

No. 04

**BASIC DESIGN STUDY REPORT
ON
THE PROJECT
FOR
THE CONSTRUCTION OF JUNIOR SECONDARY SCHOOLS
IN
THE REPUBLIC OF ZAMBIA**

DECEMBER 1988

JAPAN INTERNATIONAL COOPERATION AGENCY

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国際協力事業団

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PREFACE

In response to the request of the Government of the Republic of Zambia, the Government of Japan has decided to conduct a basic design study on the Project for the Construction of Junior Secondary Schools, and entrusted the survey to the Japan International Cooperation Agency (JICA). JICA sent to Zambia a study team headed by Mr. Tetsufumi MIKAMI, Grant Aid Division, Economic Cooperation Bureau, Ministry of Foreign Affairs, from 10 August to 18 September, 1988.

The team had discussions on the Project with the officials concerned of the Government of Zambia and conducted a field survey in Zimba, Jumbe and Lukona areas. After the team returned to Japan, further studies were made, a draft report was prepared and a mission to explain and discuss it was dispatched to Zambia. As a result, the present Report has been prepared.

I hope that this Report will serve for the development of the project and contribute to the promotion of friendly relations between our two countries.

I wish to express my deep appreciation to the officials concerned of the Government of the Republic of Zambia for their close cooperation extended to the team.

December 1988

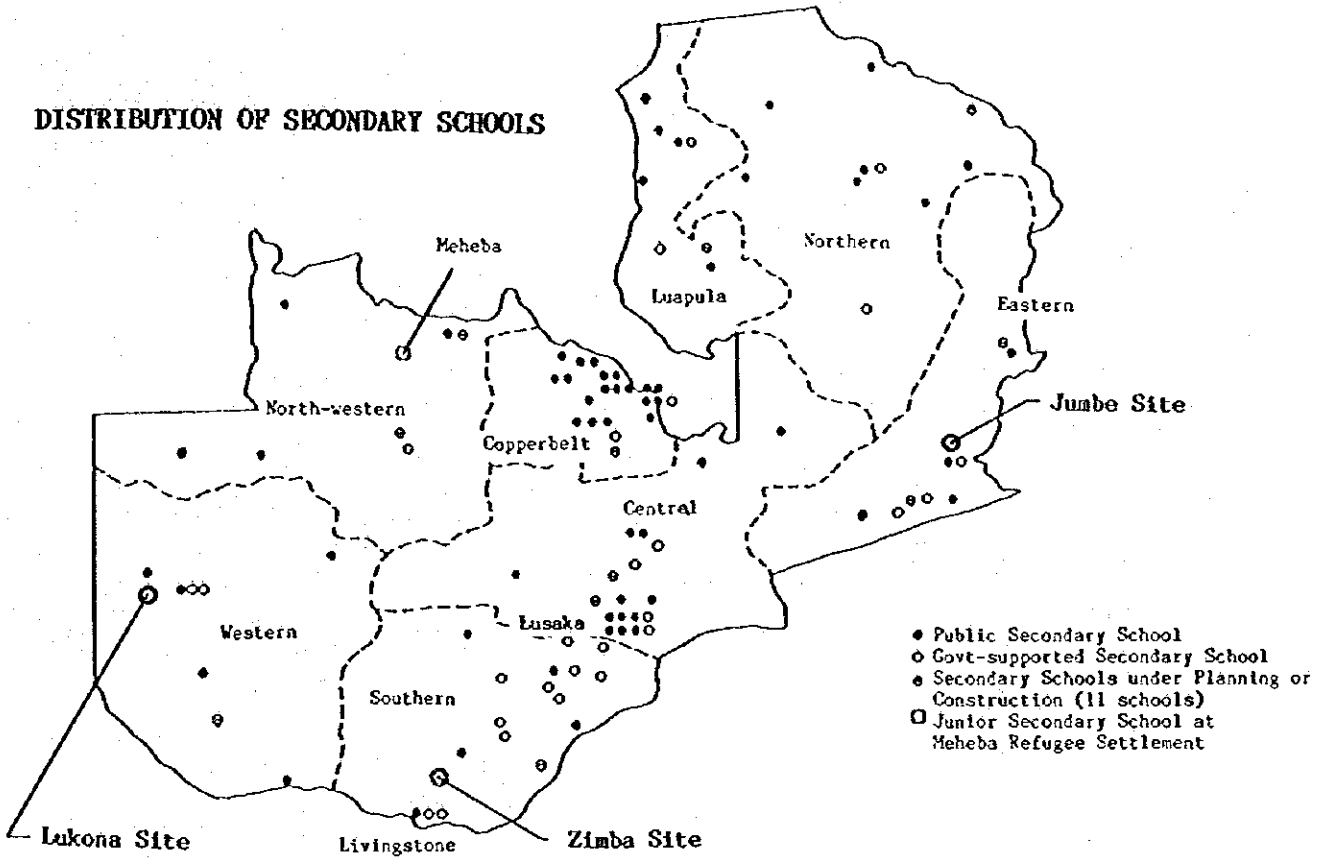


Kensuke Yanagiya

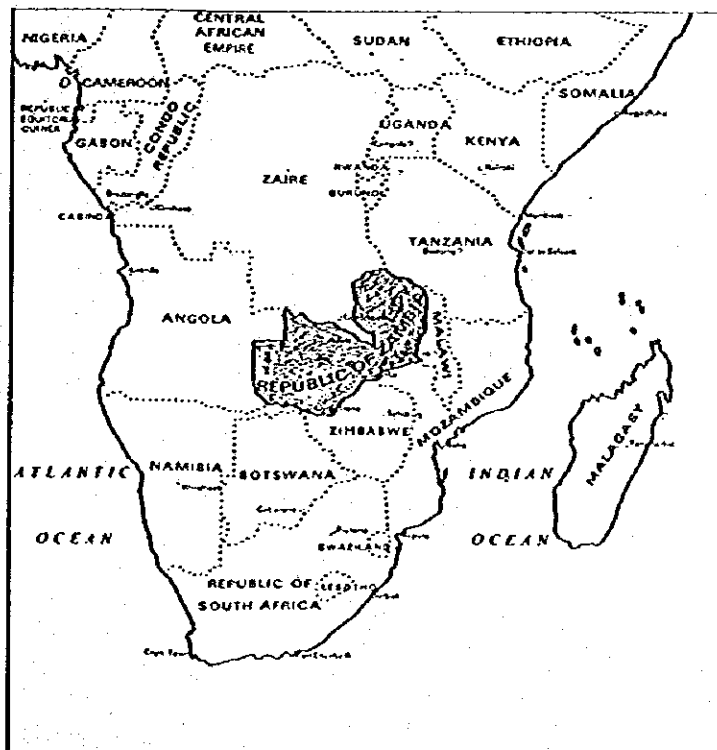
President
Japan International Cooperation Agency

MAP

DISTRIBUTION OF SECONDARY SCHOOLS



SOUTHERN AFRICA SHOWING THE RELATIVE POSITION OF ZAMBIA



SUMMARY

SUMMARY

The economy of the Republic of Zambia depends mainly on copper, which accounts for about 90% of the country's exports. Most manufactured goods including daily commodities are imports. This makes the economy vulnerable to fluctuations of the international prices of copper. Considering this situation, the Government of Zambia aims at stabilisation of the economy through the diversification of industry using domestic materials, but the economy has not attained the expected standard of development mainly because of a shortage of appropriate human resources.

To develop human resources with an adequate level of skills and knowledge to participate in productive activities necessary for economic development, the government decided on a fundamental renovation of the country's education system in the Third National Development Plan (TNDP) for the purpose of the qualitative improvement and quantitative extension of education. The new education system is to be instituted by shifting the present seven-year compulsory primary education to a nine-year system composed of a six-year primary education and a three-year junior secondary education. As the burden of expanding facilities and teaching staffs would be too heavy if the new system were instituted immediately, a provisional system was established in 1983 consisting of a seven-year primary education and a two-year junior secondary education, with the expansion of junior secondary school facilities being promoted spontaneously.

In the Fifth Education Project, the Government of Zambia planned the construction of 16 junior secondary schools in rural areas with international aid funds, of which 11 schools are being constructed with funds from the World Bank and the African Development Bank. The Government of Zambia has requested grant aid of the Government of Japan for the construction of the remaining five schools.

Examining this request, the Government of Japan decided to conduct a basic design study of three of the five schools, and sent a study team to the Republic of Zambia in August 1988. The study team discussed and reviewed the contents of the request, surveyed the background of the

project, site conditions and construction situation, confirmed the implementation organisation of the project, and conducted other studies related to the project.

After an examination of the study results, it was decided that all three schools would be designed for five classes per grade, 10 in total (400 pupils), and that boarding facilities would be provided to accommodate about 80% of the pupils. Each school is planned to consist of the following facilities and contain the following equipment:

1. Buildings

- (1) Administration building
- (2) Classroom building : classrooms, science laboratory, homecraft rooms, workshop, library, etc.
- (3) Dormitories
- (4) Dining room & kitchen: dining room also serving as an assembly room, kitchen, etc.
- (5) Ablution block : toilets, shower rooms, laundry rooms
- (6) Staff houses : teaching staff houses
support staff houses
- (7) Others : garage, storerooms, generator room (Jumbe and Lukona), electricity room (Zimba)

2. Equipment

Laboratory and training equipment (for natural science, homecraft, metalwork, woodwork, fine arts, physical training, agriculture)

A-V equipment

Furniture for the library and for educational purposes

Cooking equipment, canteen utensils

Tools and equipment for maintenance of school facilities

Vehicles to be used for school management

The situations of the three project sites are described as follows:

(1) Zimba Junior Secondary School

The project site is located at 400 km southwest of Lusaka, facing a main road connecting Lusaka and Livingstone. The shape of the site is irregular and the ground is estimated at 420 by 550 meters in

extent. There is a gradient from the north and east sides toward the southwest. A power transmission line crosses the northwest corner of the site and a water pipe runs to about 300 meters east of the site. A telephone line runs along the main road. There are a small clinic and markets in Zimba village, which lies east of the site.

