at 6% (3/49) of all of the basic schools, and that a specialist industrial arts instructor was on the faculty at 6% (1/18) of all full basic schools and none at all in the middle basic schools. However, in the interviews with the officials of the Ministry of Education, it was learned that there are

40 industrial arts instructors in the Lusaka District, and that teacher training colleges produce 55 teachers each year.

From the above, it can be determined that, while there is a need for industrial arts rooms, in general it would be difficult to conclude that practical instruction is taking place in these rooms. Accordingly, it was decided to not provide dedicated classrooms but instead, to install two regular classrooms, with a storage room that can also be used as industrial arts rooms in the future.

③ Environmental science room

Environmental science room is a classroom for teaching science by handling water, flames, chemicals, and others.

In the Guidelines, environmental science rooms are specified as special classrooms needed at new schools. In the Syllabus as well, 2 to 6 periods are set per week in Grades 1-9, and if there are 41 classes in all grades, environmental science will be taught in 26 periods per week. There are environmental science rooms at 2% (2/89) of all of the basic schools in the Lusaka District. Each school has one such room. The survey of neighboring schools showed that a specialist environmental science instructor was on the faculty at 66%* (27/41) of all basic schools. According to the budget (2001) for the Ministry of Education, 2000 "science kits" were distributed. (If these were distributed equally among the nation's 4,379 schools, this would amount to one set for about every two schools.)

From the above, it can be determined that there is a need for environmental science rooms, although there are few in neighboring schools, and the aforementioned "science kits" do not require a dedicated environmental science room; accordingly, dedicated rooms will not be provided. However, as in the case of industrial arts rooms, one classroom will be provided with water supply facility and storage room for use as an environmental science room in the future.

* Breakdown: Full basic schools: 83% (15/18) Middle basic schools: 52% (12/23)

④ Libraries

In the Lusaka District, some libraries are larger than regular classrooms and have sufficient space for pupils to read books there. However, most of libraries have limited space for teachers to store and lend books for a set period of time.

In the Guidelines, libraries are specified as crucial for education. There are libraries or book depositories at 22%* (20/89) of all of the basic schools in the Lusaka District. Each school has one such room. According to the budget (2001) for the Ministry of Education, 250,000 books for libraries were to be distributed. (If these were distributed equally among the nation's 4,379 schools, this would amount to 57 books per school.) From the above, it can be determined that there is a need for libraries, and that they have a record of

achievements. However, considering the current number of books, the space to keep and lend books will be provided.

* Breakdown: Full basic schools: 31% (14/45) Middle basic schools: 14% (6/44)

⑤ SEN (Special Education Needs) rooms

Special Education Needs room is a room for the physically handicapped. In the Lusaka District, there are two middle basic schools for the physically handicapped. The Ministry of Education guidelines give a commentary to the effect that attention should be paid to the physically challenged in school facilities but no description of providing a SEN room. However, in the Project Proposal, the Ministry of Education states its decision to integrate SEN children in the mainstream, and each school should have a SEN classroom. Nevertheless, the Lusaka District has adopted a policy of teaching physically handicapped children in the same classroom as able-bodied children, so there is no need to provide SEN rooms.

However, there is a need to provide slopes for wheelchair access to classroom buildings and other facilities, and booths in the lavatories for handicapped pupils, so they will be reflected in facility planning.

⑥ Administration block

Because the school facilities targeted this project are large in scale accommodating 41 classes, administration rooms, such as offices for head teacher, deputy head teacher, and secretary, and storage and meeting rooms, are necessary for the administration of the schools. At existing basic schools in the Lusaka District, separate administration blocks are installed in some schools and offices between classrooms (hereinafter offices) are used as administration blocks in others. Under the BESSIP standards, offices (two offices in three-classroom blocks and one office in two-classroom blocks) are laid out. These offices are provided for use as administration blocks (head teacher's office) for small-scale basic schools and designed for use as administration blocks even after expansion of the schools. For the large-scale schools targeted in this project, it is undesirable to lay out many small-scale offices, because construction costs will increase and office work will become inefficient after the opening of the schools.

The following is an overview of the results of a survey of facilities at basic schools in the Lusaka District. At the survey stage, no distinction was made between offices and separate administration blocks; the results noted below are the results of a survey for offices (including separate administration blocks). There are offices at 98%* (87/89) of all of the basic schools in the Lusaka District. The average number of offices is 3.81 per school. The survey of neighboring schools showed that the area of offices was at the maximum, 254.6 m^2 and minimum, 10.2 m^2. Offices having small floor areas are laid out

between classrooms. In the site survey as well, it was found that many head teachers were using the offices. At the large-scale schools, such as the schools constructed in the previous project (8 schools: 21 or 23 classrooms), and basic schools under the ZERP (8 schools: 25 classrooms), separate administration blocks were provided. At the schools constructed in the previous project, teachers use the lavatory in the administration block rather than lavatories in the lavatory block.

As shown above, because the schools are large in scale, there is a large amount of clerical work, so an administration block was judged to be necessary. Also from the viewpoint of separating the Grades 1-7 teachers and the Grades 8-9 teachers, one office will be provided and this will be used as the teacher's room for Grades 8-9 teachers. In addition, one strong room for storing examination papers as set by the BESSIP standards and two teachers' toilets (one for male and other for female) will be provided in the administration block.

* Breakdown: Full basic schools: 100% (45/45) Middle basic schools: 98% (42/44)

- Assessment of the number of teachers in order to set the size of teacher's rooms

  According to the Guidelines that were based on plural session routine, if there are 41 classes in all grades, the number of teachers will be 34*. The faculty includes specialist instructors (physical education, home economics, environmental science, etc.) who do not have their own classrooms. Considering plural session routine, the 34 teachers noted above would not all be working at the same time. Accordingly, the number of teachers for use in setting the area of the teacher's room was assessed as follows.

* Grades 1-4: 10 teachers (0.5/class) Grades 5-7: 15 teachers (1.0/class) Grades 8-9: 9 teachers (1.5/class)

i. For Grades 1-7: under plural session routine, out of 25 teachers, 13-19 would be working at the same time, and one specialist instructor (physical education, home economics, etc.) would be added.

ii. For Grades 8 and 9: in the survey of neighboring schools, out of 8 teachers, the maximum was 6 teachers and the average was just under 4 teachers; there were up to 5 teachers (5/8 = 0.625) on the faculty at 97% of all school hours, so the number of teachers was estimated at 60%.

Grades 1-7: 19 + 1 = 20 teachers

Grades 8 & 9: 9 x 0.6 = 5.4 → 6 teachers

Total 20 + 6 = 26 teachers (26/34 = 0.76)

⑦ Guardhouse

Considering the effectiveness of guardhouse in preventing vandalism and the fact that almost all schools employ a security guard, a guardhouse will be provided.

ⓐ Study of lavatories

The number of water closets and wash hand basins requested is shown in Table 2.9, along with the number of water closets needed according to Zambian and Japanese guidelines, the current situation at existing schools, the criteria of the Guideline, etc. In the Project Proposal, the construction of both water borne toilets and pit latrines was requested because there were many power outages in Zambia and water supply is not possible during a power outage. The required number of water closets is estimated from the sum of the number of water borne toilets and pit latrines.

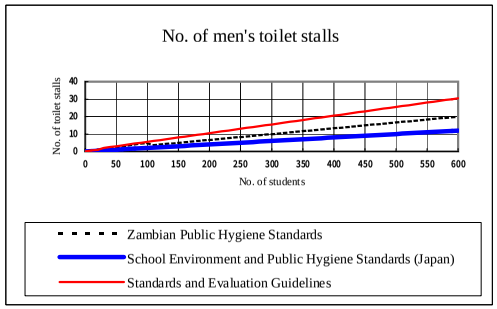
According to “Zambian public hygiene standards,” the number of male's water closets needed for use by pupils is 15.3. However, water use is expected to increase due to the pupils' use of water closet for urination. Accordingly, “Japan's school environment and public health standard” of 9.2 water closets was used as a reference to set the number of male's water closets for pupil use to 10 (6 water borne toilets and 4 pit latrines).

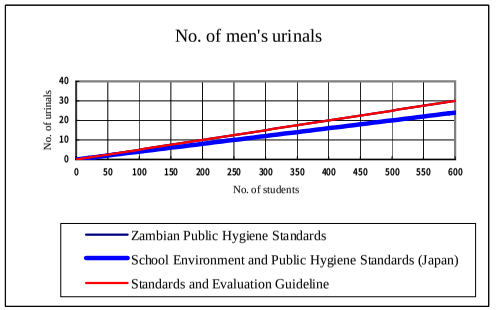
According to “Zambian public hygiene standards,” the number of female's water closets needed is 18.4, so this will be set at 18 (14 water borne toilets and 4 pit latrines). Stool type water closets, one each for male and female, and for use by the physically handicapped will be added.

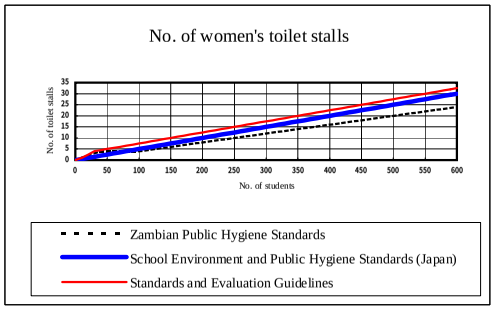
In addition, a (lockable) grill door will be provided between water borne toilet and pit latrine so that the water borne toilet will not be mistakenly used during power outages. A caretaker or a pupil, under the direction of a teacher (or head teacher), will be in charge of the key.

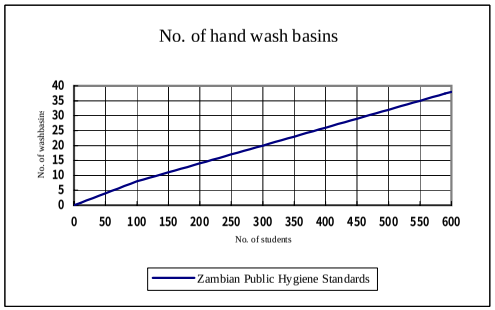
Table 2.9 Lavatory Plan

			Boys		Male teachers	Girls	Female teachers	Male/female
			Toilets	Urinals	Toilets	Toilets	Toilets	Water borne toilets
No. requested			13 (8 water borne toilets + 5 pit latrines)	16 (water borne toilets)	3 (2 water borne toilets + 1 pit latrine)	17 (12 water borne toilets + 5 pit latrines)	3 (2 water borne toilets + 1 pit latrine)	8 x 2 (men/women 1 each)
Anticipated no. of classrooms			23	23	23	23	23	23
Anticipated no. of pupils		No. of pupils using at the same time	23 × 40 ÷ 2 = 460	460	1640 ÷ 40.3 × 0.31 = 13	460	1640 ÷ 40.3 × 0.69 = 28	26×40 = 920
		Total no. of pupils	1640 ÷ 2 = 820	820		820		1640
Current situation at existing schools (91)	Average no. for no. of classrooms	Full basic	0.61 (0.61 × 23 = 14.0)	—	0.11 (0.11 × 23 = 2.5)	0.76 (0.76 × 23 = 17.5)	0.12 (0.12 × 23 = 2.8)	—
		Middle basic	0.65 (0.65 × 23 = 15.0)	—	0.12 (0.12 × 23 = 2.8)	0.70 (0.70 × 23 = 16.1)	0.13 (0.13 × 23 = 3.0)	—
		Total at basic schools	0.63 (0.63 × 23 = 14.5)	—	0.12 (0.12 × 23 = 2.8)	0.73 (0.73 × 23 = 16.8)	0.13 (0.13 × 23 = 3.0)	—
	Average no. of pupils/teachers per toilet/urinal	Full basic	70 (820 ÷ 70 = 11.7)	—	8 (13 ÷ 8 = 1.6)	59 (820 ÷ 59 = 13.9)	16 (28 ÷ 16 = 1.8)	—
		Middle basic	60 (820 ÷ 60 = 13.7)	—	6 (13 ÷ 6 = 2.1)	55 (820 ÷ 55 = 14.9)	14 (28 ÷ 14 = 2.0)	—
		Total at basic schools	66 (820 ÷ 66 = 12.4)	—	5 (13 ÷ 5 = 2.5)	58 (820 ÷ 58 = 14.1)	15 (28 ÷ 15 = 1.9)	—
Standards and Evaluation Guidelines		Water borne toilets	1 water closet/20 persons (23) 2 water closets/30 persons	1 urinal/20 persons (23)	—	1 water closet/20 persons (23) 4 water closets/30 persons 5 water closets/50 persons 6 water closets/70 persons	— ( )	8 for first 100 persons (57.2); 3 for next 50 persons
		Pit latrines	1 water closet/classroom (23)		1 water closet (1)	1 water closet/classroom (23)	1 water closet (1)	
School Environment and Public Hygiene Standards (Japan)			1 water closet/50 persons (9.2)	1 urinal/25 persons (18.4)	—	1 water closet/20 persons (23)	—	—
Public Environmental Hygiene Standard of Zambia			1 water closet/30 persons (15.3) (100 persons or more)	1 urinal/20 persons (23.0)	—	1 water closet/25 persons (18.4) (100 persons or more)	—	8 for first 100 persons (57.2); 3 for next 50 persons
No. provided in previous project 21 classrooms			1 water closet/32.3 persons (14.2) (21 x 40/2)/13 water closets = 32.3	1 urinal/26.2 persons (17.6) (21 x 40/2)/16 urinals = 26.2		1 water closet/24.7 persons (18.6) (21 x 40/2)/17 water closets = 24.7		52.5 persons per toilet (17.5) (21 x 40)/16 toilets = 52.5
No. planned for installation Distribution of water borne toilets and pit latrines to be determined from results of borehole drilling plan			10 (6 water borne toilets + 4 pit latrines)	18 water borne toilets	1 (water borne toilets) one water borne toilet for administration block	18 (14 water borne toilets + 4 pit latrines)	1 (water borne toilets) one water borne toilet for administration block	18









5) Study of furniture

① Regular classrooms

Pupil's desk and chair is of two-seater type under the MOE's standards. The required quantity is 20 sets (for 40 pupils). Closets are needed to store textbooks and teaching materials and will be built into classrooms to prevent vandalism.

② Home economics rooms

Pupil tables and chairs will be provided for cooking and other home economics practical training.

③ Library

Librarian desk and chair will be provided for the teacher in charge of lending books. Bookshelves will be of steel type available at a low price and anchored to the building frame to prevent vandalism.

④ Administration block

Desks and chairs for the head teacher, deputy head teacher, and secretary, and tables and chairs that can also be used for meetings for teachers will be provided. Lockers and cabinets for the head teacher and deputy head teacher will be provided for school administration purposes.

6) Study of equipment

① Regular classrooms

Although the current use conditions of teaching equipment in the existing schools, such as set square, are not satisfactory, but the equipment is obviously necessary for the curriculum, and the teaching equipment indicated in the Project Proposal (Table 2.10) was judged to be the minimum equipment necessary. The equipment will be of durable and readily available local item. (The quantity in the table indicates the number per classroom shown in the Project Proposal.)

Table 2.10 Teaching Equipment for Regular Classrooms in the Project Proposal

Name	Qty.	Specifications	Noted in Project Proposal	Degree of Priority	Separate Classroom (yes/no)	Durable Item	Supervision Guidelines	Status at Existing Schools	To Be Provided	Notes
Set square	1	Plastic	○	◎		○	○	△	○	
Square	1	Plastic	○	◎		○	○	△	○	
Straightedge	1	Plastic (1m)	○	◎	○	○	○	△	○	
Compass	1	Plastic	○	◎		○	○	△	○	
Protractor	1	Plastic	○	◎		○	○	△	○	

② Home economics rooms

The minimum requirement of equipment for home economic room is that the equipment is useful according to Syllabus, and can be used effectively. At existing schools the equipment is used effectively, but the quantities are not sufficient. Of the items in the table, those that meet the Syllabus but can be provided by the PTA, and those for which it is judged that pupils can bring them from home, will be removed from the target items to be provided. The equipment to be provided in this project will be durables and imported items or can readily be procured locally. (The quantity in the table indicates the number per classroom shown in the Project Proposal.)

Table 2.11 Home Economics Equipment List

Name	Qty.	Specifications	Noted in Project Proposal	Degree of Priority	Separate Classroom (yes/no)	Durable Item	Supervision Guidelines	Status at Existing Schools	To Be Provided	Notes
Stove	5	With oven	○	◎		○	○	○	○	Needed for cooking practices
Refrigerator	2		○	◎		○	○	△	○	Needed to store food
Pressure range	2		—	◎		○	○	×	×	None at neighboring schools
Iron	5		—	◎		○	○	△	○	
Ironing board	5		—	◎		○	○	△	×	Can be provided by PTA
Electric water heater	3		—	◎	○	○	○	△	×	Can be provided by PTA
Teakettle (large)	5		—	◎		○	○	△	×	Can be provided by PTA
Set of pots (6)	6		—	◎		○	○	△	×	Can be provided by PTA
Sewing machine	4		○	◎		○	○	△	○	
Set of dishes	1		—	◎		×	○	△	×	Can be provided by PTA

③ Determination of project scale

After the aforementioned target site selection and study and analysis of site survey results, all 12 sites were selected as target sites for this project.

Table 2.12 shows the project scale for the target schools.

Table 2.12 Project Scale

Project scale		Unit	Site												Total
			Mutendere	Chunga	Kabanana	Northmead	Ng'ombe	Libala Stage III	Chilenje South	Chelstone	Chazanga	Chawama/ John Howard	Marapodi/ Mandevu	Jack	
Classroom blocks	Regular classroom	Room	23	23	23	23	23	23	23	23	23	23	23	23	276
	Home economics room	Room	1	1	1	1	1	1	1	1	1	1	1	1	12
	Office	Room	1	1	1	1	1	1	1	1	1	1	1	1	12
	Library	Room	1	1	1	1	1	1	1	1	1	1	1	1	12
	Administration block	Block	1	1	1	1	1	1	1	1	1	1	1	1	12
	Male's lavatory	Water closet	11	11	11	11	11	11	11	11	11	11	11	11	132
	Female's lavatory	Water closet	19	19	19	19	19	19	19	19	19	19	19	19	228
	Guardhouse	Block	1	1	1	1	1	1	1	1	1	1	1	1	12
Furniture	Furniture for regular classroom	set	23	23	23	23	23	23	23	23	23	23	23	23	276
	Furniture for home economics room	set	1	1	1	1	1	1	1	1	1	1	1	1	12
	Furniture for office	set	1	1	1	1	1	1	1	1	1	1	1	1	12
	Furniture for library	set	1	1	1	1	1	1	1	1	1	1	1	1	12
	Furniture for administration block	set	1	1	1	1	1	1	1	1	1	1	1	1	12
Teaching equipment	Teaching equipment for regular classroom	set	23	23	23	23	23	23	23	23	23	23	23	23	276
	Teaching equipment for home economics room	set	1	1	1	1	1	1	1	1	1	1	1	1	12

2-2-1-2 Design Policy

Regarding the planning of the projected facilities and equipment, the following basic design policies should be kept in mind, taking into consideration the natural and social conditions of Zambia, the features of the project and so on.

(1) Policies with regard to natural climatic conditions

1) Policies with regard to climatic conditions

Heat insulation: In Lusaka District, the projected region for this project, the average high and low temperatures for the past five years were 32°C (in October) and 11°C (in June and July), respectively, so the climate is relatively mild. In general, classroom blocks do not have ceilings, so the roof will be covered with corrugated cement sheet for heat insulation.

Rain: The rainy season in Lusaka District is from November through March. Although total annual rainfall is comparatively low at 880 mm (the average for the past five years), the maximum monthly rainfall is 330 mm and is concentrated in January and February. As a large amount of rain falls in a short period of time, open ditches will be provided around the outer fence of the school, and spoon ditches will also be provided around the buildings. Where there are slopes, retarding pond will be provided on the downstream side.

Sand: At some of the existing schools, the windows are not glass but screen block (perforated block). However, there were complaints that sand was being blown into the classroom during strong winds. Considering the objective of letting in natural lighting as well, glass windows will be used.

2) Policies with regard to external forces

Earthquakes: Interviews with Ministry of Education and Ministry of Communication and Transport officials revealed that there is no record of earthquakes occurring in the past, and so external force due to earthquake will not be considered in the structural design.