(2) Jumbe Junior Secondary School

The project site is located at about 80 km northwest of Chipata, which is 580 km east of Lusaka. The site is spread over a wooded area, about 420 by 600 meters, and has a gentle grade from east to west except for a steep slope at the south corner. There is no electricity or water supply as yet around the site, nor are there any houses within 1.5 km distance.

Roads connecting Chipata and Jumbe are unpaved and may offer difficulties for transporting construction materials in the rainy season. It is also assumed that the work of felling trees within the site will require considerable time and expense.

(3) Lukona Junior Secondary School

The project site is located at 40 km by waterway and 10 km by land (by the shortest route) from Mongu, which lies 590 km west of Lusaka, capital of the Republic of Zambia. The site lies on a sandy hill about 30 meters high above flood plains. It is rectangular, 500 by 700 meters, rather high along the central east-west axis, and similar to a horse saddle. There is no electricity or water supply as yet around the site. In the nearby area are the scattered houses of people living self-sufficiently.

The Lukona Junior Secondary School requires careful consideration for transport of construction materials and equipment, and for the procurement of necessary foodstuffs and fuel after the school begins operation.

This project will be implemented by the Zambia Education Projects Implementation Unit (ZEPIU), which has been in charge of the Fifth Education Project under the Ministry of General Education and Culture (MGEC). The three schools will be under the administration of the Ministry of General Education, Youth and Sport (MGEYS) after completion of the project.

After signing of the Exchange of Notes between the Government of Zambia and the Government of Japan, the project will proceed to the consultant agreement, working design, preparation of bidding documents and bidding. Following the evaluation of the bids and conclusion of the construction contract, the construction work will start. The construction period will be divided into two phases; phase I for the construction of the Zimba and Jumbe schools and phase II for the Lukona school.

In addition, the following matters need to be considered for the efficient implementation of the project and proper management of the schools;

- 1) completion of site preparation work at each site and drilling bore holes in the Jumbe and Lukona sites, the work which is under the responsibility of the Government of Zambia,
- 2) assurance of budget appropriation for the school management, and
- 3) assurance of water transport on the Zambezi River throughout the year for the Lukona school.

In spite of necessity for a very large number of junior secondary schools in line with the reform of the education system, construction remains rather slow because of severe economic conditions. The establishment of the three schools in rural areas where children presently have insufficient opportunities for secondary education will increase the capacity of enrollment by about 600 pupils in junior secondary schools, equivalent to the 0.4% increase of the enrollment rate in the entire country. In other words, 600 more young people will proceed to higher education, or will enter the industrial sector with practical knowledge and skills. Furthermore, it is expected that this project will provide tremendous effect for the Government of Zambia including contribution to reformation of traditional industry, exploitation of new industry and development of

rural areas by attracting concentrations of population around the schools.

In consideration of all the above aspects, this project is regarded as well worth realising through grant aid from the Government of Japan, with considerable benefit thereby engendered.

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ABBREVIATIONS

AfDB	: African Development Bank
FNDP	: Fourth National Development Plan
IMF	: International Monetary Fund
INDP	: Interim National Development Plan
JICA	: Japan International Cooperation Agency
JOCV	: Japan Overseas Cooperation Volunteers
MEC	: Ministry of Education and Culture
MGEC	: Ministry of General Education and Culture
MGEYS	: Ministry of General Education, Youth and Sport
NORAD	: Norwegian Agency for International Development
OECD	: Overseas Economic Cooperation Fund
PIU	: Projects Implementation Unit
SIDA	: Swedish International Development Agency
TNDP	: Third National Development Plan
WB	: International Development Association of the World Bank
ZEPIU	: Zambia Education Projects Implementation Unit

CHAPTER 1 INTRODUCTION

CHAPTER 1 INTRODUCTION

The economy of Zambia mainly depends on the mining industry, including copper, of which Zambia has the fifth highest production in the world. This makes the economy vulnerable to fluctuations of the international price of copper.

Since its independence in 1964, Zambia has been compelled to rely on foreigners to act as managers and senior engineers, and to fill other important posts in many industrial sectors due to a shortage of trained Zambian personnel. In view of this situation, the Government of Zambia has attempted to reinforce education under the First National Development Plan, which aimed at the "Zambianisation of Industry" through the cultivation of human resources. The government has drawn up national development plans aiming at stabilisation and development of the economy and freedom from excessive reliance on copper through industrial diversification utilising domestic materials. To attain these goals, the fostering of a large number of qualified workers is required. The Third National Development Plan (TNDP, 1981 - 1984) was designed to extend the period of compulsory basic education from seven to nine years for the qualitative improvement and quantitative expansion of the education system.

However, the number of classrooms of grades 8 and 9 in Zambia at that time was 1,201, insufficient to cater for the expansion accompanying the two-year extension of the compulsory education period which would require 6,720 more classrooms, and it was impossible to realise the plan. So the Government of Zambia established a provisional system to shift the existing three-year junior secondary education and two-year senior secondary education to two and three years respectively, a change which came into force in 1983. Correspondingly, the construction of new two-grade junior secondary schools was decided to supplement the existing five-grade secondary schools. When the progression rate from primary schools to junior secondary schools reaches 100%, the nine-year compulsory education concept, called "Basic Education", can be realised.

Because of the severe shortage of school facilities as mentioned above, the government planned the construction of 16 junior secondary schools with international aid funds, in addition to those constructed by the government itself. Eight schools among the 16 were constructed with funds by the World Bank (WB) and three by the African Development Bank (ADB). Nine of these schools have already been opened or completed, and the other two are now under construction. The Government of Zambia has requested of the Government of Japan grant aid for the construction of the five schools which have not yet been funded.

Examining this request, the Government of Japan decided to conduct a basic design study of three of the five schools, and sent a study team headed by Mr. Tetsufumi MIKAMI, Grant Aid Div., Economic Cooperation Bureau, Ministry of Foreign Affairs, to the Republic of Zambia from 10 August to 18 September, 1988.

The study team discussed and reviewed the contents of the request, surveyed the background of the project, site conditions and construction situation, confirmed the implementation organisation of the project, explained to the Zambian authorities the scope and procedure of grant aid programmes, and confirmed the scope of responsibilities of both governments when the project is realised.

Based on previous study results, JICA carried out further studies in Japan concerning the project including scale, construction period, costs and feasibility, and prepared the draft of the basic design study (draft final report) on the basic design study. The final report mission, headed by Mr. Tetsufumi MIKAMI, Grant Aid Div., Economic Cooperation Bureau, Ministry of Foreign Affairs, was sent to the Republic of Zambia from 18 to 29 November, 1988. The mission presented the draft final report to the Zambian authorities concerned, discussed and confirmed the contents of the report and studies. Following an overall agreement as to the basic design study report, the representatives of each party signed the minutes on discussions on 24 November. The members of the study teams, schedules of their activities, minutes on discussions and the list of personnel interviewed in Zambia are attached to this report in the annex.

This basic design study report includes the background, objectives and contents of the project, optimum basic design of the junior secondary schools, project costs, implementing organisation and evaluation of the project based on review of the feasibility of this project and examination of data and information acquired through the discussions with the Zambian authorities and field surveys in Zambia.

CHAPTER 2

BACKGROUND OF THE PROJECT

CHAPTER 2 BACKGROUND OF THE PROJECT

2-1 Education in Zambia

(1) Education System

Before 1983, the education programme in Zambia was composed of seven years of primary school (compulsory), three years of junior secondary school, two years of senior secondary school, primary-level teacher training school or vocational training school, and colleges, secondary-level teacher training colleges or special courses like engineering, agriculture, commerce, etc.

The Government of Zambia recognised the necessity of fostering many people with sufficient basic knowledge and skills for productive activities in addition to a small number of highly trained people, to attain the goals of the national development plans. However, the previous education system required reform to satisfy this need. Thus, in the TNDP, compulsory education was proposed to be extended from seven to nine years in future, and a provisional system to provide a bridge between the old seven-year system and the new nine-year one was established. In this transitional system, primary education consists of seven years, junior secondary education two years and senior secondary three years. Also, the minimum entry qualification for primary school teachers' college was upgraded to the completion of senior secondary education.

In each province, among the primary school pupils, those having attained the highest marks proceed to junior secondary schools in whatever numbers are allowed by the capacity of school facilities in that district. Likewise, pupils in the junior secondary schools having the highest marks at the time of final examinations are allowed to enter senior secondary schools or vocational schools. Those having made the highest marks in the Cambridge Overseas School Certificate (though the examination has been rather "Zambianised" recently) can enter colleges.

Outside the formal education system, literacy and vocational training is provided in the name of "Continuing Education."

The Ministry of General Education, Youth and Sport (MGEYS) supervises primary, secondary and continuing education, while higher level education is under the control of the Ministry of Higher Education.

Figures 1 and 2 describe the education system in Zambia,

(2) Literacy Rate

According to the Country Profile 1985 issued by the Central Statistics Office, literacy rate among persons aged 15 and over, counting those who had not completed lower primary education (grade 1 to grade 4) as illiterate, was 64.3% for males and 42.6% for females, for a 53.0% total as of 1980. The present literacy rate is much higher than these figures, considering that the number of people who did not have sufficient opportunities for education due to limited number of primary schools before independence in 1964 has been decreasing while the population of young people is increasing by about 4% a year, and about 95% of them receive education.