Wind: The maximum average monthly wind velocity in Lusaka District provided by the Ministry of Communication and Transport was 3.9 m/sec (in October), which is not of sufficient force to affect buildings of block masonry. However, a detail design will be conducted for roof and roof supporting membranes.

3) Others

Natural lighting: Lights will be provided taking into consideration plural session routine. Windows will be made large (to the extent that this will not impair crime prevention) to enable use of natural lighting as much as the design will allow.

Ants: There are enormous anthills in various parts of Lusaka District. These anthills cause the foundations to be lifted up, and the ants may eat away wooden members, so following the BESSIP standards, the measures shown below will be taken to prevent ant damage.

- The ground floor level will be GL + 400 and an ant block will be provided.
- The foundation will be coated with ant repellent paint and the ground under the floor will be treated with pesticide.
- Roof supporting trusses will be made of steel.

(2) Policies with regard to socioeconomic conditions

1) Vandalism prevention

All of the existing schools are taking measures, such as employing security guards, to prevent vandalism. Based on this fact, the following specifications will be considered for facility design.

① All windows and doors facing the outside will be provided with burglar-bars. Particularly, narrow windows will be provided in exterior walls to prevent invasion.

② Doors of classrooms will be equipped with the hinges on the room interior side, because there have been cases of theft in which the entire door and hinge were removed.

③ The strong rooms for storing examination papers will be integrated into the administration block, with a concrete ceiling slab as well.

④ A guardhouse and security lighting will be provided at all sites.

⑤ The height of the wall will be at least 2.4 m. (Scope of work of Zambia side.)

2) Structural system of buildings

Because earthquakes do not occur in the country, concrete block masonry construction is a widespread structural system. This system, influenced by the former suzerain state Great Britain, is familiar to local contractors and will be adopted for this project adding some structural studies.

(3) Policies with regard to the results of the trial construction

Described below are the policies with regard to design and construction based on the results of the trial construction that was carried out with the objective of making effective use of local contractors and creating a cost-cutting policy.

1) Objective of the trial construction

For Japanese grants aid projects, a certain level of quality is required when local contractors are used to reduce costs. In order to evaluate the technological level of local contractors, the availability of construction equipment and materials at the project sites, and the level of necessity for involvement of consultants and a Japanese contractor, as well as check for safety and reliability, the trial construction was carried out.

Based on the results of the trial construction, policies were developed regarding the following points.

① Review of the previous project

② Policies with regard to design based on the trial construction

③ Policies with regard to construction based on the trial construction

2) Review of the previous project

The specifications adopted for the trial construction were decided based on the results of a comparison of the performances and costs between the previous and this projects, with the specifications of the BESSIP standards and those for grass-root grant aid projects placed as a starting point of design.

① Main structural system

The reinforced concrete block construction adopted in the previous project is a method not commonly used in Zambia, where earthquakes do not occur or strong wind blow. From the viewpoint of effective use of local contractors, the concrete block masonry construction in accordance with the BESSIP standards was adopted for the trial construction. In addition, instead of the footing girders adopted in the previous project, the spread foundation in accordance with the BESSIP standards, which serves also as footing girders, was adopted for the trial construction.

② Specifications of structure

Concrete blocks used in the previous project and in accordance with the BESSIP standards are 200 mm in thickness. In order to check the execution capability of local contractors, 150 mm thick concrete blocks were used for the trial construction.

③ Finishes

To check the execution capability of local contractors as well as reduce construction costs, the mortar finish on the interior side, which was adopted in the previous project, grass-root grant aid projects, and the BESSIP standards, was changed to concrete block face masonry.

3) Policies with regard to design based on the trial construction

In the trial construction carried out in this project, the structural form was made concrete block masonry construction in accordance with BESSIP standards. The local contractors were comparable to Japanese contractor with regard to the degree of finishing, if disregarding the details. To ensure that local contractors will be effective used, an active effort will be made to use specifications tailored to the site. In addition, some specifications departed from the BESSIP standards in order to ensure the strength of the structure (strength of concrete blocks), reduce costs (use of concrete block face masonry) and ensure plane rigidity (use of circumferential girders on walls). However, since the local contractors were ultimately not capable of performing the work, it was decided to adopt the following local standard specifications.

① Strength of concrete blocks: The strength designation was Class B, which is generally used in Japan. However, the strength of the blocks produced locally is far below this level. Nevertheless, there is no need for this strength in Zambia with its different design conditions, so a design in keeping with the strength of the concrete blocks generally produced in Zambia will be used.

② Concrete block face masonry: The concrete blocks produced locally have corners missing, surfaces that are not parallel, or other defects, so they are not suitable for face masonry. Accordingly, mortar finish will be adopted.

③ Circumferential girders: The bar arrangement for the circumferential girders provided on the walls to ensure plane rigidity, interferes with the reinforcing bar truss and is of a complex shape. In compliance with BESSIP standards, circumferential girders on windows will be provided to ensure plane rigidity.

4) Policies with regard to construction based on the trial construction

① Execution capability of local contractors by work type

Construction methods familiar to local contractors were adopted for the trial construction. Comparing with a Japanese contractor by work type, there was no large difference in execution capability of local contractors.

② Schedule control

Only the Japanese contractor could observe the contracted execution period. One local contractor was 26 days behind the scheduled period of 5 months (153 days) and the other was 76 days behind. The causes of the delay were: delay in ordering construction materials due to shortage of funds, repetitive work on site due to insufficient advance construction planning, and arrears in the construction steps. The above-mentioned delay was caused even though the consultant had frequently prompted the local contractors to

make arrangements for the subsequent steps during construction. Judging from the results of it, the local contractors do not seem capable of controlling construction schedule.

③ Construction management

Because the local contractors do not have the custom of preparing shop drawings, construction work was not carried out according to the plan and corrections on site became necessary. Particularly for complexly shaped steel reinforcement connections, they did not study in advance of the site work and much time was taken to make adjustments on site. One local contractor prepared shop drawings for concrete blocks but the drawings were not effectively used during the site work. Some local contractors did not have tools to draw shop drawings. The delay in the trial construction was caused by failures to procure construction materials according to the scheduled procurement plan, carry out appropriate acceptance inspections, and maintaining equipment with care.

④ Safety control

Even field engineers have no awareness of safety control. To give an actual example, field engineers did not wear hard hats, some field workers were barefoot, scaffolding braces were insufficient in quantity and toe boards were loosely secured. Safety control system was judged to be almost nil.

⑤ Quality control

Material suppliers, end users and certification organizations in Zambia are not sufficiently aware of quality control. The fact that requirements for quality of buildings are limited because of good soil conditions and favorable natural conditions such as no earthquakes or strong winds, these are considered part of the reason for this. For instance, a local contractor awaited instructions from the supervisor about concrete, the strength of which had been developed insufficiently, and he could not propose any remedial measures.

⑥ Important control items of Japanese engineers

Judging from the results of the trial construction, it will be necessary to have Japanese engineers involved in the control of the items above, planned procurement of construction materials, safety training, etc., if the local contractors are to be used effectively.

(4) Policies with regard to construction and procurement status

In Zambia, applications are generally filed for building permit and compliance with the Fire Services Act. However these procedures are not applied to grant aid projects. For design and construction of buildings, basically British Standards and Zambian Standards (which follows BS) are adopted.

Contractors have been fostered since the period when it was a colony of Great Britain, and some contractors are highly competent. Most of the major contractors are owned by non-Zambians and have high degree of technological and mechanization levels. There are many medium and small contractors that are capable of carrying out construction work of small-scale schools, such as those contracted for the trial construction. However, they are judged to be incapable of carrying out this large-scale project with accuracy and within the preset construction time period by themselves.

With regard to the local market for labor, it is easy to employ common labor around the project sites but difficult to hire the required number of skilled labor because they are scarce. Of construction materials, cement, concrete block and corrugated roof cement sheet are produced in Zambia. It is possible to import other construction materials from the Republic of South Africa. Although corrugated cement sheet for roofs is produced locally, this is an asbestos product, so a non-asbestos product will be imported.

In general, the procurement of these materials and supplies will be done locally, but the possibility of purchasing in Japan or in a third country will be studied to reduce construction costs.

(5) Policy regarding the use of local contractors

The Zambian Construction Contractors Association has 208 members. These contractors are classified into six ranks by the scale of facilities owned, number of engineers, capitals, equipment owned and so on. Of these 208 contractors, 147 have an office in Lusaka District, but only 16 of them are top ranking contractors (must have at least four engineers, at least one estimation engineer, at least six technicians, and at least 20 skilled workers). ("Short list" prepared by MOE for trial construction listed these contractors, and two from the list were selected and participated in the trial construction.) In addition, in recent years, there are many contractors that have acquired experience in local basic school construction of World Bank and African Development Bank aid.

(6) Policy with regard to the operational/maintenance capacity of implementing institutions

In the survey of neighboring schools, the funds currently provided to each school by MOE are limited to about 10% of total expenditures, and electricity charges and water fees to maintenance costs must be made up with PTA dues. Moreover, more than 80% of schools are dependent on the PTA to bear the cost of repairs for classrooms and other facilities. In addition, at around 20% of schools, the PTA itself actually makes repairs. A maintenance manual for the community at large has been prepared for facility maintenance and repairs. By adopting the method of construction written in the manual, the facility will be easily maintained by PTA in terms of both financial and technical ability

(7) Policy regarding the establishment of grades for facility, equipment, etc.

The Ministry of Education has standards (BESSIP) for classroom blocks. The structural design, finishing, and other specifications have been established with consideration given to the performance

capabilities, quality, precision, etc., of contractors in Zambia. The results of the trial construction carried out in accordance with these standards indicate that the execution capability of the local contractors by work type was satisfactory, and these standards will be followed in order to use local contractors effectively. Moreover, as mentioned above, since the specifications in the maintenance manual are based on the standards, the specifications of the facility will conform to the standard, for maintenance purpose. The requirements for the quality of construction materials (concrete, steel reinforcement, concrete blocks, and others) will be moderately set after detailed studies so that local products can meet the quality requirements.

As for pupil's desk and chair, there is a standard (BESSIP) which has improved the points of ease of use and increase in strength. The standards were adopted for the trial construction and they proved strong, so the specifications of detail design will be based on this standard.

(8) Policy regarding techniques, procurement methods, work periods, etc.

For the purpose of actively using local contractors as subcontractors and reducing the involvement of Japanese contractor, local design specifications and techniques will be actively used. However, the details of local techniques will be modified to eliminate repetition and waste as well as to increase structural safety.

With regard to the procurement of construction materials and equipment, considering repairs and maintenance in the future, in principle, local procurement including imported products will be used. Because the results of the trial construction raised questions about the local contractors' capability of systematically procuring construction materials and equipment, scheduled bulk purchase by Japanese contractor will be desirable. Particularly for concrete blocks, pupils' desks and chairs that need to be purchased in large quantities at a time, it will be necessary to draw up a procurement plan by considering available local production capacity.

With regard to work periods, thorough consideration must be given to the local contractors' capability of controlling schedule in the trial construction and factors that affect the completion of Japanese grant aid within the implementation period, and it is essential to prepare detailed plans for the execution of the work.

2-2-2 Basic Plans

2-2-2-1 Facility Layout Plan

Taking into consideration the area and shape of the site and the undulation of land, and the following items, a layout plan that is appropriate for the characteristics of the site will be made.

(1) To prevent the morning and evening sun from shining in, in principle, the gable end of classroom buildings will be placed along the east-west axis.

(2) In the case of sloping ground, level differences within the building will be avoided. The slope of the ground and the long side of the building will be placed in a straight line in order to minimize the ground leveling work (whose costs will be borne by the Zambia side).

(3) Pit latrines and waste water treatment area will be separated from the borehole by at least 50 meters to prevent foul water from flowing into the borehole. (There is no definite guideline for the extent of influence by the inflow of foul water because it depends on soil characteristics. The abovementioned requirement is based on the Ministry of Education standards, and will be adopted for the project because it does not present any problem with the layout of buildings.)

(4) To minimize the amount of fence work, whose costs will be borne by the Zambia side, the wall of the classroom block will be on the same line as the fence as much as the layout will allow.

(5) Layout planning will take future expansion into consideration.

(6) To prevent theft, the special classroom block which houses a considerable number of equipment and materials will be positioned near the administration block.

(7) In the case of sloping ground, an elevated water tanks will be located at the higher part of the site, to reduce the height of the supporting structure.

(8) The entrances to the lavatory block will avoid having male and female enter from the same direction, and the pit latrines will be placed back-to-back to make it easy to collect night soil.

2-2-2-2 Building Plan

(1) Floor planning

1) Regular classrooms

① Setting the facility scale

In the BESSIP Standard, the floor plan for classrooms is 7.8 m x 7.0 m = 54.6 m^2 (as measured from the center of wall). In the previous project, the floor plan was 6.7 m x 8.6 m = 57.62 m^2, but the Ministry of Education officials explained that the BESSIP standard represented the result of improvements to conventional classrooms, so BESSIP floor plan will be adopted. The standard number of pupils per classroom is 40, so the area for each pupil is 1.365 m^2, which is judged to be a suitable size.

An outdoor corridor measuring 1.5 m in width will be provided on the side of the classroom where the entrance is located. At the end of this corridor, a slope with an inside width of 1.2 m will be provided to enable wheelchair access, and also as a place where pupils can wait for classes to begin when it rains.

In addition, for two of the regular classroom blocks, a space of 4.0 m x 7.0 m = 28.0 m^2 (as measured from the center of wall) will be provided between classrooms for use as a teacher's office and a library. This is larger than the offices stated in the BESSIP standard (3.6 m x 5.55 m = 19.98 m^2 as measured from the center of wall), but assuming that there

will be 6 teachers for Grades 8 and 9 using these offices at the same time, the area per teacher will be 4.67 m^2, which is a suitable size.

② Closets (regular classrooms)

Closets are indispensable for storing textbooks and teaching materials. To prevent theft, they will be built into the classroom and included in the building work. The doors will be made of steel with two padlocks, while the ceiling panels will be of reinforced concrete and the walls will be of concrete block construction. The size of closets will be 700 x 1200 x 2000, and wooden shelves will be installed inside.

2) Home economics rooms

MOE does not have a standard plan on home economics rooms, therefore, the rooms are planned to have the same standard size as regular classrooms: 7.8 m×7.0 m = 54.6 m^2. The standard number of pupils per room will be 20, and therefore the floor area per pupil will be 2.73 m^2, which is judged to be reasonable the work area. Further, the following space will be provided for storage of educational equipment: 2.0 m×3.5 m = 7.0 m^2.

In one of the classroom blocks, a similar storage space will be provided as a special-purpose classroom block (a four-classroom building), containing a home economics room, so that the other three classrooms can be used as environmental science and industrial arts rooms. In one of the three classrooms, plumbing fixtures (3 faucets) will be provided for use as an environment science room in the future.

3) Classroom block type and length

① Setting the block type

Basically, the 4-classroom blocks will be adopted due to economical considerations. Four-classroom blocks that have office or library between classrooms, and blocks that also have home economics room will be provided. Out of consideration for natural lighting and crime prevention, the windows on the walls facing the outside (the opposite side of corridor) will be narrow, while the walls on the inside will have wide windows. For this reason, there will be six types of classroom block as shown below.

1. 4-classroom block (narrow windows + wide windows)
2. 4-classroom block (wide windows + wide windows)
3. 4-classroom block (with office or library; narrow windows + wide windows)
4. 4-classroom block (with office or library; wide windows + wide windows)
5. 3-classroom block with home economics room (narrow windows + wide windows)
6. 3-classroom block with home economics room (wide windows + wide windows)

② Setting the block length

The upper limit for block length is normally 30 meters (for a 3-classroom block), due to temperature variations and unequal settling, and to avoid the effect of the sloping site. However, in this project the emphasis is on economy, and since temperature variations in Lusaka District are less than in other countries of Africa, and because the ground condition is good and unequal settling is not likely to occur, a 4-classroom block (32 m and 36 m [a building containing office or others]) will be used as the standard block length.

4) Lavatories

Almost all of the basic schools in Lusaka District are equipped with water borne toilets, and boreholes will be provided at sites without access to the city water supply, so essentially, these will also be water borne toilets. However, since power supply is unstable, pit latrines will also be provided for use during a power outage. In the previous project, three lavatory blocks each for male and female were provided (with each lavatory block comprising two water borne toilets and one pit latrine). But, due to economical considerations, the lavatories will be integrated to one block each for male and female (with both water borne toilets and pit latrines). The number of pupil's water closets will be as follows:

Male pupils 10 water closets (6 water borne toilets/4 pit latrines)

Female pupils 18 water closets (14 water borne toilets/4 pit latrines)

As regards teacher's lavatory, male's and female's water closets will be provided in the administration block, and water closets for the physically handicapped (water borne) for male and female in the lavatory block will also be added.

In addition, the pits for the pit latrines will be made of a honeycombed wall of the concrete blocks, which is a standard structural system used in Zambia. However, the sides that adjoin the building foundations will be of reinforced concrete or concrete block construction supported by the lavatory floor slab, in order to avoid unequal ground settling.

5) Administration block

As regards the administration block, there areno Ministry of Education standards . The area measurements (at center of wall) for the offices in the administration block are shown below.

- Head teacher's office 4.5m x 4.5m = 20.25m^2
- Deputy head teacher's office 4.5m x 3.0m = 13.50m^2
- Secretary's office 3.0m x 2.5m = 7.50m^2
- Staff office 7.0m x 9.0m = 63.00m^2
- Strong room 2.5m x 1.5m = 3.75m^2
- Storeroom 3.0m x 2.0m = 6.00m^2

- Lavatory (water borne) 3.0m x 2.5m = 7.50m^2
- Corridor, etc. 3.0m x 2.5m = 46.50m^2
- Entire administration block 16.0m x 10.5m = 168.0m^2

The size of the staff office is based on the assumption that 19 teachers (Grades 1-7) will be present at the same time; this is an area of 3.32 m^2 per person, which is judged to be a suitable size. A slope will be provided at the entrance for wheelchair access.

6) Guardhouse

There are no Ministry of Education standards for guardhouses. The guardhouse is planned as a simple building to provide shelter from wind and rain.

(2) Section plan

As noted in Design Policy, to prevent damage caused by ants, all blocks will have a ground floor level of GL +400 and be provided with ant blocks. Spider trusses (reinforcing bar trusses) will be used as roof supporting members.

1) Classroom blocks

The use of a corrugated cement sheet roof is expected to provide thermal insulation, so ceilings will not be provided. Louvers will be provided above the windows for ventilation when it rains.

2) Administration block

A corrugated cement sheet roof will be used, and ceilings will be provided only for the head teacher's and Deputy head teacher's offices. In this block also, louvers will be provided above the windows for ventilation when it rains.

3) Lavatory block

A corrugated cement sheet roof will be used, and no ceiling will be provided. The apex of the roof will allow ventilation to exhaust malodor, and a ventilation tower will be provided.

4) Guardhouse

A corrugated cement sheet roof will be used, and no ceiling will be provided.

(3) Structural plan

As indicated in the BESSIP Standard, the main structural system will be concrete block masonry, the most common system in Zambia. However, the standard concrete blocks produced locally have no space for inserting reinforcements as do the blocks made in Japan, and reinforcements (welded wire mesh of approximately 4ϕ) are inserted every three block levels. For the roof supporting beam as

well, reinforcing bar truss used in the BESSIP will be used. At some existing schools, wooden trusses are used in school construction, but this is not desirable from the standpoint of preventing ant damage. Furthermore, in Zambia, the structural design is in conformance with the standards of the Great Britain, and the design of this project also conforms to these standards.

With regard to soil condition, from the results of site survey, no site was judged to have soft ground, and the soil bearing capacity was determined to be 100 kN/m^2. Prior to construction, a dynamic penetration test, etc. will be performed to confirm the bearing capacity.

1) Structural form

Foundation:	Reinforced concrete construction/spread foundation
Grade floor:	Reinforced concrete construction
Walls:	Concrete block masonry construction
Circumferential girders:	Reinforced concrete construction
Roof:	Reinforcing bar truss (spider truss) + corrugated cement sheet (non-asbestos)

2) Outline of structure

The foundation will be continuous footing with a rectangular section of reinforced concrete, and the foundation will be worked as foundation beam. Concrete block masonry will be used for the space between the foundation and the floor slab, and concrete will be injected into the cavities in the blocks to ensure compressive strength. The concrete slab will serve as grade concrete slab, and wire mesh reinforcements will be provided to prevent cracking.

The superstructure will be of concrete block masonry, and the circumferential girders above the windows will also be used as beams to ensure plane rigidity; these will be provided on all walls whether they have openings or not.

The reinforcing bar truss that supports the non-asbestos corrugated cement sheet on the roof will cut into and support the concrete blocks of the wall and will be held in place by concrete.

3) Weight

Dead load:

Specific gravity of concrete block:	23.5 kN/m^3
Specific gravity of reinforced concrete:	24.5 kN/m^3
Specific gravity of reinforcements:	78.5 kN/m^3
Specific gravity of non-asbestos corrugated cement sheet:	0.30 kN/m^2
Live load: Classroom floor	2.50 kN/m^2
Wind load: Wind velocity	10 m/sec (2.5 times the monthly maximum wind velocity)

Seismic load: Not considered

4) Materials used and material strength

Concrete: Ordinary concrete will be used; the design standard strength for the foundation, circumferential girders and slabs will be Fc21. Strength will be controlled using cube strength of British standard; for design of members, a80% of cube strength is used as the cylinder strength. For blinding concrete, strength control will not be performed and only the mix will be designated. (1:3:6)

Cement: Ordinary Portland cement will be used.

Sand: Local river sand

Gravel: Locally produced crushed stone

Reinforcements: The quality needed for reinforcements in Zambia, a country where earthquakes do not occur, will be strength only; ductility is not required. Accordingly, a material that ensures the yield strength below is sufficient.

Round bars	JIS G3112	SR 235 or equivalent	Yield strength $fy = 235N/mm^2$
Deformed bars	JIS G3112	SD 345 or equivalent	Yield strength $fy = 345N/mm^2$

Concrete blocks: The concrete blocks, which are the major structural material, should satisfy the necessary strength requirements confirmed through structural calculations, and a suitable safety factor will be secured by taking into consideration the variations in quality of the locally manufactured concrete blocks .

(4) Building materials plan

In this project, an overall judgment will be made regarding the climatic conditions at the site, the capacity for providing materials, maintenance after completion, and so on, and building materials that are made or can be procured at the site will be used, utilizing established method of construction of the site. However, if equipment, etc., can be efficiently and economically procured from a third country, this may be adopted after confirmation of compatibility with the materials that can be procured at the site.

1) Study of roofing materials

The corrugated cement sheet roofing materials that are generally used at the site are asbestos corrugated cement sheet manufactured in Zambia. Non-asbestos corrugated cement sheet is not manufactured in Zambia and must be imported (from South Africa).

2) Study of windows/doors

Steel windows, doors and burglar bars are manufactured at a factory in Lusaka District (the steel is imported from South Africa), and a catalog of standard dimensions has been prepared.

However, the thickness of the door frame (1 mm for standard products), the fastenings and the reinforcement of the location of the fastenings (welding of a flat bar directly to the 1mm frame) give rise to concerns in terms of strength and increases the costs somewhat (1.2 times for a 1.2 mm panel); nevertheless, a material without problems of strength in terms of preventing vandalism will be selected. The catalog of the fitting manufacturer that was researched states that manufacturer's door frames are compatible with ZS357 (of the Zambian Standards Bureau), and the catalog states that the panel thickness is 1.2 mm or greater.

A comparison of materials and techniques is shown in Table 2.13.

Table 2.13 Comparison of Materials & Techniques

Member		This Project	Site Technique	Technique Used for Trial Construction	Reason for Adoption
Major structural materials	Foundation	Reinforced concrete construction/continuous footing + filled concrete blocks	Same as left	Same as left	Standard construction method at site
	Columns	None	Same as left	Same as left	Standard construction method at site
	Circumferential girders	Reinforced concrete construction	Same as left	Same as left	Standard construction method at site
	Walls	Concrete block construction	Same as left	Same as left	Standard construction method at site
	Floor	Reinforced concrete construction	Same as left	Same as left	Standard construction method at site
	Roof	Spider truss	Wooden truss or spider truss	Spider truss	Standard construction method at site/prevention of ant damage
Exterior finish	Floor	Concrete trowel finish	Same as left	Same as left	Standard construction method at site
	Walls	Mortar base/paint finish	Same as left	Same as left	Standard construction method at site
	Windows	Steel window/burglar bar	Same as left	Same as left	Standard construction method at site
	Doors	Wooden door/burglar bar	Same as left	Wooden door + burglar bar/steel door	Standard construction method at site
	Roof	Corrugated cement sheet (Non-asbestos) + surface coat	Corrugated cement sheet (Asbestos)	Corrugated cement sheet (Asbestos)*1	Elimination of cancer-causing substances
Interior finish	Floor	Concrete trowel finish	Mortar finish	Concrete trowel finish or mortar finish	Cost reduction
	Walls	Mortar base/paint finish	Same as left	Concrete block face masonry /paint finish	Standard construction method at site (because of poor quality concrete block)
	(Ceiling)	Plywood/paint finish	Same as left	None	Standard construction method at site

*1 Because the work was done in a short period of time, an asbestos product that could be procured easily was used as an emergency measure.

2-2-2-3 Utilities Plan

Utilities were planned considering the local circumstances and regional characteristics, and with the goal of perpetual use of the facilities, by also considering durability, ease of maintenance, and low maintenance costs.

The utilities plan for the project is shown in Table 2.14.

Table 2.14 Utilities Plan

	Water supply and drainage/sanitation equipment			Electrical equipment	
	Water supply/drainage equipment	Sanitation equipment	Hot water equipment	Lighting equipment	Sockets
1. Regular classrooms	×	×	×	○	○
2. Special classrooms	○	×	×	○	○
3. Administration block	○	○	×	○	○
4. Lavatories (water borne toilet)	○	○	×	○	×
(pit latrine)	×	○	×	○	×
5. Facade	○	×	×	○	×

(1) Water supply and drainage/sanitation equipment

1) Water supply system

Most of the schools (98%) in Lusaka District are provided with a borehole or city water supply system. In terms of hygiene education, a supply of water is needed for lavatories and washbasins. In this project, city water can be supplied from the LWSC in Northmead and Libala Stage III, but there are no water main pipes near the other ten sites. The test boreholes dug during the basic design survey will be converted to production boreholes to provide water. At the project site Kabanana, because the water supply rate from one borehole falls short of the planned rate, water is planned to be supplied from two boreholes. At Mutendere, two boreholes were originally planned to be used but the water supply rate from one of the two boreholes was found to be extremely low, so another borehole with a relatively large water supply capacity will be used. Sterilizer will not be provided for the boreholes because the boreholes are too deep, 30 m or more below the ground, for colon bacilli to grow.

2) Drainage system

① Dirty water drainage

At the schools equipped with water borne toilets in Lusaka District, wastewater is treated in purification tanks unless effluents from LWSC are discharged into sewers. The foul water from the water borne toilets and the household wastewater from the special classrooms and administration block will be treated in a purification tank and then sent to waste water treatment floor for subsurface filtration.

② Rainwater drainage

At schools in Lusaka District, heavy rains in the rainy season drain into the side ditches that are around the buildings and continues flowing into the open ditches that are around the

site. In this project, the rainwater discharged from the facilities and the rainwater within the site will drain into the side ditches around the buildings and continue flowing into the open ditches around the site, from where it will seep into the ground or vaporize naturally.

3) Sanitation system

The toilets in the water borne toilet rooms will use a closed connection- low tank system (in which the rinse tank is connected directly to the toilet) commonly used at schools in Lusaka District. The toilets in the pit latrines will consist only of a hole in the concrete slab. The urinals (water borne type) will be pits with a mortar finish. The hand washbasins will be concrete mortar sinks.

The toilets for the physically handicapped in the lavatory blocks and the toilets in the administration block will be of the stool type toilets.

4) Calculation of water supply quantity

The water supply quantity will be calculated assuming the actual mode of use and based on the following assumptions.

Assumed conditions:

- The number of classes conducted simultaneously at the school is 23 classes and the total number of classes will be 41 classes.
- There are 40 pupils in each class.
- Required daily water volume per pupil (1,640 pupils in total) and that per teacher (34 teachers in total) are 20 liters.
- 30% of male pupils use water borne toilets and the remaining 70% consume water at a rate of 5 liters/day.
- Water will not be supplied to neighboring residents.

Calculation of water supply quantity

- Water use by female pupils 20 L/day x 1640/2 = 16,400 L/day
- Water use by male pupils 20 L/day x 1640/2 x 0.3 + 5 L/day x 1640/2 x 0.7 = 7,790 L/day
- Water use by teachers 20 L/day x 34 = 680 L/day
- Total 24,870 L/day

5) Calculation of capacity of elevated water tank

The capacity of the elevated water tank will be calculated based on the following assumptions.

Assumed conditions:

- The calculation is based on three urinals provided for male pupils.

- The number of toilets is 25 (7 for female pupils, 15 for male pupils and 3 urinals.)
- The water quantity for hand washbasin use is 1 liter. (Society of Heating, Air-Conditioning and Sanitary Engineering of Japan)
- The quantity of water at one time use of a toilet is 9 liters (based on the capacity of the tank planned last time), and that the toilet is used 6 times an hour.
- The number of pupils at the school who simultaneously use the toilet is 40 x 23 classrooms = 920.
- Each pupil washes hands once an hour.

Calculation of the quantity of water use at the maximum time

- Water use when all toilets are used simultaneously 25 toilets x 9 liters/toilet x 6 times = 1,350 liters/hour
- Water quantity use when everyone washes hands simultaneously 920 x 1 L = 920 L
- Total water quantity used at maximum time 1,350 L + 920 L = 2,270 L

Since the pump is not automatically operated, the capacity of the elevated water tank needs to be 4,540 liters (2,270 x 2), double the pump-up capacity of an ordinary pump or the maximum use per hour. Considering the frequent power outages, it will be 5 m^3. However, in Mutendere and Kabanana, where the pump-up capacity is low, a study of the residual amount in the tank when use is 36 liters/min leads to a judgment that the capacity of the elevated water tank should be 10 m^3.

The height of elevated water tank will be decided at each project site, considering the pressure drop through the piping system and the difference in elevation, as shown in Table 2.15.

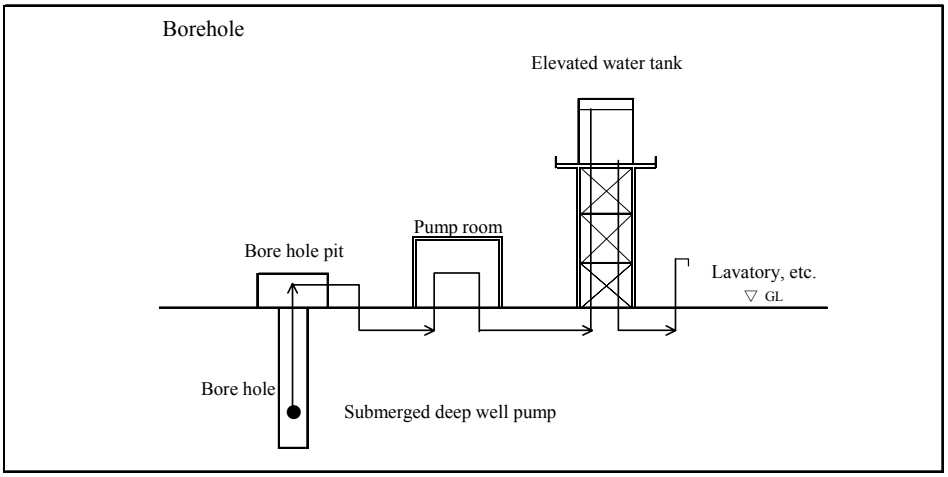


Fig. 2.3 Water Supply System (borehole)

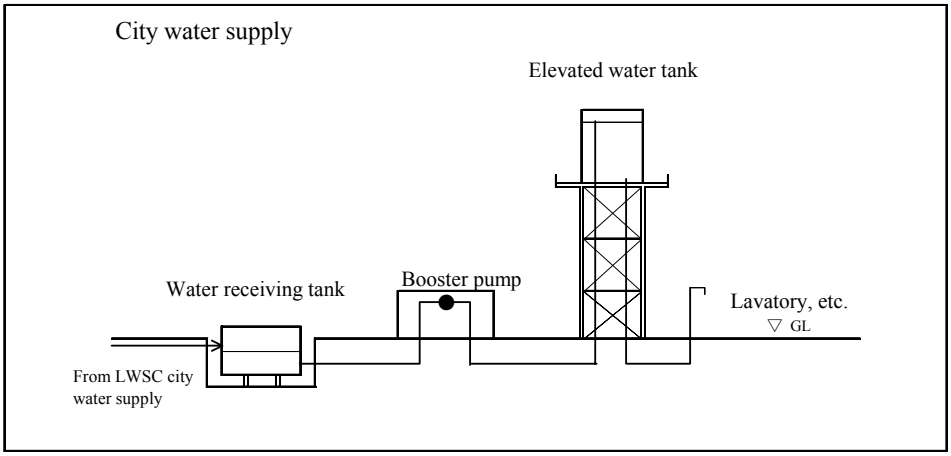


Fig. 2.4 Water Supply System (city water supply)

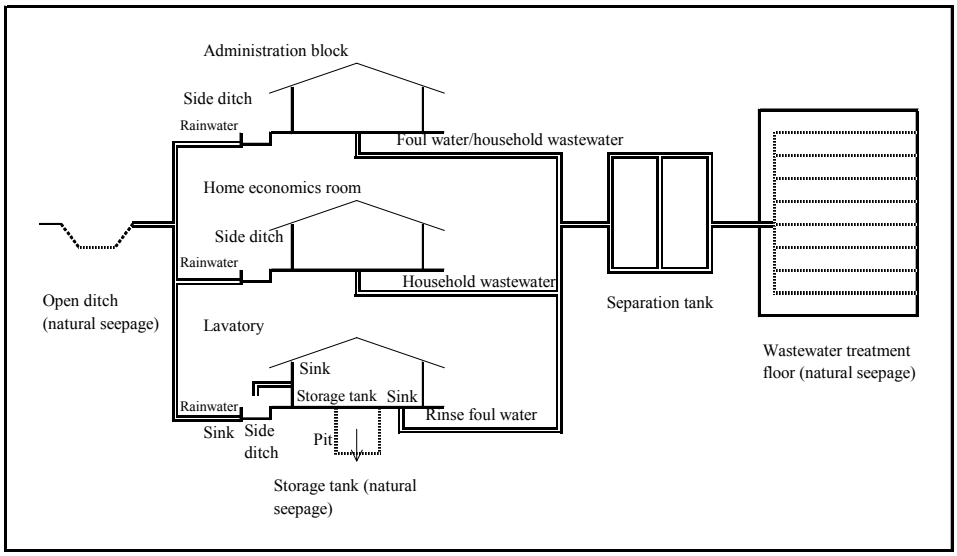


Fig. 2.5 Wastewater Treatment System

Table 2.15 Test Borehole Results & Water Supply/Drainage System

No.	Site	Test borehole results	Water supply system						Drainage system			
			Bore-holes	Sub-merged pumps	Pump rooms	Elevated water tanks	City water supply	Water reservoirs	Household wastewater (special classrooms/administration block)	Water borne toilet	Pit latrine	Rainwater
1	Mutendere	○	1	1	1	1 (capacity: 10 tons) H = 7 m	-	-	Separator → wastewater treatment floor		Pit → natural seepage	Side drainage ditch → open ditch
2	Chunga	◎	1	1	1	1 (capacity: 5 tons) H = 5 m	-	-	Separator → wastewater treatment floor		Pit → natural seepage	Side drainage ditch → open ditch
3	Kabanana	○ (total for 2 boreholes)	2	2	1	1 (capacity: 10 tons) H = 5 m	-	-	Separator → wastewater treatment floor		Pit → natural seepage	Side drainage ditch → open ditch
4	Northmead	Public water supply present	-	-	-	1 (capacity: 5 tons) H = 5 m	Yes	1	Separator → wastewater treatment floor		Pit → natural seepage	Side drainage ditch → open ditch
5	Ng'ombe	◎	1	1	1	1 (capacity: 5 tons) H = 7 m	-	-	Separator → wastewater treatment floor		Pit → natural seepage	Side drainage ditch → open ditch
6	Libala Stage III	Public water supply present	-	-	-	1 (capacity: 5 tons) H = 7 m	Yes	1	Separator → wastewater treatment floor		Pit → natural seepage	Side drainage ditch → open ditch
7	Chilenje South	◎	1	1	1	1 (capacity: 5 tons) H = 7 m	-	-	Separator → wastewater treatment floor		Pit → natural seepage	Side drainage ditch → open ditch
8	Chelstone	◎	1	1	1	1 (capacity: 5 tons) H = 7 m	-	-	Separator → wastewater treatment floor		Pit → natural seepage	Side drainage ditch → open ditch
9	Chazanga	◎	1	1	1	1 (capacity: 5 tons) H = 5 m	-	-	Separator → wastewater treatment floor		Pit → natural seepage	Side drainage ditch → open ditch
10	Chawama/John Howard	◎	1	1	1	1 (capacity: 5 tons) H = 7 m	-	-	Separator → wastewater treatment floor		Pit → natural seepage	Side drainage ditch → open ditch
11	Marapodi/Mandevu	◎	1	1	1	1 (capacity: 5 tons) H = 7 m	-	-	Separator → wastewater treatment floor		Pit → natural seepage	Side drainage ditch → open ditch
12	Jack	◎	1	1	1	1 (capacity: 5 tons) H = 5 m	-	-	Separator → wastewater treatment floor		Pit → natural seepage	Side drainage ditch → open ditch

◎: Q > 45 liters/min (Q: pump-up volume)
○: 45 liters/min > Q > 30 liters/minute

(2) Electrical facilities

1) Electrical lead-in equipment

Electricity is led into most of the basic schools (97%) in Lusaka District. Electric power equipment is needed at each site for lighting fixtures, borehole pumps, and booster pumps for elevated water tanks. The cost of power lead-in work will be borne by the Zambia side.

A 11,000 V > 3φ 4W 380/220V power supply will be received from the power company distribution line (elevated 3φ 3W 11,000 V). The power will go to the distribution panel and then be distributed to each block.

2) Lighting equipment

Lighting fixtures will be installed in consideration of the following facts: most (97%) of the schools in Lusaka District are equipped with lighting fixtures; it is difficult to let in natural light through the narrow windows in exterior walls which also serve as barriers against vandalism. Indoor lighting is necessary because continuous education, including literacy education for adults, are provided during after-school hours. Taking into account maintainability and cost effectiveness, fluorescent lamps will be used for the fixtures. The design light intensities of the fixtures are as follows.

Classrooms	150 - 180 Lx
Administration block	150 - 180 Lx
Lavatories	50 - 70 Lx

Security lighting equipment will be provided at gable ends of the school buildings.

3) Socket equipment

Considering the fact that the use of computers in lessons and radio cassette recorders and other equipment in music classes at adjacent schools is increasing, sockets will be installed at necessary locations in the following rooms.

Classroom blocks	Classrooms, library, offices, home economics room (for electric burner: 32A), store room
Administration block	All rooms (offices for head teacher and deputy head teacher, storeroom, conference room etc.)

2-2-2-4 Water Supply Plan

(1) Test hole drilling

Nineteen (19) test boreholes were drilled at 10 target sites and followed by pumping tests. It was confirmed that yields satisfy requirements for all sites except at Mutendere and Kabanana. For

Kabanana, using two boreholes will satisfy the required water supply. For Mutendere, just one borehole will be used because the reliability of the other borehole as a production borehole is low and water shortage is minimal.

Drill depths, yields during drillings are shown in Table 2.16; pumping test results, in Table 2.17; and water quality analyses results, in Table 2.18.

(2) Subjects raised through test hole drilling

The pump discharge rate was adequate from the boreholes in the area where limestone formations dominate but inadequate at Mutendere and Kabanana where schist formations dominate. Particularly at Kabanana where the pump discharge rate was very low, it was decided to use two boreholes.

As a result of the water quality analysis, fecal coliform was detected at Mutendere, Jack and Chelstone, and a high iron content at Mutendere. Generally, fecal coliform is not detected from boreholes 30 m or more below the ground because it cannot grow in that depth.