(3) Number of Pupils and Students

Table 1 shows the enrollment rates in primary schools, secondary schools, colleges for teacher training and technical education, and the University of Zambia from 1971 and 1984. The increase rates of the number of pupils in the primary and secondary schools are much higher than the annual increase rate of population (about 4%) and the expansion rate of educational facilities (Table 5). This means not only the improvement of the enrollment rate but also the increase of the number of pupils per class.

Concerning tertiary education, the number of university students shows steady increase while that in teacher training and technical education is at a standstill or rather decreasing

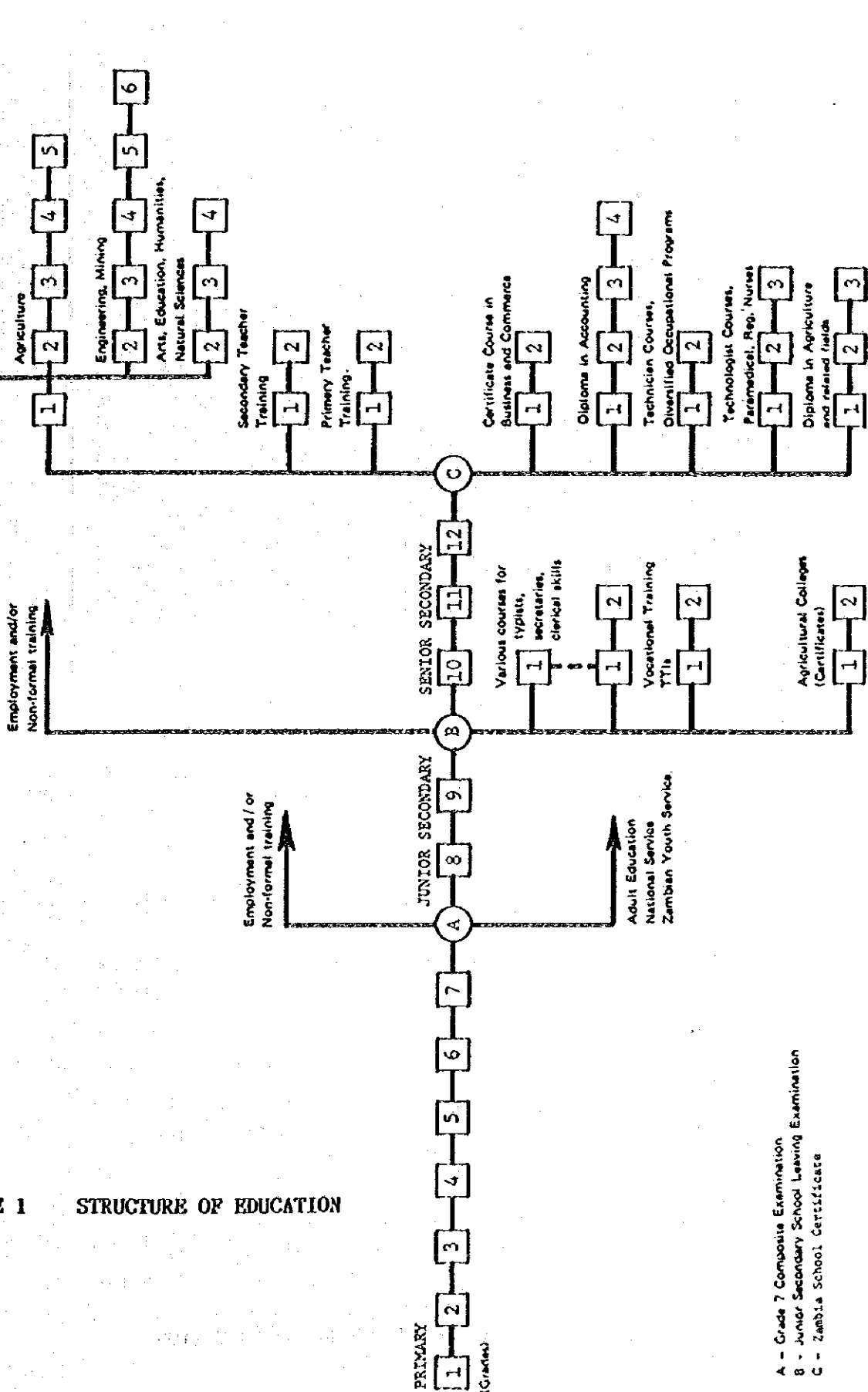
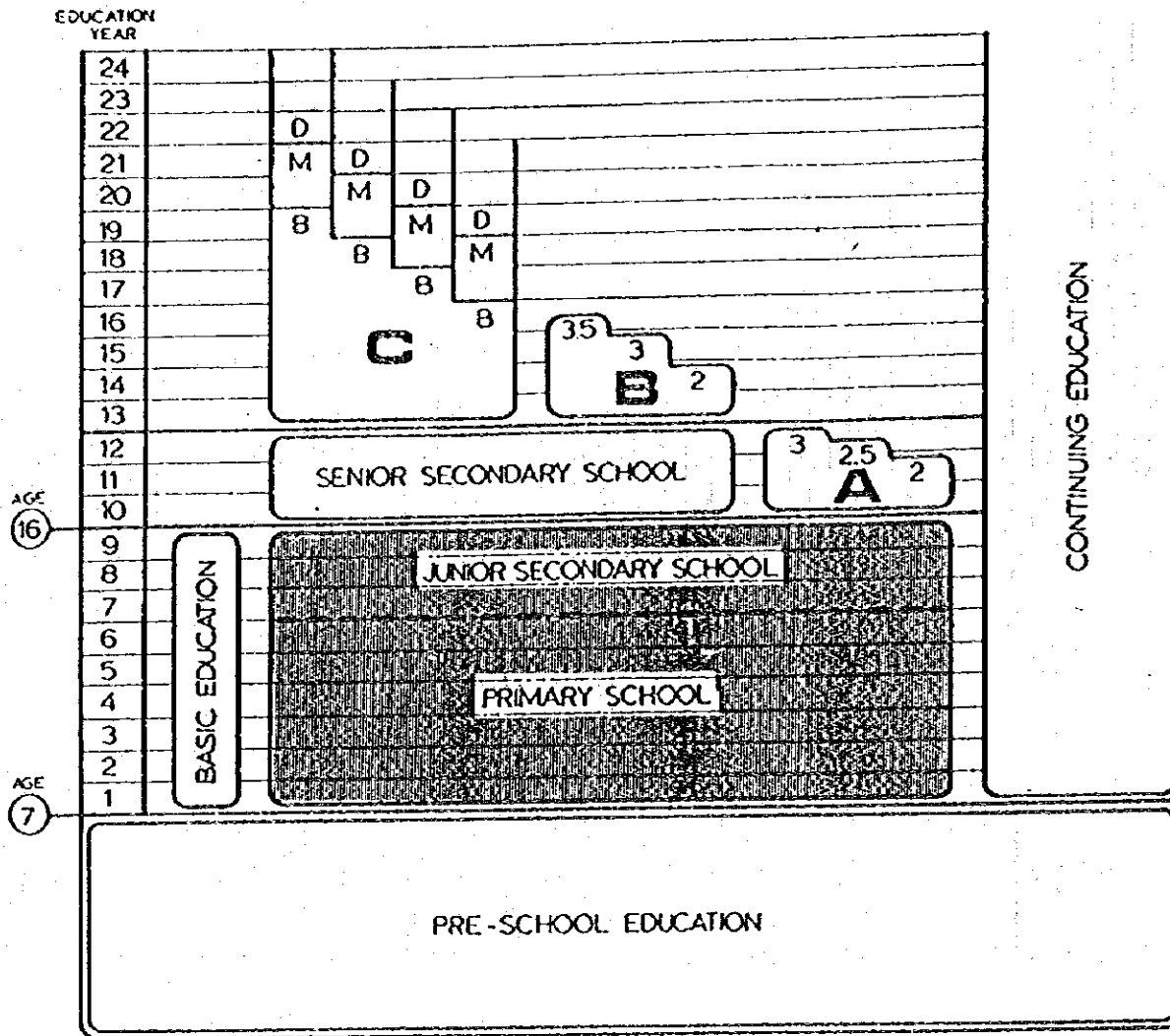


FIGURE 1 STRUCTURE OF EDUCATION

A - Grade 7 Composite Examination
 B - Junior Secondary School Leaving Examination
 C - Zambia School Certificate



NOTES

- A** Various vocational programmes, e.g., Trades, Nursing, Teacher Training, etc., leading to a certificate.
- B** Various programmes, e.g., Agriculture, Technology, Commerce, Nursing, etc., leading usually to a diploma.
- C** University degree:
 - D = Doctorate.
 - M = Master.
 - B = Bachelor: 4 years – Ordinary.
5 years – Engineering, Agriculture, etc.
6 years – Veterinary Science.
7 years – Medicine.

NB

In A and B there are also some courses which take less than 2 years.
From primary to senior secondary an education year represents a grade.

FIGURE 2 FINAL STRUCTURE OF EDUCATION

because the school facilities have hardly been expanded due to the economic difficulties.