The water quality analysis conducted this time was the water samples from unfinished boreholes, and therefore it is likely that groundwater at shallow depths flowed into the samples. There is a possibility that coliform is present in the groundwater at Mutendere because the place is a highly dense compound and is the second largest in Lusaka District. Therefore, sterilizer will not be provided for the boreholes. If fecal coliform is detected by water quality analysis even after the boreholes have been finished, it will be proposed that the water from the boreholes should be boiled for use as potable water.

For Mutendere, laboratory test results for iron content showed 3 to 5 mg/L in comparison to the WHO standard of 0.3 mg/L. However, a re-test taken 1 month later revealed a drastically reduced result of 0.5 mg/L. It is considered that a change in pressure balance of the aquifer due to drilling caused a decrease in the iron content, but a long term monitoring is needed to study the actual process. Reports show that ion content of iron will vary with time, as a result of abrupt environmental changes in aquifer from a static condition to a circulatory condition. Iron is not harmful to the health of humans, but problems can arise in color, taste, and odor to sensitive residents. The water is acceptable at the project sites where water supply is a pressing need.

On the premise that the primary application of this supply, according to the request, is for toilets, the iron content and fecal coliform level are acceptable.

Judgments on test hole results are shown in Table 2.19.

Table 2.16 Test Hole Drilling Result

	Site name	Borehole No.	Completion Date	Surface casing depth (m)	Total Depth (m)	Aquifer depth and yield during drilling	Yield from shallower than 30m (L/min)	Final yield (L/min)
1	Mtendere	1	5-Aug	30	130	20-26m, 6L/min 56m, 24L/min	6L/min	30L/min
		2	7-Aug	30	130	28m, 6L/min 36m, 18L/min 74m, 12L/min 86m, 6L/min	6L/min	36L/min
2	Chunga	1	2-Sep	30	80	20L/min,7m	20L/min	
		2	5-Sep	30	89	82m, 120L/min	12L/min	120L/min
3	Kabanana	1	10-Aug	30	130	78m, 1.8L/min		1.8L/min
		2	13-Aug	30	109	63m, 0.9L/min		0.9L/min
5	N'gombe	1	27-Aug	30	107	46m,18L/min 65m, 37.2L/min 92m, 4.98L/min 105m, 42L/min		102L/min
7	Chilenje south	1	30-Aug	30	130	NA		
		2	1-Sep	30	130	NA		
		3	7-Sep	18	73	24-26m, 120L/min 43m, 30L/min 63m,120L/min	120L/min	270L/min
8	Chelstone	1	3-Aug	30	85	18m, 300L/min 38m, 60L/min 51m, 60L/min	300L/min	420L/min
9	Chazanga	1	23-Aug	30	130	30m, 2.4L/min		2.4L/min
		2	25-Aug	30	113	39m, 72L/min 57m, 18L/min		90L/min
10	Chawama/ John Haward	1	30-Aug	30	120	NA		
		2	1-Sep	30	55	38m, 260L/min 44m, 183L/min 50m, 66L/min		480L/min
11	PHI Marapoli/ Mandevu	1	21-Aug	30	130	28-35m, 48L/min 64m, 10L/min 68m, 18L/min 86m, 12L/min		88L/min
12	Jack	1	29-Aug	30	108	25-26m, 90L/min, 33-34m, 12L/min, 39-40m, no water	90L/min	
		2	13-Sep	30	115	18-19m, 60L/min,	60L/min	
		3	14-Sep	30	43	26-27m, 600L/min 36-37m, 1080L/min	600L/min	1080L/min

Table 2.17 Pumping Test Result

	Site name	Borehole No.	Completion Date	SWL (m)	First step rate (L/min)	First step drawdown (m)	Second step rate (L/min)	Second step drawdown (m)	Third step rate (L/min)	Third step drawdown (m)	Fourth step rate (L/min)	Fourth step drawdown (m)	Constant rate (L/min)	Drawdown (m)	DWL (m)
1	Mtendere	1	14-Aug	7.4	NA	NA	NA	NA	NA	NA	NA	NA	Reach to pump after 2.5hours at rate of 36L/min	26.82	34.22
		2	12-Aug	8.46	6	1.16	12	2.57	24	5.29	36	10.14	18	5.38	13.84
2	Chunga	2	12-Sep	4.28	60	0.06	120	0.29	180	0.74	240	0.93	240	1.09	5.37
3	Kabanana	1	19-Aug	35.63	NA	NA	NA	NA	NA	NA	NA	NA	10	9.15	44.78
		2	21-Aug	21.34	NA	NA	NA	NA	NA	NA	NA	NA	10	14.30	35.64
5	N'gombe	1	29-Aug	17.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Chilenje south	3	14-Sep	18.3	120	0.23	180	0.4	240	0.9	300	1.06	300	1.19	19.49
8	Chelstone	1	9-Oct	10.19	70	1.84	162	3.27	360	6.84	480	10.29	360	9.01	19.2
9	Chazanga	2	28-Aug	3.43	30	5.89	60	8.66	90	13.6	120	21.8	108	19.5	22.93
10	Chawama/ John Haward	2	5-Sep	18	120	0.55	240	1.08	360	1.92	480	3.04	300	1.83	19.83
11	PHI Marapoli/ Mandevu	1	25-Aug	6.3	30	6.78	60	8.71	90	18.72	120	24.57m @14min	90	14.22	20.52
12	Jack	3	18-Sep	15.9	390	0.43	480	0.78	630	0.99	750	1.27	510	1.38	17.28

Table 2.18 Water Quality Test Result (1/2)

Table 2.18 Water Quality Test Result (2/2)

	Site name	Borehole No.	Completion Date														Laboratory, Zambia university															
	Site name	Borehole No.	Color	Taste	Odder	Temp ℃	Turb.	pH	EC mS/m	DO mg/L	Coliform	Bacteria	NO2 mg/L	NO3 mg/L	Fe mg/L	NH4 mg/L	Turb.	pH	Cl mg/L	Fe mg/L	TH mg/L	TDS (W)	ZN mg/L	Mn mg/L	As mg/L	Cd mg/L	F mg/L	HG mg/L	NO2 mg/L	NO3 mg/L	Coliform	Faecal coliform	Bacteria
	WHO standard		-	-	-	-	5	-	-	-	0		3	50	0.3	1.5	5	-	250	0.3	-	-	3	0.5	0.01	0	1.5	0.001	3	50	0	0	-
1	Mtendere	1	clear	faint iron	nil	23.1	error	6.71	43.7	error	colored	colored	0.1	10	10	nil	9.7	6.5	67	3.47	112	131	nil	nil	nil	nil	0.04	nil	0.008	0.94	120	6	280
		1	faint color	faint iron	nil	24.1	0	6.77	47.6	2.37	colored	colored	0.1	5	10	0.1	8	6.5	19	2.64	160	153	nil	0.09	nil	nil	0.04	nil	0.296	16.4	38	36	80
		2	clear	iron	nil	24.2	6	6.21	48.3	13	nil	colored	0.02	10	5	nil	6.4	6.1	80	5.04	220	228	nil	nil	nil	nil	0.04	nil	0.008	0.49	400	15	850
		2	clear	iron	nil	24.3	0	6.71	49.8	1.33	nil	nil	nil	20	0.5	nil	0.8	6.1	39	0.14	220	370	0.04	0.01	nil	nil	0.09	nil	0.013	2.81	0	0	2
2	Chunga	2	clear	nil	nil	23.7	0	7.18	87.4	2.45	nil	nil	nil	45	nil	nil	0.9	6.9	49	0.04	484	634	0.001	0.17	0	0	0.14	2E-04	0.006	5.2	0	0	4
3	Kabanana	1	clear	iron	nil	23.7	error	6.71	4.37	error	nil	nil	nil	2-5	0.5	nil	6.6	7.3	13	0.25	88	192	0.011	0.2	nil	nil	0.32	nil	0.32	18.5	0	0	30
		2	clear	iron	nil	24.3	1	6.31	29.3	2.07	nil	nil	0.02	5	10	nil	4.6	6.2	15	0.71	96	194	nil	0.2	nil	nil	0.36	nil	0.006	21.01	0	0	14
5	N'gombe	1	clear	iron	nil	25.3	0	6.89	47.8	1.3	nil	nil	nil	nil	5	nil	17.7	6.7	9	0.05	228	322	0.07	0.3	nil	nil	0.17	nil	0.005	5.2	0	0	20
7	Chilenje south	3	clear	nil	nil	23.7	0	7.3	53.9	4.3	4	10	nil	10	nil	nil	0.48	7.2	nil	nil	352	282	nil	0.07	nil	nil	0.04	nil	0.003	6.7	0	0	0
8	Chelstone	1	clear	nil	nil	23.7	0	6.8	87.4	1.2	colored	colored	nil	nil	nil	nil	0.18	6.8	53	0.06	492	552	nil	0.4	nil	nil	0.1	nil	0.01	0.31	26	12	2
9	Chaznaga	2	clear	iron	nil	23.3	0	6.8	32.1	1.83	nil	3	nil	2	0.2	nil	1	6.7	12	0.26	136	236	nil	0.1	nil	nil	0.26	nil	0.006	3.61	0	0	0
10	Chawama/ John Haward	2	clear	nil	nil	23.6	0	7.2	77	3.45	nil	<50	nil	20	nil	nil	0.08	6.9	28	0.03	444	510	nil	0.1	nil	nil	0.18	nil	0.017	10.3	0	0	5
11	Marapoli/ Mandevu	1	clear	iron	nil	23.6	0	6.76	25.2	1.7	nil	15	0.02	5	1	nil	2.9	6.4	25	0.2	192	380	nil	0.01	nil	nil	0.08	nil	0.025	2.1	0	0	4
12	Jack	3	clear	nil	nil	24.2	0	7.11	53.2	1.08	nil	nil	0	20	0.2	0	2.55	6.9	11	0.01	272	59.1	0.002	0.1	0	0	0.07	4E-04	0.004	6.61	71	58	138

exceeds standard value

*It was confirmed that Nitrate, at Kabanana is less than standard value by re-test.

**At Mtendere, it is justified that turbidity is not problem by field observation. Water quality at Mtendere will be clarified after proper completion of borehole.

*** The second borehole at Mtendere Nitrate value exceeds standard, but it can be used because standards is for infant.

Table 2.19　Summary of Test Borehole Performance

No.	Site name	Judgment	Pumping method	Subjects to be raised	planned operation pumping rate (finalized during implementation)
1	Mtendere	○（second borehole）	Submersible pump, tank capacity is 10 tons	Yield Iron content Low pH Fecal coliform	25L/min-35L/min
2	Chunga	◎（second borehole）	Submersible pump	OK	150L/min
3	Kabanana	○（total of two boreholes）	Submersible pump, tank capacity is 10 tons	Yield Iron content Low pH	1st：15L/min-30L/min 2nd：15L/min-25L/min
4	Northmead	－	LWSC water	－	
5	N'gombe	◎（first borehole）	Submersible pump	OK	100L/min
6	Libra stageIII	－	LWSC water	－	
7	Chilenje south	◎（third borehole）	Submersible pump	OK	150L/min
8	Chelstone	◎（first borehole）	Submersible pump	1.　Fecal coliform	150L/min
9	Chazanga	◎（second borehole）	Submersible pump	OK	130L/min
10	Chawama／ John Haward	◎（second borehole）	Submersible pump	OK	150L/min
11	PHI Marapodi／ Mandevu	◎（first borehole）	Submersible pump	OK	100L/min
12	Jack	◎（third borehole）	Submersible pump	1.　Fecal coliform	150L/min
Total number		19 boreholes			

◎：Q＞45lit/min
○：45lit/min＞Q＞30lit/min
△：30lit/min＞Q＞10lit/min

(2) Construction plan

1) Borehole specifications

Test boreholes drilled through the basic design survey will be completed as production boreholes by reaming. Their basic specifications are as follows.

Casing:

PVC casing, which is widely used recently and is cheaper than steel casing, as well as its properties to counteract low pH, will be used. The nominal size is 5 inches to enable installation of submersible pumps. Although application of nominal 5-inch casing is not common in Zambia, and since the other sizes normally used are imported from the Republic of South Africa, this can be applied.

Drilling diameter:

Drilling diameters are 8-1/2 inches for schist formations and 10 inches for limestone/dolomite formations. For drilling small diameters into limestone, local drilling companies sometimes drill boreholes having bends and curves, creating difficulties in installing casing pipes. To avoid this situation, a larger drilling diameter will be applied. Larger drilling diameters can increase costs, but the increased cost is still much cheaper than using steel casings.

Drilling specifications are shown in the table 2.20.

Table 2.20 Drilling Specifications

No	Site name	Borehole No.	Depth (m)	Pumping rate (L/min)	DWL (m)	Total head loss (m)*2	Pump power capacity (kw)
1	Mtendere	2	100	35	20	37.5	0.55kw
2	Chunga	2	105	150	15	31.5	1.5kw
3	Kabanana	1	95	30	65	81.5	1.1kw
		2	85	25	55	76.5	0.75kw
5	N'gombe	1	120	100	35	57.5	2.2kw
7	Chilenje south	3	90	150	32	48.5	2.2kw
8	Chelstone	1	65	150	26	45.5	2.2kw
9	Chazanga	2	70	130	27	44.5	1.9kw
10	Chawama/John	2	70	150	26	42.5	1.9kw
11	Marapodi/Mandevu	1	100	100	22	40.5	1.5kw
12	Jack	3	65	150	30	46.5	1.9kw

*1 The design of pumping rate is the maximum rate which was estimated from the pumping test result at the test hole (however, the rate will be set at 150L/min even if the maximum rate exceeds 150L/min). Pumping rates of 100L/min to 150L/min can pump the total daily requirements in 3 to 6 hours. From this point of view, even if the confirmed rate is more than 150L/min, the rate will be set from 100L/min to 150L/min by selecting a low power pump.

*2 Total head loss (DWL + tank height + loss on pipe + height difference + safety margin)

The following matters should be noted during supervision.

- Install surface casing to stop water flowing from shallower zones and increase reliability of pumping test.

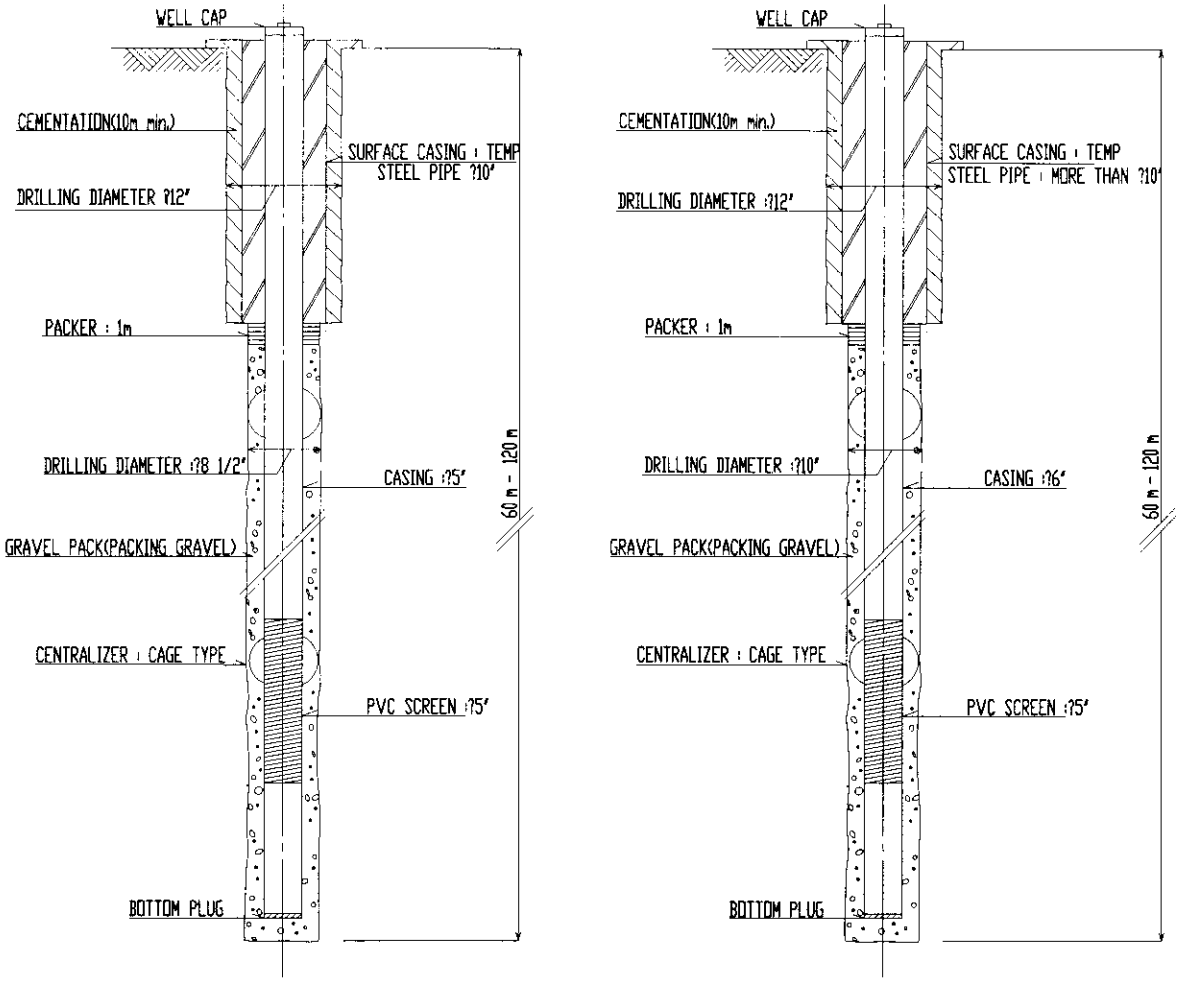
- Refer to the test hole results, confirm depth of aquifer and yield, and then decide on the position of the screen.
- Decide on submersible pump specifications after referring to the pumping test results.
- Check existence of fecal coliform at Mutendere, Jack, and Chelstone.

2) Pit for borehole

The submersible pump is rated as: three-phase, 380V-50Hz or single-phase, 230V-50Hz. Low-level detectors are equipped to avoid motor burning, and an Automatic Voltage Regulator (AVR or CVT) will be installed.

High Density Polyethylene (HDPE) pipes, which are generally used, will be used for riser pipes to withstand corrosive water. Drawings for design borehole structure and pump installation are shown on the following page.

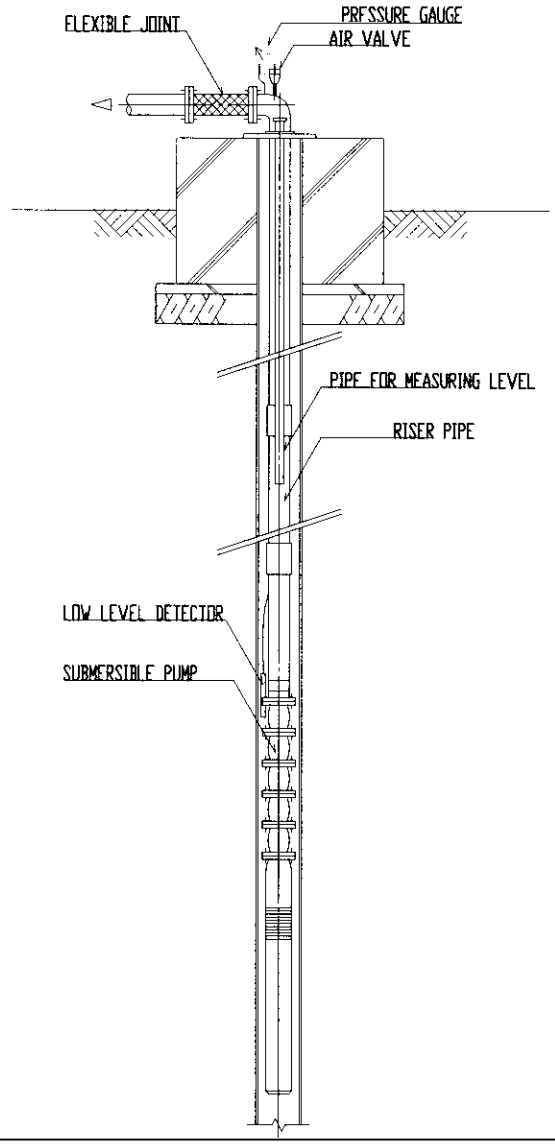
Fig.-2.6 STANDARD BOREHOLE STRUCTURE



STANDARD BOREHOLE STRUCTURE (FOR SCHIST)

STANDARD BOREHOLE STRUCTURE (FOR LIMESTONE)

Fig.-2.7 SUBMERSIBLE PUMP INSTALLATION



2-2-2-5 Furniture Plan

(1) Desks and chairs

The following table shows the specifications for the desks and chairs in the classroom and administration block. There are Ministry of Education standards for the pupil desks and chairs in regular classrooms, so these will be adopted. Other desks and chairs, including those for teachers, will be the same as provided in the previous project.