TABLE 1 TOTAL ENROLLMENT BY TYPE OF INSTITUTION

Year	Primary Schools	Secondary Schools	Teacher Training	Technical Education	University of Zambia
1971	729,801	56,005	2,419	3,656	1,566
1972	777,873	60,051	2,428	4,123	1,765
1973	810,234	61,354	2,642	4,609	2,244
1974	858,191	65,764	2,900	5,666	2,612
1975	872,392	73,049	3,070	5,421	2,354
1976	907,867	78,805	3,406	5,569	2,569
1977	936,817	83,887	3,780	5,709	3,102
1978	964,475	88,980	3,923	5,788	3,268
1979	996,597	91,795	4,406	5,284	3,399
1980	1,041,938	94,595	4,445	5,338	3,425
1981	1,073,314	98,862	4,485	5,502	3,923
1982	1,121,769	104,859	3,343	5,668	3,337
1983	1,194,070*	115,088	4,304	5,291	4,311
1984	1,260,366*	125,811	4,653	4,910	4,554

Source: Ministry of General Education and Culture

* Provisional

(4) Enrollment Rate

According to Zambian law, the primary school cycle starts at the age of seven. However, some children of expatriates enroll at the age of 11 and some at the age of five if regarded as capable of enrollment as shown in Table 2. In fact, 7-year-old children enrolling in the primary schools make up less than 45% of the total annual enrollment. However, the nominal enrollment rate sometimes exceeds 100% because it counts the number of children enrolled in grade one regardless of their age among the total population of 7-year-old children. Thus it does not always show the true enrollment rate.

Accordingly, the following methods are introduced to determine the enrollment rate in primary education. The enrollment rate is calculated in Zambia as the total enrollment of one grade divided by the total population of the appropriate age group.

TABLE 2 ENROLLMENT IN PRIMARY SCHOOLS BY AGE AND SEX - 1983

Region: Whole Country	Under							Over						
	7	8	9	10	11	12	13	14	14	14	14	14	Total	
Boys	2,924	35,631	36,657	18,212	3,385	792	246	91	45	57	98,040			
Girls	3,349	38,645	33,883	15,943	2,724	608	150	49	10	49	95,410			
Total	6,273	74,276	70,540	34,155	6,109	1,400	396	140	55	106	193,450			
Boys	380	3,122	33,755	35,311	18,970	4,946	1,070	475	123	100	98,252			
Girls	405	3,636	35,303	33,139	15,720	3,827	700	248	46	53	93,077			
Total	785	6,758	69,058	68,450	34,690	8,773	1,770	723	169	153	191,329			
Boys	12	469	3,582	29,970	33,105	18,981	5,871	2,206	437	205	94,838			
Girls	23	466	3,953	31,096	30,953	16,477	4,293	1,382	204	99	88,946			
Total	35	935	7,535	61,066	64,058	35,458	10,164	3,588	641	304	183,784			
Boys	0	26	529	3,818	27,656	31,235	18,484	7,740	2,138	769	92,395			
Girls	2	33	668	4,681	27,851	29,094	15,140	5,539	1,337	299	84,652			
Total	2	59	1,197	8,499	55,507	60,329	33,632	13,279	3,475	1,068	177,047			
Boys	0	10	95	520	3,649	22,469	25,556	18,358	7,403	3,267	81,322			
Girls	0	9	77	553	4,312	22,033	23,410	14,366	4,815	1,276	70,851			
Total	0	19	172	1,073	7,961	44,502	48,966	32,724	12,218	4,543	152,178			
Boys	0	2	6	40	663	4,014	21,645	26,414	17,331	10,167	80,282			
Girls	0	0	6	99	746	4,421	20,450	22,441	13,490	5,501	67,154			
Total	0	2	12	139	1,409	8,435	42,095	48,855	30,821	15,668	147,436			
Boys	0	0	0	1	79	620	4,347	22,287	30,952	29,174	87,460			
Girls	0	0	0	7	70	673	4,374	18,528	23,234	15,579	62,465			
Total	0	0	0	8	149	1,293	8,721	40,815	54,186	44,753	149,925			
Boys	0	1	2	2	12	15	6	13	7	23	81			
Girls	0	0	2	4	6	9	2	12	3	6	44			
Total	0	1	4	6	18	24	8	25	10	29	125			
Boys	3,316	39,261	74,626	87,874	87,519	83,072	77,225	77,584	58,436	43,762	632,675			
Girls	3,779	42,789	73,892	85,522	82,382	77,142	678,527	62,565	43,139	22,862	562,599			
Total	7,095	82,050	148,518	173,396	169,901	160,214	145,752	140,149	101,575	66,624	1,195,274			

ESN : Educationally Sub-Normal

Source: Educational Statistics - 1983

Ministry of General Education and Culture

When the children from age 7 to 13 who enrolled in the primary schools as of 1983 are calculated from Table 2 and divided by the total population of the same age group (provisional figure in 1983 based on the 1980 census), the enrollment rate will be --

$$1,019,980 / 1,241,250 \times 100 = 82.2\%$$

When the total enrollment calculated from Table 2 and 3 ignoring the age of primary school children is divided by the total population aged from 7 to 13, the rate will be --

$$1,195,274 / 1,241,250 \times 100 = 96.3\%$$

The children from the age of 7 to 13 enrolled in the primary or secondary schools (Table 2) divided by the total population of the same age group will be --

$$1,022,867 / 1,241,250 \times 100 = 82.4\%$$

The progression rate to secondary level education shows a steady annual increase. However there are only limited school places in secondary education to cater for primary school graduates with good marks. (Actually each secondary school takes students up to 110% to 120% of capacity.) Consequently, the progression rate from grade seven to grade eight declines when the expansion rate of primary school graduates is larger than that of the capacity of grade eight, the first year in secondary schools. As shown in Table 4, the progression rate reached 21% in 1983, the aim of the Fifth Education Project, but decreased to 19.8% in 1984. The rate has increased to 27.3% in 1988 owing to the foundation of new junior secondary schools supported by bank groups, as well as through the establishment of basic schools by communities.

When the number of 14- and 15-year-old children enrolled in junior secondary schools in 1983 is divided by the total population of the same age group, their enrollment rate will be --

$$24,664 / 297,750 \times 100 = 8.3\%$$

The rate of total number of students at the age of 14 and 15 enrolled in primary and secondary schools will be --

$$(151,319 + 24,664) / 297,750 \times 100 = 59.1\%$$

The rate of total enrollment in junior secondary schools will be --

$$60,816 / 297,750 \times 100 = 20.4\%$$

TABLE 3 SECONDARY SCHOOL ENROLMENT BY AGE, GRADE AND SEX IN THE WHOLE COUNTRY REGIONS - 1983

Grade	Sex	Under 12	12	13	14	15	16	17	18	19	Over 19	All Ages
8	Boys	22	186	770	2,582	5,045	5,653	3,357	1,157	355	54	19,181
	Girls	50	245	1,012	2,866	4,156	2,437	740	171	44	4	11,725
	Total	72	431	1,782	5,448	9,201	8,090	4,097	1,328	399	58	30,906
9	Boys	5	62	175	765	2,311	4,507	5,515	3,598	1,296	466	18,680
	Girls	19	69	231	1,163	2,956	3,733	2,311	636	96	16	11,230
	Total	24	111	406	1,928	5,267	8,240	7,826	4,234	1,392	482	29,910
10	Boys	0	1	29	176	809	2,184	4,377	5,430	3,682	1,350	18,038
	Girls	0	1	30	248	1,197	2,808	3,689	2,122	595	58	10,748
	Total	0	2	59	424	2,006	4,992	8,066	7,552	4,277	1,408	28,786
11	Boys	0	0	0	17	111	483	1,456	2,326	2,560	1,629	8,582
	Girls	0	0	0	33	207	696	1,405	1,295	680	154	4,470
	Total	0	0	0	50	318	1,179	2,861	3,621	3,240	1,783	13,052
12	Boys	0	0	0	0	12	115	526	1,373	2,583	3,874	8,483
	Girls	0	0	0	2	8	179	672	1,334	1,244	512	3,951
	Total	0	0	0	2	20	294	1,198	2,707	3,827	4,286	12,434
8-12	Boys	27	229	974	3,540	8,288	12,942	15,231	13,848	10,476	7,373	72,964
	Girls	69	315	1,273	4,312	8,524	9,853	8,817	5,558	2,659	744	42,124
	Total	96	544	2,247	7,852	16,812	22,795	24,048	19,442	10,437	8,117	115,088

Source: Educational Statistics - 1983
Ministry of General Education and Culture

TABLE 4 GRADE 7 - 8 PROGRESSION RATE (1971 - 1985)

Year	Progression Rate
1971	23.4 %
1972	21.3
1973	21.8
1974	22.6
1975	22.9
1976	22.2
1977	21.9
1978	19.7
1979	19.3
1980	21.6
1981	20.2
1982	20.8
1983	22.4
1984	19.8
1985	21.6

Source: Ministry of General Education and Culture

Secondary level education consists of junior secondary level (grades 8 and 9) and senior secondary level (grade 10 to 12). About 50% of grade nine graduates progressed to senior secondary schools but their progression rate has been declining because the extension of senior secondary schools cannot catch up with the extension rate of junior secondary schools.

The ratio of boy students to girl students in secondary schools was 64% and 36% in 1983, and the difference tends to expand in higher grades. The government is trying to equalise the boy to girl student ratio and the discrepancy is being reduced.

In 1983, the number of secondary school graduates was 12,400. The capacity of institutions of higher education like colleges, teacher training institutions, vocational schools, etc. was about 5,350 students, some 4% of the total population aged 19.

(5) Educational Institutions

The primary school enrollment as of 1964 was about 380,000 pupils in 1,876 schools (1,260,000 in 1984) with the secondary school enrollment about 14,000 pupils in 72 schools (126,000 in 1984). These figures show that there were few schools at the time of independence. The number of classrooms rapidly increased in the 1960s, and the capacity of primary education in 1970 was double that of 1964, with a fourfold increase in secondary education. Construction of new educational institutions stagnated in the 1970s affected by the collapse of international copper prices. Since the report "Educational Reform Proposals and Recommendations" was published in 1977 by the Ministry of Education and Culture, which suggested the present seven-year basic education programme be lengthened to a nine-year programme, construction of secondary schools has been continuously increasing as shown in Table 5.

Recently, proper maintenance and rehabilitation of old facilities have been emphasised as well as the construction of new schools. The number of boarding students has been reduced and the surplus dormitory space transformed into classrooms to accommodate more

pupils. On the other hand, few primary schools were constructed by the government in spite of the sharp increase in the number of children within the appropriate age range. Schools practice double and triple sessions to accommodate the maximum number of pupils. This is more common in urban areas, where a large number of people tend to concentrate.

TABLE 5 NUMBER OF EDUCATIONAL INSTITUTIONS BY TYPE, 1971-1984

Year	Primary Schools	Secondary Schools	Teacher Training	Vocational and Technical	University of Zambia
1971	2,598	114	9	13	1
1972	2,628	110	9	13	1
1973	2,654	110	10	13	1
1974	2,669	113	11	14	1
1975	2,710	120	12	14	1
1976	2,743	121	13	14	1
1977	2,756	120	14	15	1
1978	2,777	124	14	14	1
1979	2,786	125	14	14	1
1980	2,813	128	14	14	2
1981	2,851	135	14	14	2
1982	2,886	142	14	14	2
1983	2,977	144	14	14	2
1984	3,055	194	14	14	2

Source : Ministry of General Education and Culture

(6) Composition of Primary and Secondary Schools

At present, there are the following types of primary and secondary schools.

Lower primary school	(Grade 1 to 4)
Primary school	(Grade 1 to 7)
Basic school	(Grade 1 to 9)
Junior secondary school	(Grades 8 & 9)
Secondary school	(Grade 8 to 12)

These schools are ranked as follows according to the number of classes they can accommodate.

Primary school	GRADE I	31 classes or more
	II	22 to 30 classes

	III	11 to 21 classes
	IV	5 to 10 classes
	UG	less than 5 classes
Secondary school	GRADE I	23 classes or more
	II	16 to 22 classes
	III	9 to 15 classes
	UG	less than 9 classes

(UG : Ungraded)

Primary and secondary schools can also be divided into government schools, government-aided schools (mostly constructed by communities) and private schools, depending on the source of construction and administrative costs.

(7) Teacher Training

Table 6 shows the number of primary and secondary school teachers and changes in the pupil-to-teacher ratio. On the average, the number of teachers increases annually 4.2% in primary and 4% in secondary schools. The government included expansion of teacher

TABLE 6 PRIMARY AND SECONDARY SCHOOL PUPIL/TEACHER RATIOS, 1971 - 1984

Year	Primary Schools		Secondary Schools	
	Number of Teachers	Pupil/Teacher Ratio	Number of Teachers	Pupil/Teacher Ratio
1971	14,708	49.6	2,585	21.7
1972	16,024	48.5	2,779	21.6
1973	16,916	47.9	2,880	21.3
1974	17,881	48.0	3,038	21.6
1975	18,096	48.2	3,202	22.8
1976	19,089	47.6	3,478	22.7
1977	19,441	48.2	3,755	22.3
1978	19,877	48.5	3,669	24.2
1979	22,494	44.3	3,878	23.7
1980	21,172	49.2	4,297	22.0
1981	22,362	48.2	4,650	21.2
1982	23,870	47.0	4,602	22.8
1983	24,045	49.7	4,772	23.4
1984	24,993	50.4	5,030	25.0

Source : Ministry of General Education and Culture

training colleges in its policy to produce a number of new teachers corresponding to the yearly increase of pupils (about 4.8% in primary and 7.5% in secondary schools). However, the number of students and graduates of the teacher training colleges has been declining due to worsened economic conditions. The pupil-to-teacher ratio in primary and secondary schools is becoming larger accordingly.

The teacher training institutions are composed of one pre-school teacher training college, 10 primary school teacher colleges (including homecraft), two secondary school teacher training colleges, one special education teacher training college and one pre-employment teacher training college (for teachers of commerce, industry and engineering subjects). In addition, about 150 graduates from the University of Zambia become teachers every year.

(8) Education Budgets

Education in Zambia had been free from the primary to university level under the country's socialistic economic system, but since 1986, boarding fees have been levied in secondary schools at a rate of 300 kwachas a year. The government intends to expand the principle of transfer of education costs from the government to the beneficiaries.

The share of public expenditure devoted to education has been increasing in general, from 11.5% in 1975 to 16.8% in 1984, as shown in Table 7. Recurrent expenditure has been steadily increasing while capital expenditure has been varying depending on the economic conditions. Personnel costs are the dominant factor in recurrent expenditure, especially in primary schools, where some 95% of the total recurrent expenditure was spent on personnel emoluments. Thus, provision for educational materials etc. is a small part of the recurrent expenditure.

The outstanding feature in Table 8 is the sharp increase of the capital expenditure for secondary level education from 1983. It is because international financial aid like the WB and the ADB

TABLE 7 SHARE OF GOVERNMENT EXPENDITURE ON EDUCATION, 1975 - 1984

YEAR	RECURRENT		CAPITAL		TOTAL	
	(K '1000')	% OF TOTAL GOV. RECURRENT EXPENDITURE	(K '1000')	% OF TOTAL GOV. CAPITAL EXPENDITURE	(K '1000')	% OF TOTAL GOVERNMENT EXPENDITURE
1975	75,406	12.4	22,603	9.2	98,009	11.5
1976	94,140	15.5	21,747	6.6	115,887	12.4
1977	95,458	14.4	17,620	11.0	113,078	13.8
1978	99,672	15.4	12,560	7.5	112,252	13.8
1979	109,456	13.8	6,300	3.8	115,756	12.1
1980	129,640	12.0	7,790	1.4	137,430	8.3
1981	156,840	12.7	4,690	3.0	161,530	11.6
1982	213,720	16.2	14,800	4.6	228,520	13.9
1983	224,870	19.5	16,440	8.8	241,310	18.1
1984	230,036	17.7	19,846	10.9	249,882	16.8

SOURCE: Ministry of Finance; Compiled from the Financial Reports of various years.

TABLE 8 GOVERNMENT RECURRENT AND CAPITAL EXPENDITURES ON EDUCATION BY FUNCTION, 1979 - 1984 (PERCENT)
(R=RECURRENT, C=CAPITAL) (UNIT: Million Kwacha)

FUNCTION	1979		1980		1981		1982		1983		1984	
	R	C	R	C	R	C	R	C	R	C	R	C
PRIMARY SCHOOLS	50.16 (45.8)	1.00 (15.9)	54.53 (42.1)	2.08 (15.9)	63.01 (40.2)	1.98 (42.2)	89.2 (41.74)	1.08 (7.3)	97.32 (43.3)	0.69 (4.2)	101.43 (44.1)	0.44 (3.2)
SECONDARY SCHOOLS	24.06 (21.9)	0.92 (14.6)	27.00 (20.8)	0.93 (11.9)	29.06 (18.5)	1.30 (27.7)	40.21 (18.81)	3.30 (22.3)	51.06 (22.7)	9.04 (55.0)	47.36 (20.6)	11.43 (57.6)
TEACHER TRAINING	3.41 (3.1)	0.29 (4.6)	3.73 (2.9)	0.52 (6.7)	4.33 (2.7)	0.24 (5.1)	5.50 (2.57)	1.40 (9.5)	5.43 (2.4)	0.18 (1.1)	6.75 (2.94)	0.23 (1.2)
TECHNICAL AND VOCATIONAL TRAINING	8.16 (7.4)	0.58 (9.2)	8.76 (6.8)	1.72 (22.0)	10.53 (6.7)	0.33 (7.0)	13.06 (6.11)	1.2 (8.1)	13.95 (6.2)	1.19 (7.2)	13.02 (5.7)	0.87 (4.4)
UNIV. OF ZAMBIA	11.29 (10.3)	0.17 (2.7)	16.83 (13.0)	0.75 (9.6)	19.71 (12.6)	0.005 (0.1)	27.25 (12.15)	6.72 (45.4)	34.46 (15.3)	2.06 (12.5)	31.98 (13.9)	0.55 (2.8)
OTHER ADMINISTRATION	12.39 (11.1)	3.34 (53.1)	18.79 (14.5)	1.79 (22.9)	30.20 (19.3)	0.84 (17.9)	38.50 (18.1)	1.09 (7.4)	22.65 (10.1)	3.28 (20.0)	29.40 (12.8)	6.13 (30.9)
GRAND TOTAL	109.46 (100.0)	6.30 (100.0)	129.64 (100.0)	7.79 (100.0)	156.84 (100.0)	4.69 (100.0)	213.72 (100.0)	14.8 (100.0)	224.87 (100.0)	16.44 (100.0)	229.94 (100.0)	19.84 (100.0)

NOTE: Figures within brackets indicate percentage to total.

SOURCES: 1. Ministry of General Education and Culture; Educational Statistics 1973 & 1980.
2. Ministry of Finance; Financial Report for the years 1981-1984.

TABLE 9 CURRENT COSTS PER STUDENT, 1979 - 1983 (Kwacha)

	1979	1980	1981	1982	1983
PRIMARY SCHOOL	50.53	52.34	58.71	73.05	77.52
SECONDARY SCHOOL	262.10	285.43	293.95	381.47	443.68
TEACHER TRAINING	773.69	839.15	965.44	1,301.07	1,262.54
TECHNICAL EDUCATION	1,543.44	1,641.06	1,913.85	2,293.58	2,242.68
UNIV. OF ZAMBIA	3,317.64	4,913.87	5,024.22	5,283.24	9,884.39

SOURCE: Central Statistical Office; COUNTRY PROFILE 1985.

started for construction and maintenance projects for junior secondary schools. The fund has been included in the government budget. On the other hand, the share of the primary schools in capital expenditure has been sharply decreasing since 1982. The educational situation in the primary schools is deteriorating considering the yearly increase of pupils.