Table 2.21 Specifications for Desks, Chairs etc.

		Length Depth	Width	Seat Height	Total Height	Material	Frame	Notes
Regular Classroom For pupils	Desks	1150	400	625	-	Wood (t = 25)	Square steel tubing + steel tubing	MOE standards 2-person seating, integrated desk/chair
	Chairs	1150	250	375	-	Wood (t = 25)		
Regular Classroom For Teachers	Desks	1550	800	700	-	Wood (t = 30)	Square steel tubing	With drawers on both sides
	Chairs	365	365	445	780	Plywood (t = 6)	Steel tubing	
Home Economics Room For pupils	Tables	1400	700	737	-	Wood (t = 37)	Square steel tubing	
	Chairs	365	365	445	780	Plywood (t = 6)	Steel tubing	
Library For Teacher	Desks	1550	800	700	-	Wood (t = 30)	Square steel tubing	Same as teacher table and chair in regular classrooms
	Chairs	365	365	445	780	Plywood (t = 6)	Steel tubing	
Library	Book-shelves	320	900	1650	-	Steel	-	
Administration Block For head teacher/ deputy head teacher	Desks	1600	800	700	-	Wood (t = 30)	Square steel tubing	With drawers on both sides With armrest
	Chairs	660	650	470	850	Cloth finish	Square steel tubing	
Administration Block For Secretary	Desks	1550	800	700	-	Wood (t = 30)	Square steel tubing	Same as teacher table and chair in regular classrooms
	Chairs	365	365	445	780	Plywood (t = 6)	Steel tubing	
Administration Block		450	980	-	1790	Steel		
Cabinets/Lockers		630	380	-	1010	Steel		
Administration Block/Office For Teacher's Room	Desks	1400	700	737	-	Wood (t = 37)	Square steel tubing	Same as pupil tables and chairs in home economics room
	Chairs	365	365	445	780	Plywood (t = 6)	Steel tubing	

(2) Writing boards (regular classrooms and special classrooms)

As in the Ministry of Education standards, writing boards will be writing board paint finish on top of a mortar base. The chalk rail and frame will be made of wood and fastened in place with nails. The size will be 4800 x 1200.

(3) Bulletin boards (regular classrooms, special purpose classrooms, administration block and office)

The specifications for bulletin boards will be the same as those provided in the previous project and will be soft boards on top of a Styrofoam base. Based on the previous project, the size of a bulletin board will be 2,400 x 1,200 for regular and special purpose classrooms, staff office in administration block, and offices, and 1,200 x 1,200 mm for head teacher's office, deputy head teacher's office.

2-2-2-6 Utilities Plan

(1) Regular classroom equipment

The teaching equipment indicated in the Project Proposal was judged to be the minimum quantity necessary. The following is a list of these pieces of equipment.

Table 2.22 Regular Classroom Equipment

Name	Specifications	Qty.
Triangle	Plastic	1 set
Try square	Plastic	1
Straightedge	Plastic (1m)	1
Compass	Plastic	1
Protractor	Plastic	1

(2) Home economics room equipment

The following pieces of equipment are planned for home economics rooms, as durable goods in response to the request from the Ministry of Education. There are 20 pupils in each home economics class; on the assumption that the pupils will be divided into groups, three pieces of each item will be provided (with the exception of the refrigerator).

Table 2.23 Home Economics Room Equipment

Name	Specifications	Quantity
Refrigerator	2-door type	1
Iron		3
Sewing machine		3
Stove with oven	4 burners	3

2-2-2-7 Project Scale

The scale of the project as determined from the above study is as follows.

Table 2.24 Scale of the Project

Number of schools		12 schools		
Scale of facilities (common to each school)				
Number of regular classrooms		23	12	276
Number of home economics room		1	12	12
Classroom blocks	4-classroom block	3	12	36
	4-classroom block with office	1	12	12
	4-classroom block with library	1	12	12
	3-classroom block with home economics room	1	12	12
Total number of classroom blocks		6	12	72
Administration block		1	12	12
Guardhouse		1	12	12
Men's lavatory		1	12	12
Female's lavatory		1	12	12
Furniture				
Regular classrooms	Pupil desks/chairs	20	276	5520
	Teacher desks/chairs	1	276	276
	Writing board	1	276	276
	Bulletin boards	1	276	276
Home economics rooms	Pupil tables	10	12	120
	Pupil chairs	20	12	240
	Teacher desk/chair	1	12	12
	Writing board	1	12	12
	Bulletin board	1	12	12
Administration block	Head teacher/deputy head teacher desks and chairs	2	12	24
	Secretary desk and chair	1	12	12
	Teacher tables	8	12	96
	Teacher chairs	30	12	360
	Lockers	2	12	24
	Cabinets	2	12	24
	Bulletin board	4	12	48
Office	Teacher tables	2	12	24
	Teacher chairs	12	12	144
	Bulletin board	1	12	12
Library	Teacher desks/chairs	1	12	12
	Bookshelves	10	12	120
Teaching materials				
Regular classrooms	Triangle	1	276	276
	Try square	1	276	276
	Straightedge	1	276	276
	Compass	1	276	276
	Protractor	1	276	276
Home economics rooms	Refrigerator	1	12	12
	Iron	3	12	36
	Sewing machine	3	12	36
	Stove with oven	3	12	36

2-2-3 Basic Design Drawings

2-2-3-1 Basic Design Drawings (regular classroom)

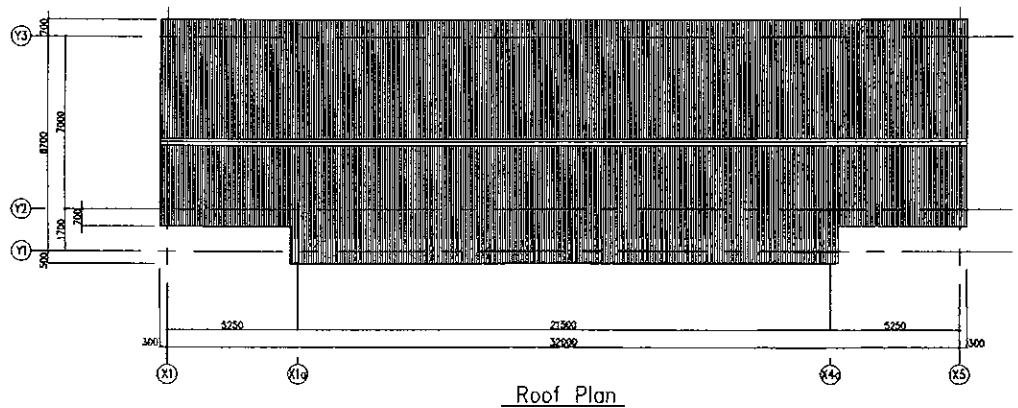
2-2-3-2 Basic Design Drawings (administration block)

2-2-3-3 Basic Design Drawings (lavatory block)

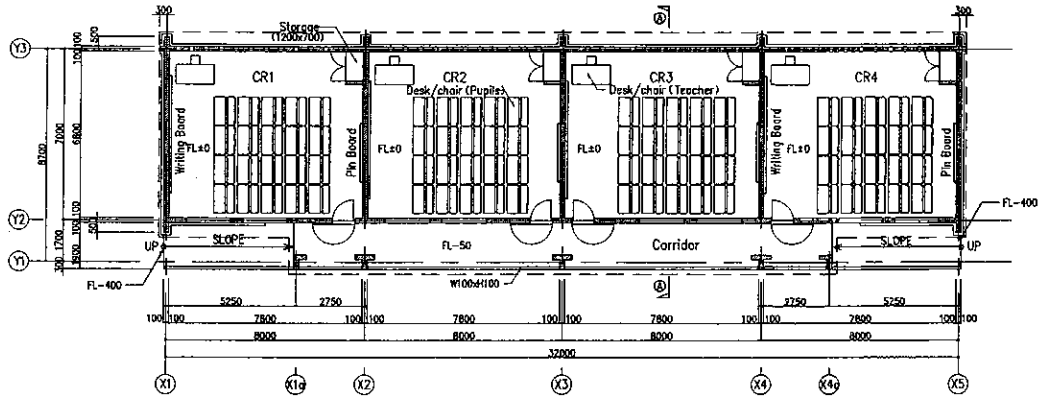
2-2-3-4 Guardhouse

2-2-3-1 Basic Design Drawings (regular classroom)

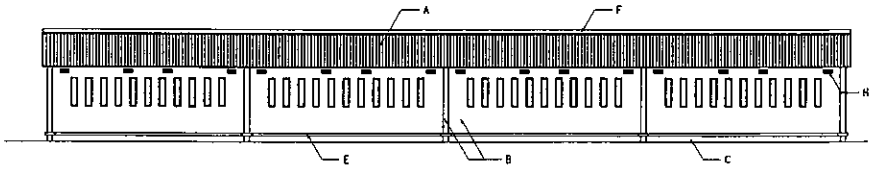
(1) 1×4 Classroom Block (Narrow Window Type)



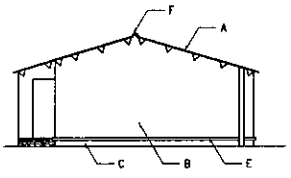
Roof Plan



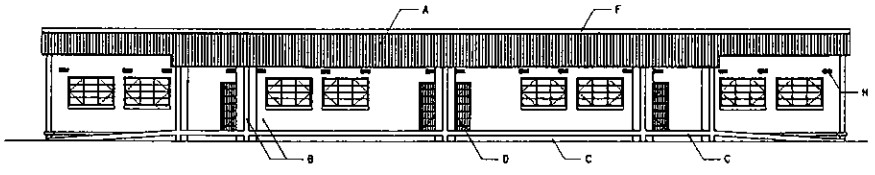
Floor Plan



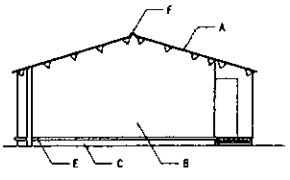
Rear Elevation



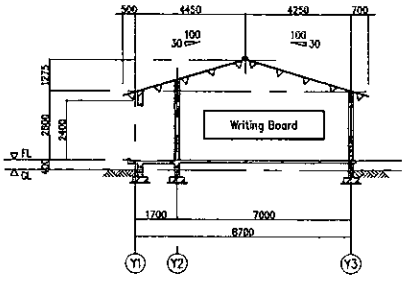
Side Elevation



Front Elevation



Side Elevation



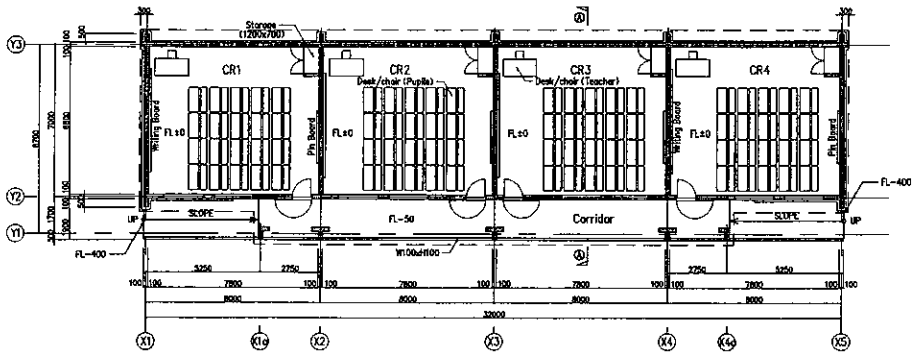
Section Ⓐ – Ⓐ

Exterioer Finishing Schedule

Mark	Finishing
A	Corrugated Cement Sheet t=6 with Waterproof Paint
B	Screed Wood Float t=15 with Paint
C	Screed Wood Float t=15 with Anti-Termite Paint
D	Burglar Gate
E	Screed Steel Trowel t=15 with Paint
F	Adjustable Ridge Capping
G	Fair Face Concrete
H	Air Vent

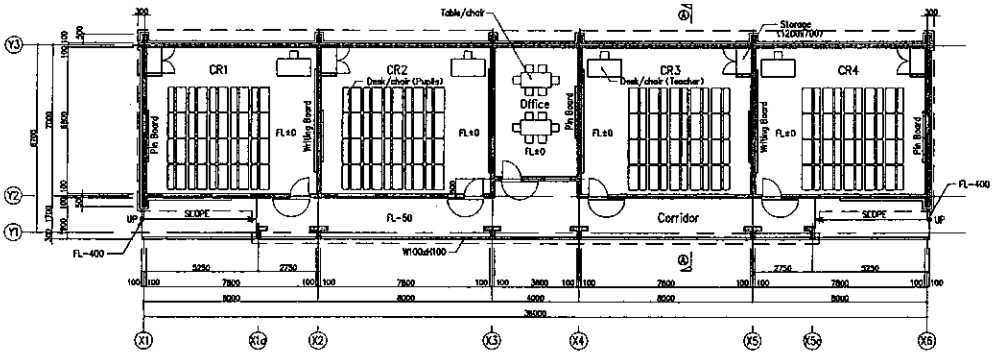
(2) Typical Plan of Classroom Block

1×4 Classroom Block (Standard)



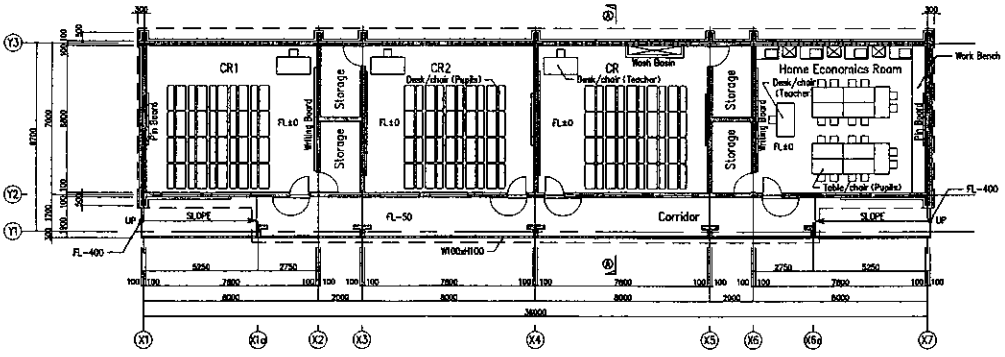
Floor Plan

1×4 Classroom Block with Office or Library



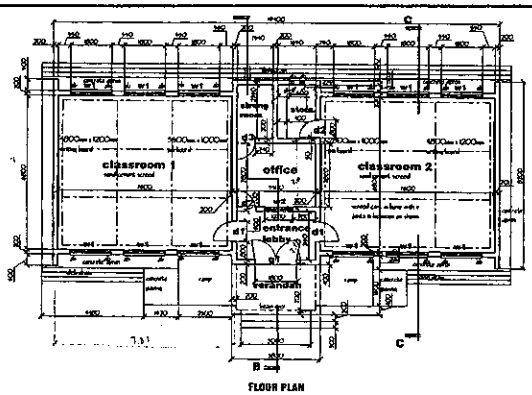
Floor Plan

1×3 Classroom Block with Home Economic Room



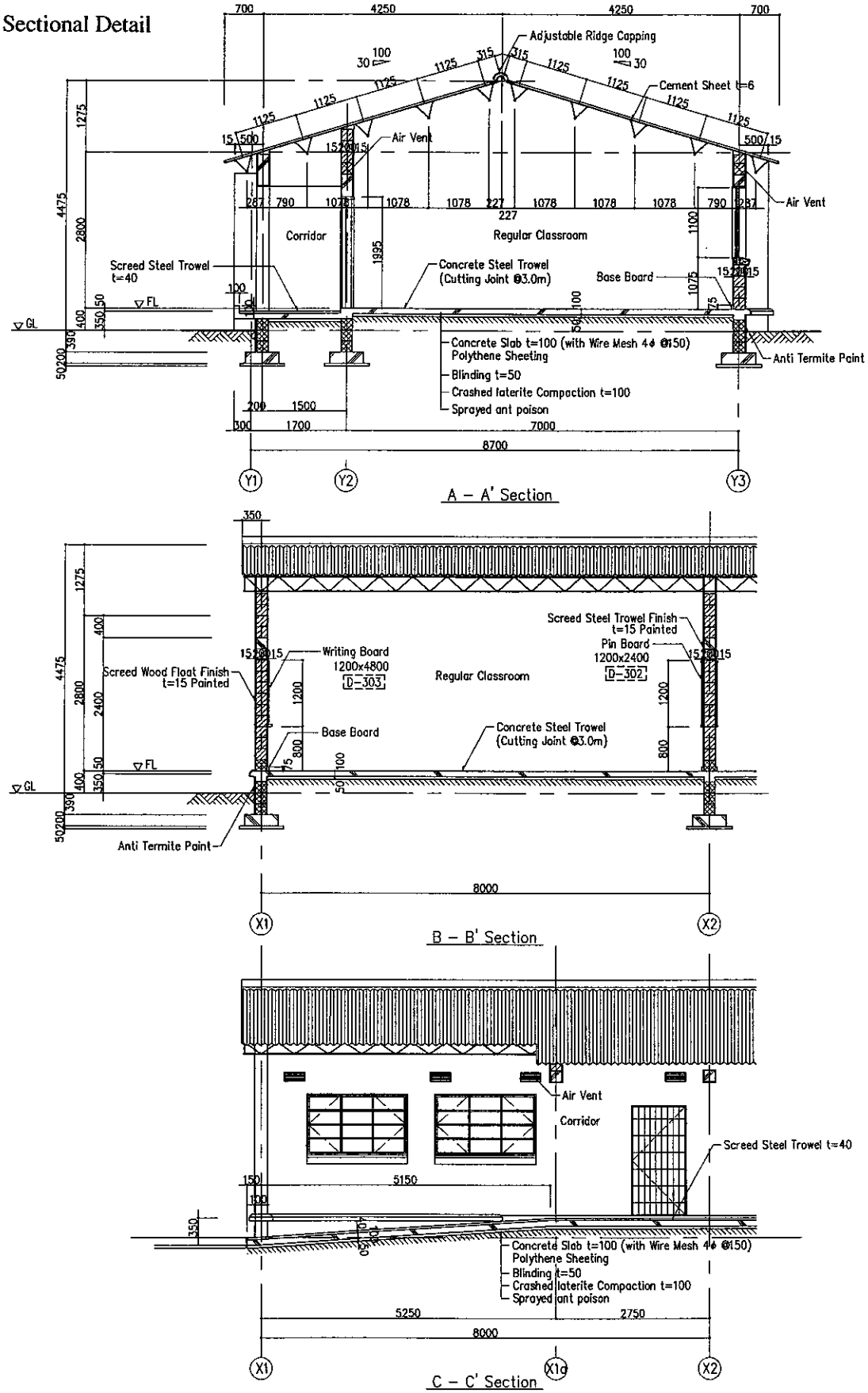
Floor Plan

<Reference> 1×2 Classroom Block by BESSIP

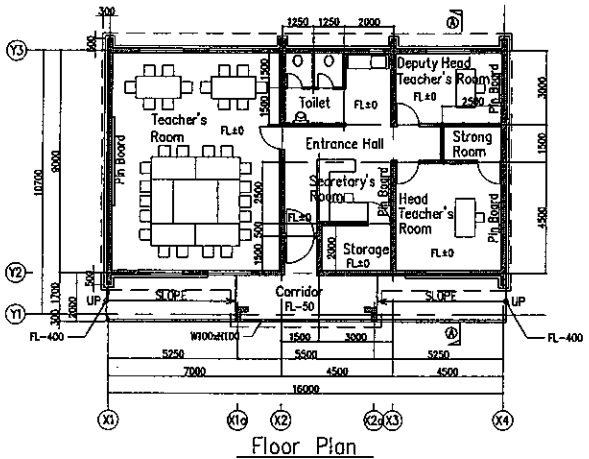


FLOOR PLAN

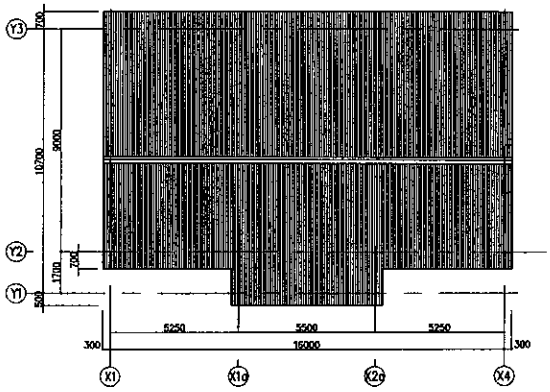
(3) Sectional Detail



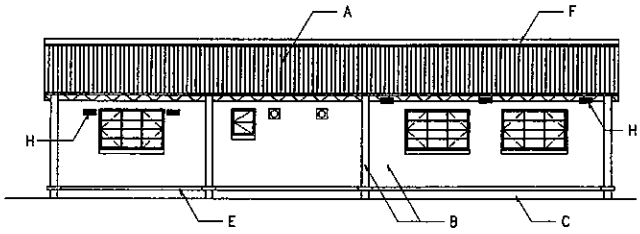
2-2-3-2 Basic Design Drawings (administration block)