As the increase rate of the cost per pupil is about 12% annually, considerably lower than the annual inflation rate of about 21% except for university students, the cost per pupil in real terms has been decreasing (Table 9).

2-2 Related Projects

(1) National Development Plans and Education Policies

The objectives of the TNDP activated from 1981 to 1984 were, in summary, economic development for the establishment of a socialistic economic system; generation of massive employment opportunities; economic diversification; promotion of agricultural and rural development; expansion of industrial production using domestic materials; reduction of income disparities; advocacy of "Zambianisation" in industry and education; manpower development by qualitative and quantitative improvement of educational facilities; achievement of reasonable price stability, etc.

The Interim National Development Plan (INDP; July 1987 - December 1988) which was drawn up prior to the Fourth National Development Plan, contained the following objectives: more productive use of investment in development; rehabilitation of the economy; restructuring of patterns of production and consumption to save foreign currency; strengthening of smaller-size industries to create more employment opportunities; better management of the economy by the government, etc.

In order to attain these objectives, a policy of "personnel development by expansion and improvement of educational and

training institutions" has been given the highest priority. The education policies are based on this concept.

Zambia advocates humanitarian principles and states that the goal of education is to provide equal educational opportunities and to develop individual capabilities to the maximum extent possible in order to attain self-fulfillment as well as to encourage the devotion of oneself to society and friends. Practically, it aims for the acquisition of knowledge and skills applicable to one's social life and, depending on individual interest and abilities, for creating people that can contribute to the social development of the country.

In summary, the objectives of education aimed at in the national development plans according to the situation in Zambia are --- 1) emphasis on basic education, 2) expansion of educational opportunities, 3) qualitative improvement of education, and 4) advocacy of scientific and technical education. In fulfillment of these principles, the following strategies are adopted:

- 1) Emphasis on basic education
 - Realisation of universal basic education (every child can finish grades one through nine)
 - Increase in number of primary and secondary school teachers
 - Introduction of production units
- 2) Expansion of educational opportunities
 - Expansion and improvement of school facilities
 - Amplification of continuing education
 - Implementation of educational broadcasting services
 - Implementation of educational correspondence courses
- 3) Qualitative improvement of education
 - Improvement of teachers' knowledge, character and teaching skills
 - Development of new syllabuses and curricula
 - Extension of publishing and supply of textbooks and teachers' handbooks

- Development, production and supply of instructional materials other than textbooks and teaching equipment
- 4) Advocacy of scientific and technical training
- Qualification of more teachers with science and mathematics majors
 - Expansion of ratio of scientific or technological schools in the universities
 - Expansion and improvement of vocational training schools

In addition to the above four principles, the transfer of part of education costs to beneficiaries is one method to achieve national goals and to deal with the country's economic depression. This is carried out by means of participation of communities in self-help projects for constructing primary and secondary schools (25% of construction costs is paid by the government) and parents' responsibilities in providing boarding fees in secondary schools. It is also proposed to introduce boarding fees in universities.

(2) Fifth Education Project

International bank groups provided financial assistance for the Fifth Education Project under the TNDP (1981-1984) for the expansion and improvement of educational institutions.

This project aims at realisation of equal opportunity for basic education by constructing junior secondary schools in remote areas and at the development and enhancement of school maintenance projects. It further contributes to reducing population concentration into urban areas and keeping people in rural areas complementing the policy for less dependence on mining and the emphasis on agriculture which is one of the main objectives of the TNDP.

Summary of the Fifth Education Project is as follows:

- 1) Period: from March 1982 to September 1987

Some schools in fact are still under construction as of October 1988.

2) Description of the Project:

i) Construction of junior secondary schools

The Ministry of Education and Culture (MEC) requested the assistance of the bank group for construction of 16 schools, and the WB planned 12 schools. Finally eight schools were financed by the WB and three by the ADB. The total fund amounted to US\$25 million by the WB and US\$7.92 million by the ADB. Table 10 shows the details of the 11 schools.

TABLE 10 JUNIOR SECONDARY SCHOOLS FUNDED BY THE WORLD BANK AND THE AFRICAN DEVELOPMENT BANK

Name	Type	Capacity	No. of Bldgs.	No. of Dorms	Power Supply	Water Source	Source of Fund
MWENZO	GB	360	3	4	ZESCO	City	WB
CHIBONBO	MB	480	4	6	ZESCO	Well	WB
LUBWE	MB	360	3	4	ZESCO	Well	WB
MPONGWE	MB	360	3	4	ZESCO	Well	ADB
KASEMPA	BB	360	3	4	ZESCO	Well	ADB
MAAMBA	MB	480	4	6	ZESCO	City	ADB
SOLWEZI	MD	360	3	0	ZESCO	City	WB
MYOOYE	GB	360	3	4	ZESCO	Well	WB
LUMEZI	MB	360	3	4	Generator	Well	WB
KAFUMBWE	MB	360	3	4	Generator	Well	WB
SIOMA	MB	480	4	6	Generator	River	WB

Notes 1) Type BB: Boys Boarding School, GB: Girls Boarding School
MB: Mixed Boarding School, MD: Mixed Day School

2) ZESCO: Zambia Electric Supply Corporation

3) Water Source City : City Water Supply Network
Well : Well Water
River: River Water

ii) Secondary schools maintenance programme

This was a rehabilitation programme for damaged or obsolete buildings, furniture and equipment of secondary schools with repair materials, spare parts, equipment and their transportation provided by the bank group.

The Norwegian Agency for International Development (NORAD) extended technical cooperation for this programme continuously from the Third and Fourth Education Projects. The technical cooperation included the transfer of expertise to

implement the programme in cooperation with the Projects Implementation Unit (PIU) and training maintenance and repair methods to Zambian teachers of technical subjects so that they can maintain the school facilities themselves.

After the cooperation from the bank group ended, this programme was succeeded by the Zambia Education Projects Implementation Unit (ZEPIU; the former PIU).

iii) Research on Educational Reform

This was a research programme by the MEC to determine the most economical and effective implementation method for the reform plan, supported financially and with the dispatching of experts from the Swedish International Development Agency (SIDA). It was carried out for 13 months from December 1982.

iv) Technical cooperation

The NORAD provided technical cooperation both for technical subjects and the entire management of the Fifth Education Project along with cooperation for the secondary school maintenance programme.

2-3 Circumstances and Contents of the Request

Though the Government of Zambia emphasised economic development as the most important feature in each national development plan, it has not fully accomplished the target results mainly because of a shortage of appropriate personnel. For national development, it is indispensable to improve the entire country's educational standard through the training of a number of competent personnel.

The government designated the improvement of basic education as the goal of the TNDP based on the educational reform proposals presented by the MEC in 1977. The Fifth Education Project under the TNDP, has stipulated construction of 16 junior secondary schools with international aid funds, among which 11 schools were funded by the WB and the ADB. On this account, the Government of Zambia has requested

of the Government of Japan grant aid for the construction of the remaining five schools.

Examining the request, the Government of Japan has decided to execute basic design studies on three schools out of the five and sent a basic design study team to Zambia through JICA.

The study team confirmed the contents of the request and drew up definite plans through discussions with the Zambian authorities concerned, conducted field surveys in and around the three project sites, and collected data and information necessary for determining the feasibility of the project and its realisation.

The contents of the project requested by the Government of Zambia are as follows:

Project title : Construction of Junior Secondary Schools in the Republic of Zambia

Requesting agency: Ministry of General Education, Youth and Sport (MGEYS)

Project sites : Zimba Kalomo District
Jumbe Chipata District
Lukona Kalabo District

Number of pupils : 360

Major facilities :

Classrooms 9 rooms

Laboratory

Workshop (woodwork, metalwork)

Homecraft room (cookery and needlework)

Library

Administration rooms

Canteen (capacity to serve meals for half of the boarding pupils and to accommodate gatherings of all the pupils)

Kitchen

Dormitories (same shape as classrooms) 12 rooms

Teaching staff houses

Support staff houses

Major equipment :

Educational equipment

A-V equipment, laboratory equipment, homecraft equipment, work shop tools and materials

Kitchen Cooking equipment, canteen utensils

Offices stationary, maintenance equipment

Furniture for classrooms, dormitories, canteen and offices

Vehicles truck, pick-up truck, 4-wheel-drive vehicle

CHAPTER 3 CONTENTS OF THE PROJECT

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3-1 Objective of the Project

The objective of the project is to construct junior secondary schools in rural areas in Zambia to aid in establishing a 9-year basic education system and generating equal educational opportunity according to the policy of the Government of Zambia. This construction project is conceived with a view to increasing the number of people who can get sufficient education to take part in productive activities, aiding people to proceed to higher grades, and contributing not only to the promotion of the general welfare but also achieving the aims of the national development plans.

3-2 Review of the Request

(1) Necessity of the Project

Since independence, the Government of Zambia has been targeting economic development as the most important goal, and in order to achieve it, the government has made efforts to promulgate education as a principal policy throughout the country. The country's economy, however, which has been largely dependent on the mining industry, and especially copper output, has been in a slump since the sudden collapse of the world copper market in 1975. Therefore the government planned to revitalise the economy by diversification of the industrial structure. To complete this plan, it is indispensable to increase the number, not only of those with useful skills but also those educated enough to take part in productive activities. In the TNDP, the government decided to extend the period of compulsory education from seven years to nine years in future. However, judging from the present situation with the secondary schools able to accommodate only some 20% of the children at the appropriate age of enrollment, it is considered essential to construct many more secondary schools to carry out this plan.

The progression rates in Southern, Eastern and Western Provinces, where the project schools are located, are lower than the national average as shown in Table 12. It means that construction of these schools will contribute to providing the people with equal opportunity for secondary education. In particular, the vast Kalabo District in Western Province, where there are only three secondary schools in Kalabo, the center of the district, has necessity of secondary schools in the rural areas. There scatter many primary schools around Lukona, located at about 40 km south of Kalabo. It is highly significant to construct the Lukona Junior Secondary School for the primary school graduates in this areas with unfavourable transport conditions.

At present over 96% of the children of the appropriate age receive education in primary schools, though it is necessary in some schools to give lessons in double or triple sessions because of the shortage of facilities. Only about 27% of the graduates of primary schools can be enrolled in secondary schools. The cause of this low rate is attributed to the shortage of schools and teachers compared with the great numbers of applicants for secondary school. In 1983 the number of classes of grades eight and nine was 743 and 675 respectively, 1,418 in total. To accommodate 50% of the 14- and 15-year-old children in secondary schools in 1995 according to the Fourth National Development Plan, $(227,800 + 219,100) \times 0.5/40 = 5,586$ classes will be necessary according to the expected population figures issued by the Central Statistics Office. This figure is four times the present number of classes in secondary schools.

Considering the pressing desire for expansion of school facilities and the excess of the fixed number of pupils in all present secondary schools whether the school is big or small, there is a lot of necessity for constructing secondary schools.

(2) Teachers and Scale of Schools

In secondary schools, teachers should teach their own special subjects, because the level of lessons is higher than those of

primary schools and teachers are required to have professional knowledge and understanding of each subject as well as to master appropriate teaching methods.

However if one school has nine classes or less, the teachers' special subject system is difficult to implement because many of the teachers teach less than 30 periods a week, standard duty of the MGEYS, which causes imbalance of the burdens among the teachers and inefficient use of the teachers as described in Table 16 in the following pages. If there are only six classes or less in a school, almost all the teachers need to teach subjects in addition to their special subjects. This will lower the level of lessons other than their specialty. Thus, it is not recommendable to construct small secondary schools.

(3) Facilities

Concerning the facility planning of secondary schools in Zambia, the Building Department under the Ministry of Power, Transport and Communication has issued an "Architectural Brief and Schedule of Accommodation, Fifth Educational Project in the Republic of Zambia", which shows required facilities, floor areas per person in each facility, standard floor areas of facilities, etc.

Some major secondary school facilities are examined here.

- Classrooms

Ordinary classrooms are used for social science, mathematics and other subjects which need little special equipment for teaching, however, these rooms shall be so designed that an overhead projector or a 16 mm film projector can be used there. One classroom accommodates 40 pupils.

- Science Laboratory

Classes in physics, chemistry and biology require various laboratory equipment to show scientific phenomena or allow experiments by the pupils for their better understanding. A laboratory larger than the ordinary classroom and equipped with such

facilities that enable the teacher and pupils to use electricity, water, burners, etc. is needed for these experiments.

- Assembly Room

The construction of a school's own assembly room for use for plays, meetings or examinations was requested, but there are scarcely any exclusive assembly rooms in other secondary schools, thus in this project, a dining room with enough space to accommodate all the pupils will be constructed.

- Workshop and Homecraft Rooms

These kinds of rooms are necessary because the Government of Zambia aims at the acquisition of basic knowledge and skills well adapted to a productive life as a basic aim of education.

It is recommended that the rooms for metalwork and woodwork be provided separately in the workshop building for the different purposes and functions of the rooms.

- Drafting Room

According to the secondary school curriculum, there are classes in drafting from grade 10. However as the schools in this project have only grades eight and nine, a drafting room is not considered necessary.

- Dormitories

As the secondary schools in this project are constructed in local areas where population is sparse in the catchment areas of the schools, dormitories are needed. The percentage of boarding pupils in each province where the secondary schools of this project are to be located has been determined from the Education Statistics of 1983: at 79.6% in Southern Province, 75.6% in Eastern Province and 86.4% in Western Province. These figures include the secondary schools in urban areas where many pupils commute to school from their homes, and the size of the dormitories in the schools of this project will be determined using the rate of boarding pupils of the province where each school is located.

- Teaching Staff and Support Staff Houses

Since its independence, the Government of Zambia has been adapting such policies as houses for public workers are provided by the national or provincial government. Persons who have a teacher's license are appointed by the central office of the MGEYS to the various regions. As none of the three sites where the schools are to be constructed have accommodations for the teachers, it is impossible to secure teachers unless the residences are offered by the school. The non-teaching staff in major posts are also dispatched by the MGEYS, so accommodations for them are also necessary.

- Library

According to the MGEYS standard, 5041 books should be available for each library. However under the economic conditions in Zambia the schools can hardly afford to purchase these books, so secondary schools rarely have their own books. It is therefore highly important to construct a library building and provide books for this project.

(4) Equipment

As to the equipment for the secondary schools that have been established recently, there is a standard equipment list which was arranged for the Fifth Education Project and the equipment should be provided according to this list. In this project, it is necessary to consider the scope of the Japanese grant aid system and each school's circumstances (for instance, whether electricity is supplied or not) to choose the equipment.

Here are referred to the vehicles to be used for the management of the schools. The major purposes of these vehicles will be transport of food and fuel for the boarding pupils, school staffs and their families. The procurement of food in an existing junior secondary school of about the same scale as the project schools is --

milmil (corn powder)	5,600 kg/month
beans	2,700 kg/month
rice	5,400 kg/month
meat	300 kg/month
cooking oil	400 kg/3 months
sugar	600 kg/month
vegetables	

Vegetables and meat are purchased in a small amount because they cannot be stored for a long time, while other food is purchased per month. In addition to food, not a small quantity of firewood and fuel needs transport. Considering the capacity and distance of transport as well as efficient utilisation of drivers and fuel, a pick-up truck and a 4-ton truck shall be provided.

3-3 Overview of the Project

(1) Implementing Organisation

The implementing organisation of this project in the Government of Zambia is the Ministry of General Education, Youth and Sport (MGEYS), which succeeded the MGEC in November 1988 according to an administrative reform. In the MGEYS, the head of the section in charge of this project is the Permanent Secretary, and administration is under the ZEPIU, which is an organisation attached to the MGEYS. The ZEPIU was first organised under the name of Project Implementation Unit (PIU) as an implemental organisation of the Third Education Project under control of the Ministry of Water and Supply. In 1984 it was transferred to become an attached organisation of the MGEC and renamed ZEPIU. Today the ZEPIU is administered within the budget of the MGEYS and uses funds from foreign aid organisations. The ZEPIU is mainly concerned with the management of secondary school construction and maintenance projects and coordination of activities of foreign aid organisations or domestic organisations. The ZEPIU also served as the counterpart of the Government of Zambia in the Fifth Educational Project, which was supported by bank groups as mentioned in "2-2 Related Projects" above.

The organisations of the ZEPIU and the MGEYS are shown in Figures 3 and 4.