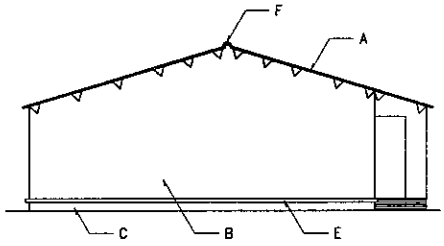
Floor Plan



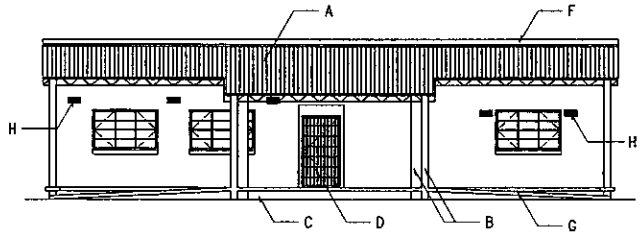
Roof Plan



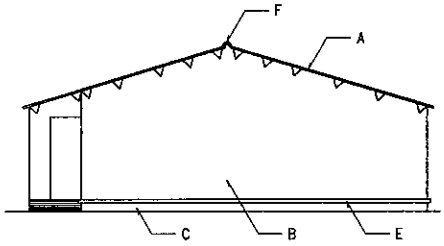
Rear Elevation



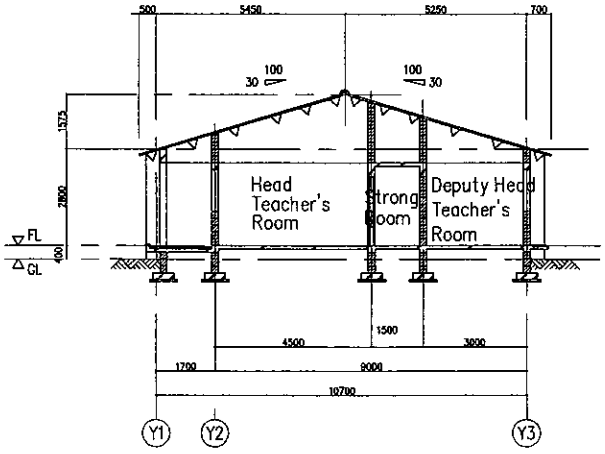
Side Elevation



Front Elevation



Side Elevation



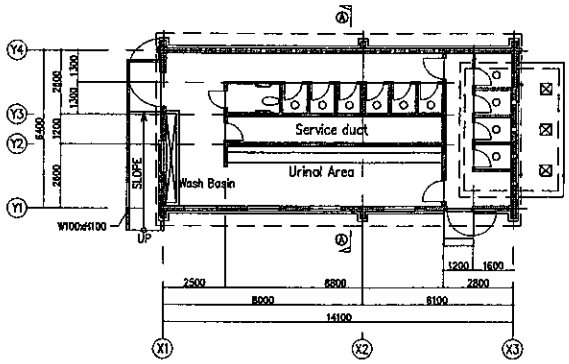
Section Ⓐ-Ⓐ

Exterioer Finishing Schedule

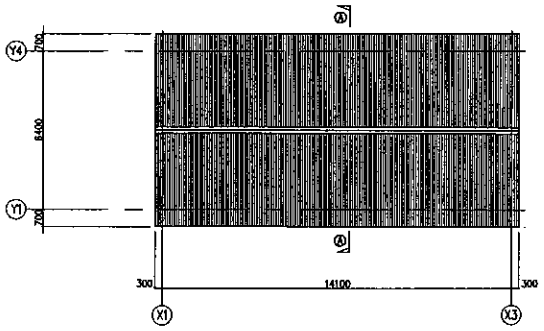
Mark	Finishing
A	Corrugated Cement Sheet t=6 with Waterproof Paint
B	Screed Wood Float t=15 with Paint
C	Screed Wood Float t=15 with Anti-Termite Paint
D	Burglar Gate
E	Screed Steel Trowel t=15 with Paint
F	Adjustable Ridge Capping
G	Fair Face Concrete
H	Air Vent

2-2-3-3 Basic Design Drawings (lavatory block)

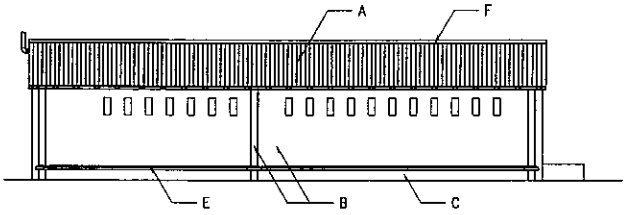
(1) For Male



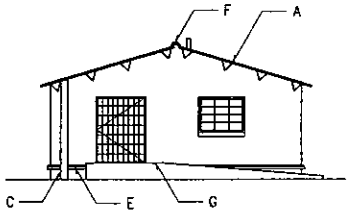
Floor Plan



Roof Plan



Rear Elevation



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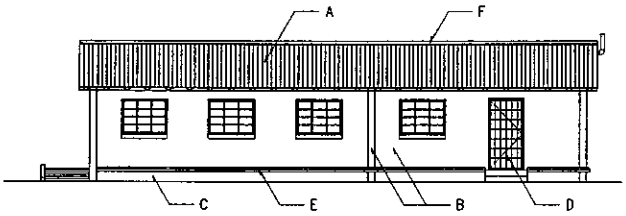
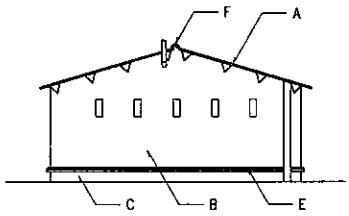
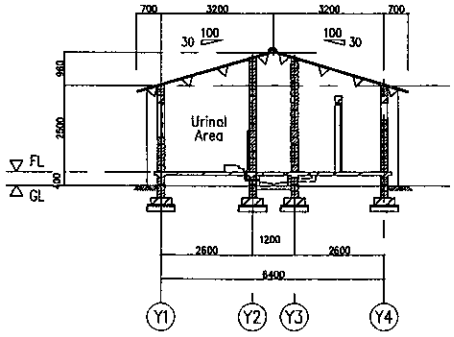


Front Elevation



Side Elevation

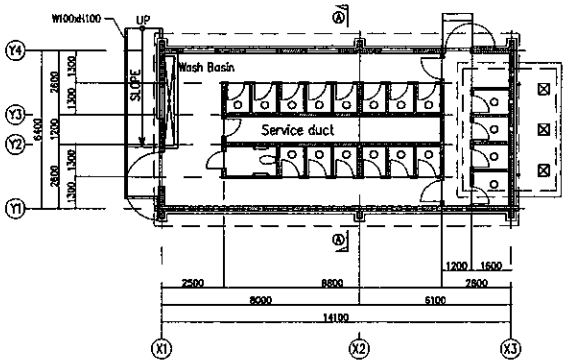


Section Ⓐ – Ⓐ

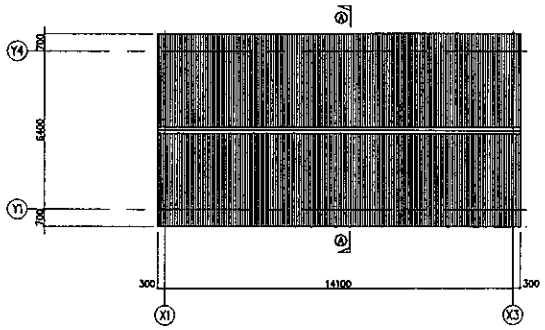
Exterioer Finishing Schedule

Mark	Finishing
A	Corrugated Cement Sheet t=6 with Waterproof Paint
B	Screed Wood Float t=15 with Paint
C	Screed Wood Float t=15 with Anti-Termite Paint
D	Burglar Gate
E	Screed Steel Trowel t=15 with Paint
F	Adjustable Ridge Capping
G	Fair Face Concrete

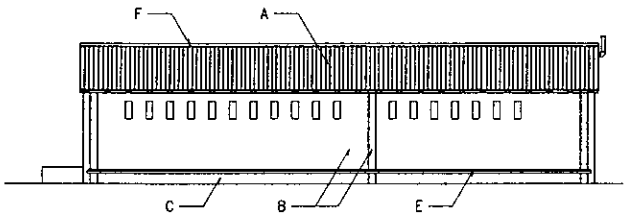
(2) For Female



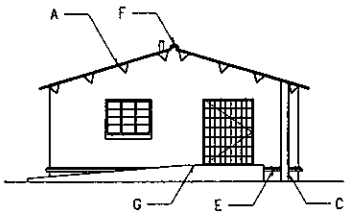
Floor Plan



Roof Plan



Rear Elevation



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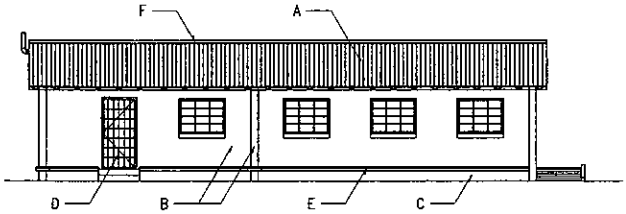
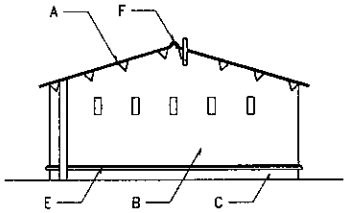
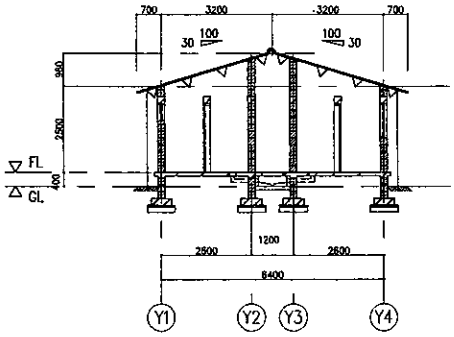


Front Elevation



Side Elevation

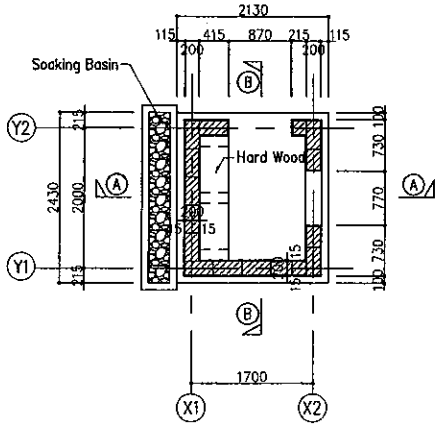


Section Ⓐ - Ⓐ

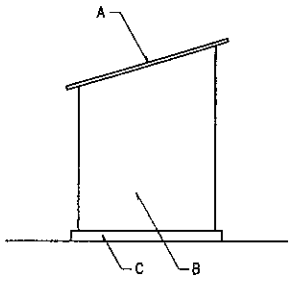
Exterioer Finishing Schedule

Mark	Finishing
A	Corrugated Cement Sheet t=6 with Waterproof Paint
B	Screed Wood Float t=15 with Paint
C	Screed Wood Float t=15 with Anti-Termite Paint
D	Burglar Gate
E	Screed Steel Trowel t=15 with Paint
F	Adjustable Ridge Capping
G	Fair Face Concrete

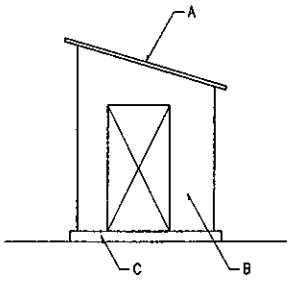
2-2-3-4 Guardhouse



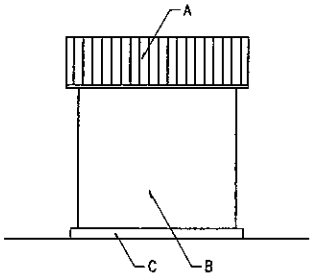
FLOOR PLAN



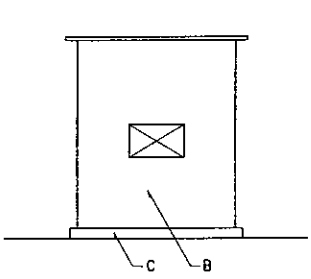
Side Elevation



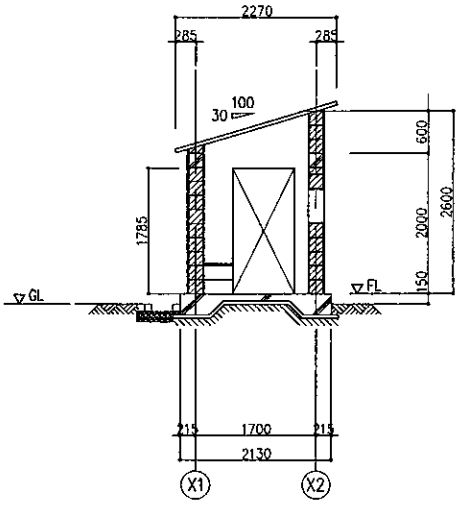
Side Elevation



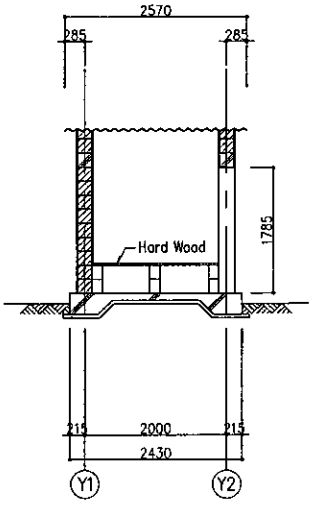
Rear Elevation



Front Elevation



SECTION Ⓐ – Ⓐ



SECTION Ⓑ – Ⓑ

Exterioer Finishing Schedule

Mark	Finishing
A	Corrugated Cement Sheet t=6 with Waterproof Paint
B	Screed Wood Float t=15 with Paint
C	Fair Face Concrete

2-2-4 Construction Planning/Procurement Planning

2-2-4-1 Construction Policy

(1) Basic matters for project implementation

Before execution, the planning content must be reviewed by related Japanese government agencies, based on the basic design survey report, and approval must be given by a Cabinet resolution. Following the cabinet resolution, an exchange of notes (E/N) must be agreed upon by the Japanese and Zambian governments, after which the project will be implemented as a grant aid programme.

The procedure for implementing the project involves contracts entered into by the Zambian implementation agency in charge, the Japanese consultant, and the Japanese contractor, in accordance with the rules of Japan's Grant Aid Programme. The contract made between the Zambia side and the Japanese consultant, and the contract made between the Zambia and the Japanese contractor must be approved by the Japanese government.

(2) Executing organization

The Ministry of Education (MOE) is the Zambian government agency in charge of coordination, etc. for the exchange of notes between the two governments regarding the implementation of this project, and the Zambian government agency that will implement the project. The MOE's Construction Unit will execute the actual liaison work.

The Ministry of Education will also be the signatory to the design supervision contract with the consultant and the construction work contract with the contractor. The MOE's Construction Unit will be the overall supervisor for the matters that are to be executed by the Zambian government, as well as the Banking Arrangement (B/A), issuance of Authorization to Pay (A/P), and other interdepartmental coordination matters, and will also be in charge of construction work supervision.

(3) Consultant

After the exchange of notes (E/N) between the government of Zambia and the government of Japan, the Ministry of Education will conclude a supervision contract for supervision of the project execution with a Japanese consultant, in accordance with Japan's Grant Aid Programme. Under this contract, the consultant will implement the following:

1) Bidding: Cooperation on the selection of a successful bidder and matters relating to the work contract
2) Construction work supervision: Supervision of construction work until the completion and delivery of equipment

(4) Contractor

The contractor will be selected by open bidding among the Japanese contractors with set qualifications. In principle, the contract will be awarded to the lowest bidder. The successful bidder will enter into a construction work contract with the Ministry of Education.

Following approval of the work contract by the Japanese government, the contractor will complete the work within the estimated work deadline in accordance with the contract. Following the post-completion inspection, the completed facilities and equipment/materials will be handed over to the Ministry of Education.

(5) Employment system and methods for local consultants and local contractors

This project will be implemented at 12 sites. At each site, a new large-scale school will be constructed; so overall, the project is a major undertaking. For this reason, it would be effective for the Japanese contractor to hire local contractors who are experienced in large-scale school construction in Lusaka District as subcontractors, and effectively use these local contractors' local expertise in the procurement of materials, personnel hiring, construction techniques, and so on. In such cases, it would be best to divide the site into appropriate areas, taking into account the execution capability of the local contractors, construction management, schedule, quality, and safety control capabilities in particular, and have the work executed by several subcontractors.

To ensure uniform quality for the work carried out at multiple sites within a set period of time, the introduction of uniform quality and process control and rigorous implementation by the Japanese contractor will be needed.

The technical staff members of the Ministry of Education have great experience and a wealth of accumulated technical expertise in the design and construction supervision of educational facilities. The Japanese consultant will effectively use their expertise in a collaborative manner for the supervision of the construction.

(6) Other

Immediately after the bid has been awarded, the Japanese consultant, contractor and the Zambian government in charge will review the execution plan. This will involve meetings to confirm the time for the Japan and Zambia sides to commence their respective work and the methods that should be used, for each item, and to ensure that the works of both sides are carried out smoothly.

It is particularly important to coordinate the leveling of the construction site, electrical and water supply lead-in work, and construction of the fence (all of which are works to be performed by Zambia side) within the work period for the Japanese contractor.

2-2-4-2 Important Notice Regarding Construction Work

(1) General construction situation and site attributes

1) Contractors

Due to the economic downturn in recent years, there are almost no large-scale construction projects underway in Lusaka District. With regard to the construction of educational facilities, the previous project (completed in 2000) was the last large-scale project. Previous to this, the World

Bank ZERP project (completed in 1998) was implemented. In regional areas, classroom construction was conducted even after that time due to assistance from the World Bank and the African Development Bank. As a result, there are many contractors with experience in classroom construction.

2) Labor situation

In the construction industry of Lusaka District, the number of specialist workers is small compared to the number of general workers. In this project, it is important to secure trained specialists to work as supervisors for each work, in order to maintain high quality. Due to Zambia's high unemployment rate, securing ordinary workers should not be difficult, and furthermore, hiring local workers would be beneficial from the standpoint of stimulating the local economy.

3) Construction materials

Of the construction materials for the facilities in this project, steel and non-asbestos corrugated cement sheet are not produced in Zambia. Steel fittings are manufactured locally from imported raw materials. In addition, steel products imported from the Republic of South Africa are common. Of the educational materials and equipment provided in the previous project, the number of pupils' desks and chairs that could be produced on site was insufficient and it was arranged to import some that had been manufactured in South Africa. Therefore, if necessary, import of equipment such as desks and chairs will also be considered.

4) Rainy season and dry season

The rainy season in Lusaka District lasts five months, from November through March, with the months of January and February raining the most. Rain will have the greatest impact on the work of foundation, especially, excavation and pouring concrete, so this condition must be taken into consideration when planning the construction schedules.

(2) Considerations on construction

The general construction situation and site attributes discussed in the previous section show that the following major considerations for the execution of this project are needed.

1) Procurement of materials

Of the construction materials, those for which large quantities are needed at the same time (concrete blocks, corrugated cement sheet, etc.) will need to be procured on a scheduled basis by a Japanese engineer, rather than leaving procurement up to the local contractors.

2) Process control

In the implementation of this work, a clear critical path schedule will be established, not only for each site but also for the overall work, and this must be observed strictly. For this purpose, liaison meetings made up of all concerned parties in the departments supervising the construction will be held at regular intervals, in order to ensure that the control standards for piecework are thoroughly met and to heighten the overall sense of participation in the project.

3) Quality control

The facilities to be constructed at each site and the specifications for the buildings are almost identical. The first block to be constructed at each site will be used as the model building, and a study made with regard to putting the details into the general finishing work and so on, to ensure that uniform quality in construction is maintained for other buildings. In addition, thorough control standards for work quality will be established during the aforementioned liaison meetings and control exercised to ensure that uniform quality is maintained.

4) Safety control

Since many local contractors will be working at multiple sites, a liaison meeting will also be established for safety control to promote an understanding of the importance of safety control and maintain the control organization.

2-2-4-3 Construction Categories

The following is a summary of the work to be performed by each nation with regard to the construction of facilities for this project.

(1) Japan work

No. of schools 12

① Facility construction

Schools	12
Regular classrooms	276
Home economics rooms	12
Administration blocks	12
Guardhouses	12
Lavatories (male)	12 (with 11 water closets each)
Lavatories (female)	12 (with 19 water closets each)

② Provision of furniture

Regular classrooms

Pupils' desks and chairs

Teachers' desks and chairs

Writing boards and bulletin boards

Home economics rooms

Pupils' tables and chairs

Teachers' desks and chairs

Writing boards and bulletin boards

Administration block

Head teacher's and deputy head teacher's desks and chairs

Secretary's desks and chairs

Teachers' tables and chairs

Bulletin board

③ Provision of equipment

Regular classrooms

5 items of teaching equipment

Home economics rooms

4 items of teaching equipment

(2) Zambia work

① Prior to the start of construction work, remove any wastes, existing buildings (existing lavatories at Kabanana, etc.) that may hinder the work.

② Prior to the start of construction work, level the construction site.

③ Prior to the start of construction work, secure and construct an entryway for construction vehicles.

④ Construct gates and fence and carry out landscaping and other external work.

The Zambia work noted above is described in accordance with standard regulations for the work to be conducted by the recipient country of Japanese grant aid. For this project, talks were held with the Zambian officials in charge regarding the locations for classroom construction. In addition, the condition of sites' grounds were surveyed and the layout determined to minimize the need for site leveling. It has also been confirmed that work vehicles would be able to accesssites. Accordingly, ① through ③ above will not entail additional costs.

With regard to construction of gates and fences, almost all of the schools in Lusaka District are provided with gates and fences as a measure to prevent vandalism, and they are also necessary to ensure a good learning environment. Fences are usually constructed of concrete blocks, and their heights are around 2.4 meters. Under the layout plan, building outer walls can be used as part of the fence as well, and to keep the length of the fence as short as possible, the classroom blocks will be placed on the periphery of the site in an effort to reduce the work costs borne by the Zambia side.

2-2-4-4 Construction Supervision Plan

(1) Construction supervision policy

Under the policy for grant aid offered by the Japanese government, consultants create an integrated project team for implementation of work based on the aims of the basic plan and prepare design for execution and carry out construction supervision in a smooth manner. The policies relating to construction supervision for these works are as follows.

① The consultant will keep in close contact with the officials in charge at the relevant agencies of each country and aim to complete the construction of facilities and the delivery and installation of desks, chairs, and other teaching equipment and materials without delay

② The consultant will impartially render appropriate guidance and advice to the contractors and related parties.

③ The consultant will confirm that the construction work and the installation of desks, chairs and teaching equipment and materials have been completed and that the conditions of the contract have been fulfilled, and then attend the handover of the facilities and, with the approval of the Zambia side, bring the work to a conclusion.

The following considerations should be kept in mind with regard to construction supervision for this project.

① To implement the work, a project implementation committee comprised primarily of the authorities of implementing organizations will be formally inaugurated, and this committee will serve as liaison and conduct close contacts and reporting, and will also work to ensure that the Zambia side has a thorough understanding of the objectives of the project and that relevant agencies implement tax exemption measures and budgetary measures.

② The Consultant will prepare a "Construction Supervision Schedule" that makes a thorough study of particularly important considerations such as quality, piecework, processes, safety/sanitation and so on, and will confer with officials of the Ministry of Education.

③ Prior to the execution of the work, the construction plan and construction drawings submitted by the contractor will be thoroughly studied and reviewed to confirm the validity of the process plans, construction organization, construction methods, temporary construction plan, quality control plan, procurement plan, safety control plan and environmental plan.

④ During the period of work execution, regular meetings will be held with the contractor to check on, confer about, and issue instructions regarding the progress of processes, quality and piecework control, and safety and sanitation control. In addition, the consultant will be present at the inspection of each work. The minutes will be distributed to the relevant departments and will serve as the official record. Changes to the design will be reported in advance to the Japanese government via JICA.

⑤ At the time of work completion and handover, in the presence of Zambian government representatives, Japanese embassy officials, JICA office personnel, contractor representatives, and so on, an inspection will be conducted to confirm that functions and performance of facilities and equipment/materials fulfill the requirements of the contract documentation. If repairs are needed, appropriate instructions will be given.

⑥ Specifications, construction plans, construction records, completion drawings, photographs and reference materials related to design changes and the like will be kept for 10 years.

(2) Organization for construction supervision

Because the results of the trial construction proved that local contractors have, in no small measure, problems with execution, schedule, and quality control capabilities, construction supervision system will be provided in accordance with the following principles.

To provide appropriate guidance and supervision with regard to construction quality, work period, safety, and so on, and to conduct liaison with relevant agencies, and also to ensure that the facilities are completed within the scheduled date and in accordance with contract documentation and that the work progresses smoothly, the consultant will appoint a resident site supervisor (architect) and dispatch the following engineers as needed by the progress of the work.

① Chief consultant (overall coordination/process supervision)

② Architect (to confirm construction methods, design aims, construction drawings, material specifications, etc.)

A diagram of the organization for construction supervision is shown below.

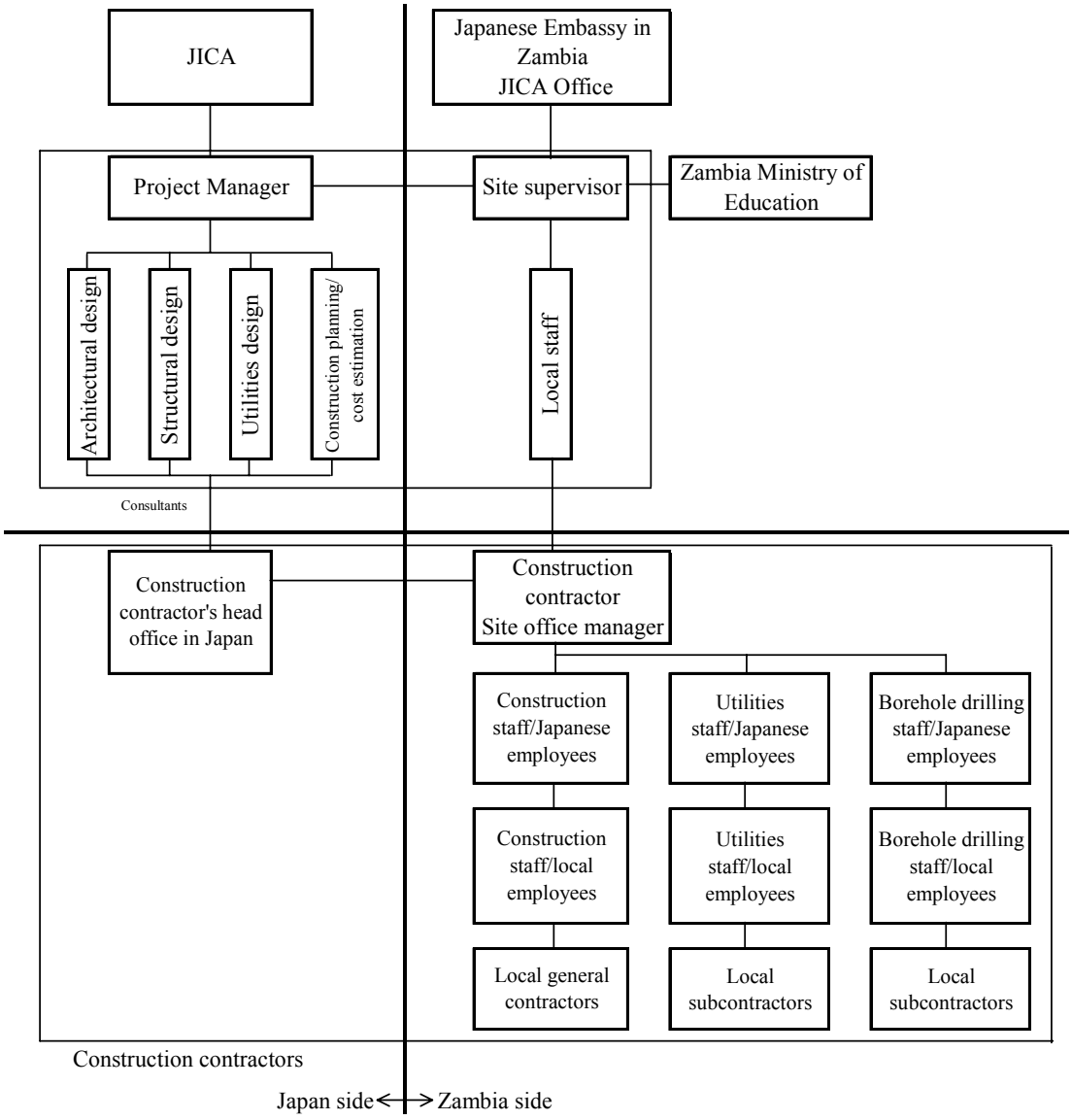


Fig. 2.8 Organization Chart of Construction and Supervision

2-2-4-5 Quality Control Plan

The facilities constructed by this project will have foundations of reinforced concrete, a superstructure of concrete block masonry, and a roof of corrugated cement sheet on top of reinforcing bar trusses. Considering the materials strengths, testing and execution conditions during the trial construction, the objectives of the quality control for reinforcement work, concrete work, and concrete

block work are shown below. Hereinafter referred to as "Common Specifications", it shows the Common Specifications for Building Work (2001 edition) of the Public Buildings Association (PBA).

(1) Reinforcement work

1) Materials

Reinforcement must have a quality (yield strength/tensile strength) equal to or greater than JIS G3112 products or equivalent, as confirmed with mill sheet. If mill sheet cannot be obtained, the material test will be done in accordance with Common Specifications 5.2.3 "Material Testing." However, the number of test specimens to be prepared for each test is 6, and if the test equipment and the test method used for the first 3 test specimens results in nonconformity, then the test will be conducted again with the remaining 3 test specimens and an overall judgment will be made from the results of all 6 specimens. Two items will be tested: yield strength and tensile strength.

The material will be judged to have passed the test if the values of all 3 test specimens meet the requirements.

2) Bending and assembly

With regard to reinforcement bending shape, joint length and anchorage length, the shape and length will be checked in accordance with Common Specifications 5.3.2 "Bending" and 5.3.4 "Joints and Anchorages" as the criteria.

(2) Concrete work

1) Concrete specifications

- Type of concrete: ordinary concrete
- Proportioning strength: Considering the difference between cube strength and the actual strength of the concrete, the proportioning strength will be set to the design standard strength +3 N/mm^2. However, for the blinding concrete, instructions will be given only for the mix; no strength instruction will be given.
- Structure concrete: mix proportion strength Fc24 N/mm^2 (design standard strength Fc21)

2) Concrete materials

- Cement: Ordinary Portland cement (JIS R5210 or equivalent)
- Coarse aggregate: Locally produced crushed stone (maximum size 20 mm; quality in accordance with Common Specifications 6.3.3 "Aggregate")
- Fine aggregate: Locally produced river sand (quality in accordance with Common Specifications 6.3.3 "Aggregate")
- Water: Public water that can be obtained at each site, or borehole water suitable for drinking

3) Mix proportions

The planned mix proportions will be calculated in accordance with Common Specifications 6.2.4 "Conditions for Materials and Mix Proportions" and finalized after carrying out trial mixing and compressive strength tests prior to the start of work.

4) Mixing

Concrete mixing in Zambia is done at the work site using a medium size engine type mixer. Measurement is done based on the results of trial mixing, by making measurement boxes for cement, aggregate, and water that correspond to the capacity of the mixer and then measuring the mix proportions. In accordance with Common Specifications Chapter 6, Section 8 "Handling of Concrete During Summer Heat," hot cement, aggregate and water are not used.

5) Placement

With the structural system used for this project, there is no need to place the concrete from a high location. However, during concrete placement, to prevent concrete separation, thorough consideration must be given to the drop height (1.5 m or less), and a bar type vibrator should be used to ensure that the concrete fills all the way to the corners of the formwork. The temperature of the concrete during placement, the spraying of water on sheathing, etc., and the curing after placement should conform to Common Specifications Chapter 6, Section 8 "Handling of Concrete During Summer Heat."

6) Formwork

Formwork should have no harmful water leakage, should be easy to remove, and should not damage the concrete during removal. The material for sheathing should be a material with no knots, wanes, bulk breaking, reaction wood, decay, wormholes or other defects.

7) Compressive test

A compressive test should be conducted for each building, by preparing a total of six test specimens (3 each for material ages of 7 days and 28 days) sampled during foundation placement, grade concrete slab placement and circumferential girders placement. Sampling should be done at appropriate intervals for each mixing process to obtain two test specimens (a 7-day specimen and a 28-day specimen). The test method and judgment method should be in accordance with JAS S5T-602 "Control test method for proportioning strength of mixing concrete at site."

(3) Concrete block work

1) Concrete block specifications

- Size of concrete blocks: 190 x 190 x 390
  140 x 140 x 390 (inner wall not supporting trusses)

- Strength of concrete blocks: 2.5 N/mm^2 (for general sections)
  (For full section) 4.0 N/mm^2 (only for self-supported columns)

2) Joint mortar mix proportions: Cement:sand = 1:2.5

3) Stacking of concrete blocks, etc.

The method of stacking concrete blocks, curing etc. should be in accordance with Common Specifications 8.2.6 - 8.2.12.

2-2-4-6 Plan for Procurement of Equipment, Materials etc.

Of the construction materials for the facilities planned in this project, only steel and non-asbestos corrugated cement sheet are not produced in Zambia. Steel fittings are manufactured locally from imported raw materials. In addition, steel products imported from the Republic of South Africa are common. Accordingly, the basic policy for procurement of construction materials will be local materials, and a thorough study will be conducted for quality, ease of use, price, supply capacity and so on. Table 2.25 shows the categories for equipment and material procurement.

Table 2.25 Categories for Procurement of Materials & Equipment

Material	Zambia	Third country	Notes
【Construction Materials】			
Sand	○	—	Locally available river sand can be used
Gravel	○	—	Locally available gravel can be used
Cement	○	—	Cement factory exists
Reinforcements	○	—	Imported product will be procured from inside Zambia
Steel	○	—	Imported product will be procured from inside Zambia
Formwork materials	○	—	Lumber procured from inside Zambia will be used for manufacture
Concrete blocks	○	—	Block manufacturing factory exists
Steel fittings	○	—	Imported steel will be used for manufacture from inside Zambia
Wooden fittings	○	—	Local product will be purchased
Corrugated cement sheet (non asbestos)	○	—	Imported product will be procured from inside Zambia
Hardware	○	—	Imported product will be procured from inside Zambia
Paint	○	—	Local product will be procured from inside Zambia
Utility equipment and materials	○	○	Local or imported product will be procured from inside Zambia
【Furniture】			
Desks/chairs	○	○	Local product will be procured from inside Zambia
Steel furniture	○	—	Local product will be procured from inside Zambia
【Equipment】			
Teaching equipment	—	○	Imported product will be procured from inside Zambia

2-2-4-7 Implementation Schedule

The project will be implemented in two phases. The schools for each phase will be selected according to the priority indicated by the Ministry of Education, and the schools with the highest priority will be constructed in Phase 1.

Table 2.26 List of Project Sites by Phase

Phase	Site	Schools	Classrooms	Lavatories	Administration blocks	Guardhouses
1	Jack Chunga Chazanga Chawama/John Howard Chelstone Ng'ombe	6	144	12	6	6
2	Marapodi/Mandevu Chilenje South Northmead Mutendere Kabanana Libala Stage III	6	144	12	6	6

The period needed for each of the work above is estimated to be as shown below, with the six sites in each phase divided into three construction control groups and conducted simultaneously. A project implementation schedule prepared based on these periods is shown in Table 2.27.

Phase 1 (6 sites)

Bidding/contracting	3 months
Construction work	14 months
Total	17 months

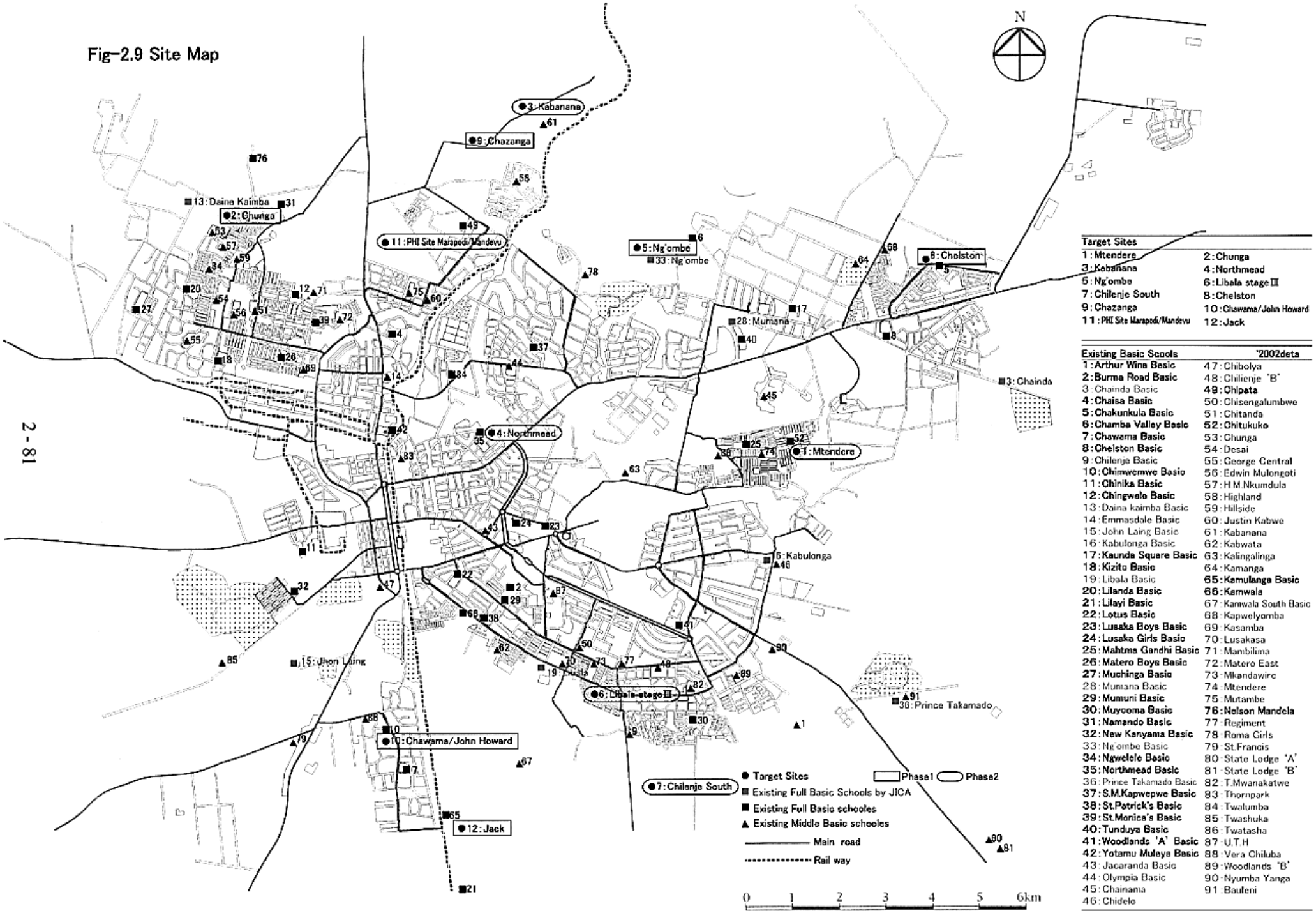
Phase 2 (6 sites)

Bidding/contracting	3 months
Construction work	14 months
Total	17 months

The work in each phase will be implemented in accordance with following procedure:

1) Exchange of notes (E/N) by both governments
2) Signing of consultancy contract between Zambian government and Japanese consultant
3) Preparation of bidding documents
4) Bidding work: Bidder pre-qualification (P/Q), holding of bidding process
5) Construction work: Signing of work contract between Zambian government and the winning contractor. The work begins after authorization by the Japanese government

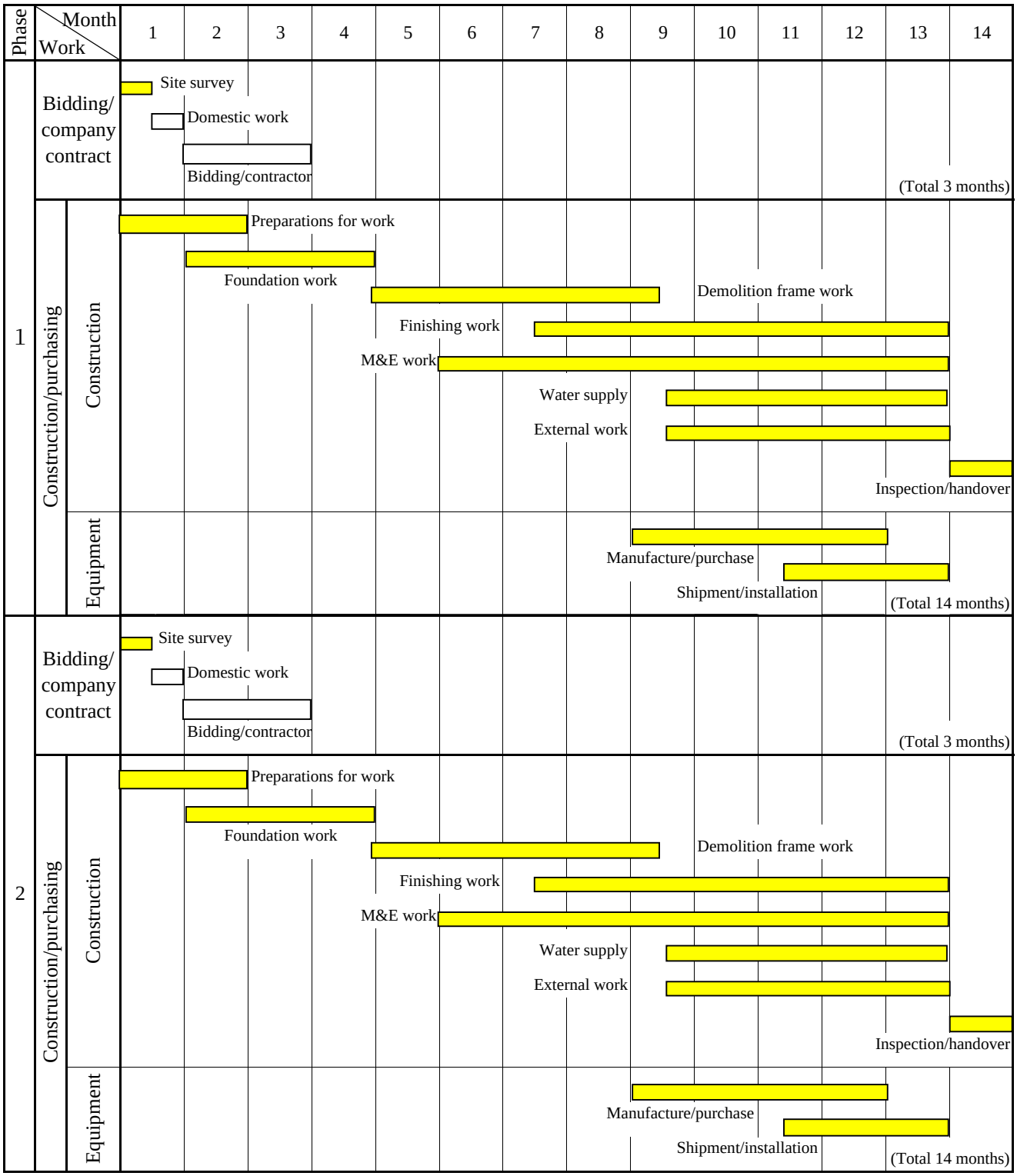
Fig-2.9 Site Map



Target Sites	
1:Mtendere	2:Chunga
3:Kabanana	4:Northmead
5:Ng'ombe	6:Libala stageIII
7:Chilenje South	8:Chelston
9:Chazanga	10:Chawama/John Howard
11:PHI Site Marapodi/Mandevu	12:Jack

Existing Basic Scools	'2002deta
1:Arthur Wina Basic	47:Chibolya
2:Burma Road Basic	48:Chilenje "B"
3:Chainda Basic	49:Chipata
4:Chaisa Basic	50:Chisengalumbwe
5:Chakunkula Basic	51:Chitanda
6:Chamba Valley Basic	52:Chitukuko
7:Chawama Basic	53:Chunga
8:Chelston Basic	54:Desai
9:Chilenje Basic	55:George Central
10:Chimwemwe Basic	56:Edwin Mulongoti
11:Chinika Basic	57:H M Nkumdula
12:Chingwelo Basic	58:Highland
13:Daina kaimba Basic	59:Hillside
14:Emmasdale Basic	60:Justin Kabwe
15:John Laing Basic	61:Kabanana
16:Kabulonga Basic	62:Kabwata
17:Kaunda Square Basic	63:Kalingalinga
18:Kizito Basic	64:Kamanga
19:Libala Basic	65:Kamulanga Basic
20:Lilanda Basic	66:Kamwala
21:Lilayi Basic	67:Kamwala South Basic
22:Lotus Basic	68:Kapwelyomba
23:Lusaka Boys Basic	69:Kasamba
24:Lusaka Girls Basic	70:Lusakasa
25:Mahtma Gandhi Basic	71:Mambilima
26:Matero Boys Basic	72:Matero East
27:Muchinga Basic	73:Mkandawire
28:Mumana Basic	74:Mtendere
29:Mumuni Basic	75:Mutambe
30:Muyooma Basic	76:Nelson Mandela
31:Namando Basic	77:Regiment
32:New Kanyama Basic	78:Roma Girls
33:Ng'ombe Basic	79:St.Francis
34:Ngwelele Basic	80:State Lodge "A"
35:Northmead Basic	81:State Lodge "B"
36:Prince Takamado Basic	82:T.Mwanakatwe
37:S.M.Kapwepwe Basic	83:Thornpark
38:St.Patrick's Basic	84:Twalumba
39:St.Monica's Basic	85:Twashuka
40:Tunduya Basic	86:Twatasha
41:Woodlands "A" Basic	87:U.T.H
42:Yotamu Mulaya Basic	88:Vera Chiluba
43:Jacaranda Basic	89:Woodlands "B"
44:Olympia Basic	90:Nyumba Yanga
45:Chainama	91:Baufeni
46:Chidelo	

Table 2.27 Project Implementation Schedule



2-3 Summary of Work to be Executed by Zambia

2-3-1 Work to be Executed by Zambia

The following matters will be executed by the Zambian government.

① Secure the land for the project and ensure its ownership into the future

② Remove existing facilities and structures that may hinder the construction and fell trees prior to the start of construction

③ Perform electric wiring and water piping to the site and drainage from the site, and other incidental facility construction and work

④ Pay the advice fees, payment commissions, etc., for the Authorization to Pay (A/P) to Japanese banks in accordance with the Banking Arrangement (B/A)

⑤ Speedily conduct necessary customs procedures for the equipment and materials for the project

⑥ Provide exemption from the customs duties levied in Zambia on the services and equipment/materials provided in accordance with the approved contract, and the domestic taxes levied on Japanese companies and Japanese individuals and other fees

⑦ Ensure the means for entry to and residence in Zambia needed to provide the services of the Japanese individuals and employees of Japanese companies needed to provide services and equipment/materials in accordance with the approved contract

⑧ Issue the permits, exemptions etc. needed for project implementation, without delay

⑨ Secure the budget needed for satisfactory operation of the classrooms constructed in the project, and assign suitable teachers

⑩ (To be done by the Ministry of Education) Implement regular monitoring to ensure that the facilities constructed and equipment/materials provided by the grant aid are being suitably maintained by the Ministry of Education or the PTA of those schools, etc., and provide appropriate guidance and advice as needed

⑪ (To be done by the Ministry of Education) Establish the personnel and budgetary means for maintenance of water supply facilities

⑫ Bear all costs needed for planning not provided by Japanese grant aid

2-3-2 Estimated Cost of the Aid Project

The following table shows the expenses that must be covered by Zambia in the event that this project is implemented by means of grant aid of Japan, in accordance with the estimation conditions shown in (2) below.

(1) Costs borne by Zambia

Unit: US$

Item	Phase 1	Phase 2	Total
(1) Site preparation costs	7,780	4,780	12,560
(2) Electricity/water lead-in costs	38,483	67,085	67,225
(3) Gate/fence construction costs	52,318	58,436	110,754
Total	88,382	103,096	190,539

(2) Conditions for estimation

- Date of assessment July 2002
- Exchange rate 1US$ = kw 4,300

- Construction period Work will be carried out in two phases, with the contract and work period needed for each phase as shown in the construction schedule.
- Other This project is to be implemented in accordance with the grant aid programme of the Japanese government.

2-4 Project Operation/Maintenance

2-4-1 School Administration

Nine Provincial Education Offices serve as subordinate organizations for the national Ministry of Education, and each district in the province has its own education office. These District Education Offices make recommendations regarding the appointment and assignment of head teachers to the Ministry of Education's Teaching Service Commission (TOS), which is responsible for making the actual appointments and assignments. In the case of this project, the project will issue a request for the assignment of head teachers to the District Education Office via the MOE's implementing agency, the Directorate of Planning Unit. The District Education Office will make recommendations and the TOS will conduct the actual appointments and assignments.

With regard to pupils, every year in October, parents submit application forms to individual schools for first grade pupils to enter school. During December, the school head teacher, the PTA, the community, and so on, selects the pupils who are to be admitted. The selection criteria are that the pupil must be between the ages of 7 and 9 and live near the school. Each school is also required to organize a PTA with the head teacher as its chairman. The role of the PTA is to collect funds for school administration and to conduct facility repairs, expansion, maintenance and so on using these funds.

The roles of each government body are shown below.

[Ministry of Education]

- Draft education laws and regulations
- Draft education policies
- Draft education plans
- Develop curriculum
- Allocate budgets

  etc.

[Provincial Education Office]

- Coordinate with the national MOE
- Draft plans on the provincial level
- Monitor the quality of education

  etc.

[District Education Office]

- Implement education policies relating to basic education
- Plan and implement basic education

  etc.

In addition, the MOE sets up Education Boards in each district to monitor education at individual schools and in individual districts on behalf of the MOE.

When this project is implemented, the PTA of each school will maintain the schools that are provided through the grant aid programme.

As of March, 2002, "Free Education" for Grades 1-7 was enforced. This new system restricts the levying PTA fees and supplementary instruction fees. For this reason, PTA fees may decrease as a result of the new system. Appropriate budgetary steps by the Ministry of Education and establishment of maintenance funds by the PTA will be necessary.

2-4-2 School Administration Expenses

When this project is implemented, the increase in the number of teachers for the administration of the project schools, in accordance with MOE guidelines, will comprise 34 teachers per school for a school with a total of 41 classes in all grades. Adding to this number a head teacher and a deputy head teacher gives the following number of required teachers per term:

Head teacher	1 x 6 schools = 6 persons
Deputy head teacher	1 x 6 schools = 6 persons
Teachers	34 x 6 schools = 204 persons

In the Poverty Reduction Strategy Paper (PRSP), short-term goal 2 cites thorough training of teachers and instructors and calls for a 20% increase in rate of attendance at teacher training college by 2004. There are 14 teachers training colleges, and together these schools graduate 4,000 teachers each year. As the number of teachers required by this project represents about 5.1% of this figure, it is thought that the necessary teachers will be assigned.

The yearly personnel costs for the increased number of head teachers, deputy head teachers, and teachers required by this project are as follows.

Head teacher	Kw392,000/month x person x 12 months x 6 persons
	= Kw28,224,000/year
Deputy head teacher	Kw363,000/month x person x 12 months x 6 persons
	= Kw26,136,000/year
Teacher	Kw298,000/month x person x 12 months x 204 persons
	= Kw729,504,000/year
Total	Kw783,864,000/year

This amounts to approximately 0.25% of the total personnel expenditure of the MOE (based on 2001 records). This can be regarded as almost insignificant compared with overall personnel costs, so this personnel plan can be judged quite feasible. The MOE has promised to provide the teaching personnel

required for the new schools. Other personnel required may include caretakers, security guards and janitors.

2-4-3 Operation/Maintenance Costs

(1) Facility maintenance

As long as the buildings constructed by this project are used appropriately, repainting of the inside walls about once every 10 years and painting of fittings about once every five years should be sufficient. The writing boards will need to be repainted about once a year. The expenses needed to conduct this repainting can be estimated as follows, so money should be set aside regularly for this purpose.

Unit: Kw

ITEM	FREQUENCY	Kw/school/year
Spider-Truss	Once every 10 years	1,371,500
Inside Walls	Once every 10 years	1,594,000
Outside Wall	Once every 10 years	382,300
Fittings	Once every 5 years	2,530,500
Writing board	Once every year	3,003,100
Total		8,881,400

(2) Maintenance of sanitation facilities

In general, the facilities constructed by this project are maintenance-free. However, at a minimum, they require cleaning and maintenance as noted below. The cost will be approximately Kw750,000 /school/year.

1) Cleaning/maintenance of pit latrine:

Cleaning of pit interior and removal of excrement (about once a year)

2) Cleaning/maintenance of septic tanks (separation tanks):

Periodic inspection and cleaning of tank interior (to remove dirt and foreign matter from strainer)

3) Cleaning/maintenance of elevated water tanks:

Periodic inspection and cleaning of tank interior (about once a year)

(3) Maintenance of water supply facilities (borehole-related facilities)

Maintenance costs of water supply facilities include running costs, such as electricity expenses, and reserves for repair of pumps and others. Because the maintenance of the facilities is part of school administration, these costs are planned as part of school administration expenses.

1) Power costs Kw7,200,000/school/year
2) Reserve funds for pump repair Kw900,000/school/year
(when pumps are replaced after 8 years)

(4) Yearly maintenance costs

Totaling the costs in (1)-(3) above, the cost per school results in Kw17,700,000/year. The results of the survey of neighboring schools show that the average annual school administration budget is Kw36,200,000 and the average annual maintenance expenditure is Kw16,300,000. Accordingly, the total maintenance cost mentioned above is judged to be reasonable. Although maintenance costs are covered practically by PTA dues, PTA dues cannot be received from Grades 1-7 pupils because free education is clearly stated.

Yearly PTA dues at the schools surveyed by the basic design survey team came to an average of Kw78,000 per pupil. Assuming the number of Grades 8 and 9 pupils is 240, the yearly PTA dues total Kw18,720,000 per school. Adding the maintenance cost of Kw2,050,000 per school provided by the government totals Kw20,770,000. Accordingly, it will be possible for each subject school to bear the aforementioned costs. However, because there is a possibility that PTA activity expenses will be reduced, additional revenue sources will become necessary to continue the activity of the same scale. The Zambian government has an intention to supply part of funds by taking steps to reduce debt under the heavily indebted poor country initiative for free education. In addition, in order to provide free education, the Ministry of Education advocates that PTA should raise funds by collection of waste articles and other means. Judging from the above discussions, the above costs are sums that can be borne.

CHAPTER 3 PROJECT EVALUATION AND RECOMMENDATION

Chapter 3 Project Evaluation and Recommendation

3-1 Effects of the Project

Under this project, 12 new basic schools will be constructed in Lusaka District (with 288 classrooms, including 12 special classrooms), as well as 12 administration blocks, 24 lavatory blocks, 12 guardhouse blocks and 12 water supply/drainage facilities. In addition, teaching materials will be provided for both regular classrooms and home economics rooms. This will have the following effect.

(1) Direct effects

Current situation and problems	Measures implemented under this plan (grant aid)	Effect of plan and the degree of improvement
1. Approximately 30% of the children aged 7 who are of the age to start grade 1 are unable to gain access to education in any school due to insufficient facilities. Moreover, there has been a dramatic increase in population in urban areas, and the scarcity of classrooms has become even more severe.	Twelve new basic schools will be constructed in Lusaka District to provide an additional 276 regular classrooms and 12 special classrooms.	The number of pupils entering middle basic schools in the Lusaka District will increase as follows. In 2002: 15,688 pupils In 2006: 18,088 pupils
2. Due to insufficient facilities, teaching at basic schools is being done in plural session routine (average number of routines: 2.26).	Same as above	Of the overcrowding population of 27,946 children, this will enable 14,400 children to be accommodated, reducing the average number of session routines to 2.02.
3. Due to insufficient junior secondary school facilities, more than half of the children in the first grade are unable to advance to Grade 8.	Same as above	The number of pupils entering Grade 8 in the Lusaka District will increase as follows. In 2002: 4,391 pupils In 2006: 5,831 pupils
4. The proposed revisions to the curriculum are designed to teach pupils the basic technical knowledge they need to be productive members of society by the end of the nine year basic education program. However, only 78% of basic education schools are equipped with home economics rooms.	One home economics room will be provided for each school and the necessary teaching materials will be provided.	The proportion of schools equipped with home economics rooms will be increased to 82%, providing children with increased educational opportunities.

(2) Indirect effects

Traditionally in Zambia, local community members have been engaged actively in school administration. The project will provide lighted classrooms as a setting and opportunity for adult and literacy education and community activities after school hours.

3-2 Issues and Recommendations

To enable the continuous and effective use of the school facilities constructed through this project, and to ensure that these facilities are maintained in the future as well, the Zambian government must deal with the following issues.

(1) Funds to cover school administration and maintenance expenses

In Zambia, the full and middle basic school administration and maintenance expenses are mostly covered by PTA dues. The Zambian government has provided free education (education without PTA dues) for Grades 1-7 pupils since 2002. For this reason, the Ministry of Education has carried out a policy to allocate the national budget for education, which was increased by steps to reduce debt (HIPC)**,** as a source of funds for the free education since 2001, and advocated that PTA should raise funds by collection of waste articles and other means. In addition to the appropriate budgetary steps by the government, it will be necessary for the PTA to set up a system of raising funds to cover school administration expenses.

(2) Recruitment of teachers

In Zambia, 4,000 new teachers graduate every year. This project will create 6 new schools in each phase, and will require 204 teachers (approximately 5% of the new graduate teachers), and 12 head and deputy head teachers. In addition to the appropriate training and assignment of teachers by the Ministry of Education, it will be necessary to take appropriate measures, such as the retraining of current teachers and training for the plural Session routines.

(3) Appropriate school administration by head teachers

In Zambia, the organization of a PTA for each school (with the head teacher as its chairman) is mandatory. The Ministry of Education should provide guidance to ensure that each head teacher obtains the cooperation of parents in properly maintaining school facilities.

(4) Transfer of grade 2-7 pupils

Approximately 50% of the basic schools in Lusaka District suffers from overcrowding. The transfer of pupils to the new schools that will be constructed under this project will help alleviate (albeit only partially) the overcrowding at existing schools.

(5) Provision of textbooks and teaching materials

Textbooks for major courses (Zambian and arithmetic), except for English, are not distributed as noted in the BESSIP, which is, one textbook for every two pupils. Therefore, it will be necessary to distribute the textbooks with integrity.

(6) With the cooperation of the PTA, each school head teacher will implement thorough measures to prevent vandalism, such as the hiring of security guards, etc.

With regard to the operation and maintenance of existing basic schools in Lusaka District, the preparation of Maintenance Manuals and other procedures on the Zambia side are going smoothly, and no request for technical assistance has been made to Japan. Moreover, while there has been no direct coordination with other donors involved in this project, expanded cooperation for future projects relating to enhanced school operation and maintenance, retraining of teachers, etc., can be anticipated.