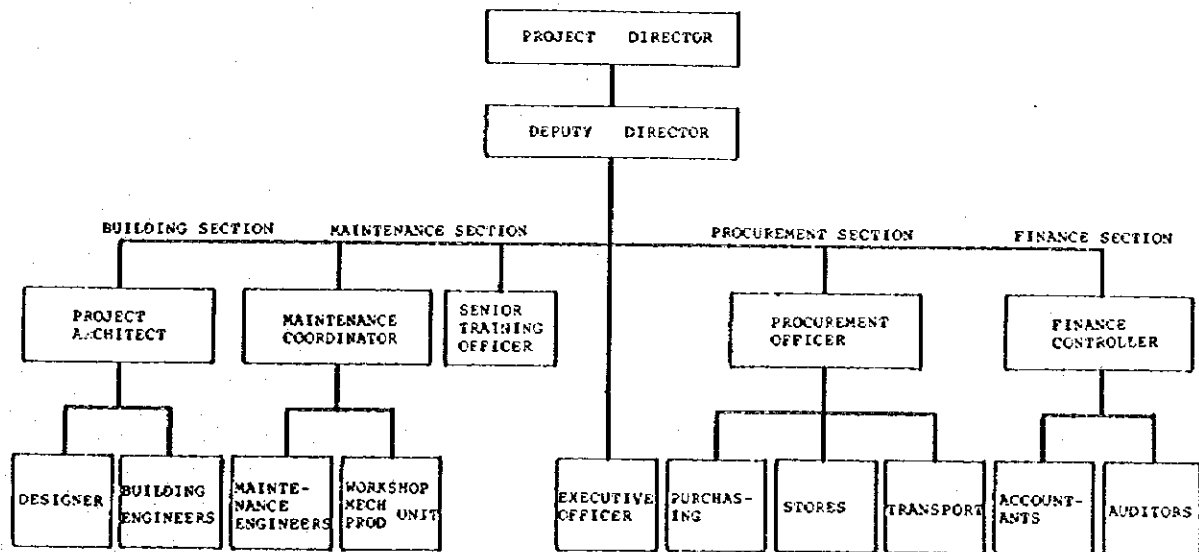


FIGURE 3 ORGANISATION OF THE ZAMBIA EDUCATIONAL PROJECTS IMPLEMENTATION UNIT

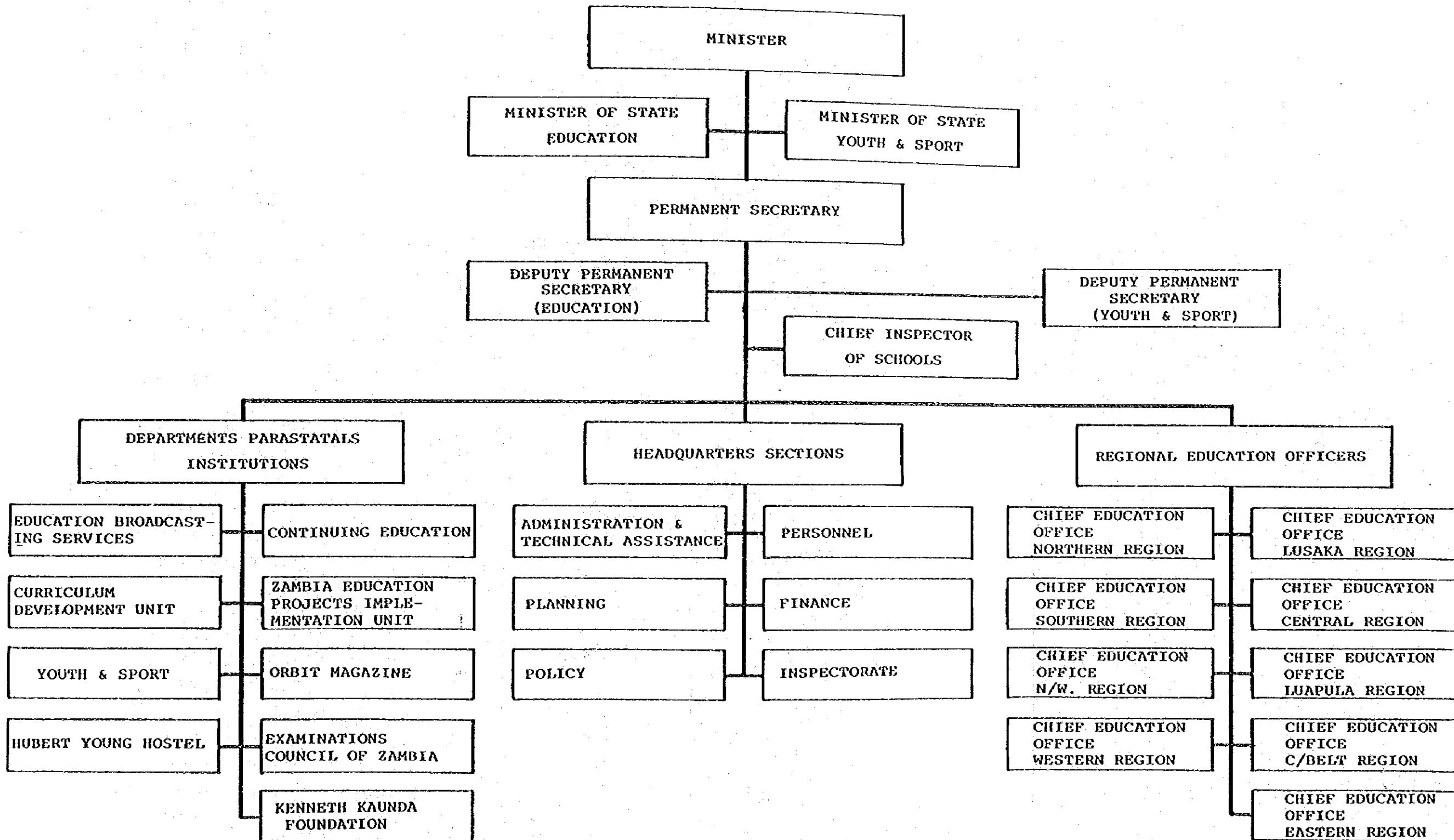


FIGURE 4 FUNCTIONAL STRUCTURE
MINISTRY OF GENERAL EDUCATION, YOUTH AND SPORT

(2) Basic Planning

The following is a review on the scale of each school and the number of teachers in each school based on the curriculum of secondary schools.

1) The curriculum of secondary schools

The syllabuses and curricula of primary schools, secondary schools, and teacher training schools are being revised in the Curriculum Development Center. Even after the provisional education system was introduced, the curriculum made in the early 1970s is being correspondingly applied in secondary schools.

The next page shows the curriculum which is being used now. As it shows, a junior secondary school has four courses, an academic boys' course, an academic girls' course, a commerce course and an agricultural science course, and each course has optional subjects: technical drawing, homecraft, commerce, agricultural science and arts, respectively. Basic subjects like languages, mathematics, natural and social science are regarded important in the junior secondary education, and pupils in each course have to take 40 periods (one period consists of 40 minutes) a week.

Apart from this curriculum, the "Educational Reform Proposals and Recommendations" prepared in 1977 suggested that each secondary school should be regarded as a "Production Unit" and the pupils should play active parts as after-school activities according to the circumstances of each school. This proposal is now being implemented. In local schools, agriculture and stock raising are often practiced, while in urban areas, as schools do not have much space, some of them realise practical training for administration or production such as running minibuses and other productive activities.

The aim of the pupils' participation in productive activities is more educational than economic. The MGEYS regards this educational effect as the basis necessary for adapting the

TABLE 11 SECONDARY SCHOOL CURRICULUM

Subjects	GRADES 8 - 9				GRADES 10 - 12					
	General		Com- merce	Agricul- tural Science	Arts	Science	Agricul- tural Science	Tech- nical Drawing	Home- craft	Commercé
	Boys	Girls								
English Language	8	8	8	8	7	7	7	7	7	7
Literature	-	-	-	-	4	-	-	-	-	-
Zambian Languages	3	3	3	3	3	3	3	3	3	3
Mathematics	7	7	7	7	7	7	7	7	7	7
Religious Knowl.	1	1	1	1	1	1	1	1	1	1
Civics	2	2	2	2	1	1	2	1	1	2
History	3	3	3	3	4	4	4	4	4	4
Geography	3	3	3	3	4	-	-	-	-	-
Technical Drawing	2	-	-	-	-	-	-	5	-	-
Woodwork	2	-	-	-	-	-	-	-	-	-
Metalwork	2	-	-	-	-	-	-	5	-	-
Homecraft	-	4	-	-	-	-	-	-	10	-
Commerce	-	-	6	-	-	-	-	-	-	8
Science	6	6	6	6	6	14	-	6	6	6
Agric. Science	-	-	-	4	-	-	10	-	-	-
Art/Craft/Music	2	2	-	2	2	2	4	-	-	2
Physical Training	1	1	1	1	1	1	2	1	1	1
T O T A L	40	40	40	40	40	40	40	40	40	40

NOTES - 1. Pupils taking French do not take Zambian Languages.

2. Grades 8 - 9

(i) Art/Craft is an alternative to Technical Drawing.

3. Grades 10 - 12

(i) Literature will generally be taken in the Arts Stream but occasional pupils in other streams may be allowed to join the literature class if they are sufficiently qualified and timetabling allows.

(ii) The fourteen periods in the Science Stream cover three subjects. If two science subjects (ten periods) are taken, boys take four periods of Technical Drawing and girls take four periods of History or Geography.

(iii) In the Science Stream if additional Mathematics is taken, Music/Art and Physical Training are dropped.

(iv) Agricultural Science (ten periods) includes other science subjects.

(v) Technical Drawing in Grade 10 takes three periods of Technical Drawing and drop Physical Training.

pupils to school or social life, and as the development of their ability to contribute to school and social welfare and national development. The MGEYS also hopes that pupils' participation in productive activity will result in practical use of knowledge and skills, learning how to solve problems, exploitation of individuals' interests and potential, acquisition of concepts such as order, independence, leadership, and respect for the dignity of labour. Furthermore, the MGEYS hopes the pupils will experience the gratification of working together and creating something of value.

2) Scale Estimation

The scale of school facilities is determined by the number of pupils. The scales of the three junior secondary schools in Jumbe, Zimba, Lukona are estimated according to the following conditions:

a. Target year

Construction will be finished in 1991 according to the present schedule. The scale is estimated using the number of pupils in 1996, five years after school opening.

b. Catchment area

The scale is determined for the number of pupils in the catchment area of each junior secondary school decided by the MGEYS.

c. School

Junior secondary schools receive pupils for two school years, grades eight and nine, based on the provisional education system in Zambia. One class is composed of 40 pupils as a standard. As Zambian schools do not have a "homeroom" system, a school accommodates more classes than the number of classrooms by using both ordinary classrooms and special rooms.

d. Progression rate

In 1988, the progression rate from primary schools to junior secondary schools (grade seven to grade eight) was 27.3% on the average for the whole country. The provisional target in the FNDP is to raise the country's average progression rate to 30.6% (the ultimate target 50%). Thus, the progression rate in 1996 is assumed to be 30.6%.

TABLE 12 REGIONAL PROGRESSION RATE IN 1988

Region	NO. OF GRADE 7 CLASSES 1987	NO. OF GRADE 8 CLASSES 1988	PROGRESSION RATE
Copperbelt	852	261	30.6
Kabwe	424	92	21.7
Lusaka	379	107	28.2
Southern	530	144	27.2
Luapula	351	83	23.6
Northern	497	157	31.6
Eastern	403	96	23.8
N/Western	247	71	28.7
Western	314	82	26.1
T O T A L	3,997	1,093	27.3

e. Promotion rate

In a primary school, pupils must pass an examination when they go from grade four to grade five, and some 10% of pupils leave school then. In addition, every year there are some pupils who leave school or repeat a grade for some reason. These vacancies are filled with repeaters from the previous year. Thus, in the statistics, the number of pupils enrolled in grade seven may be more than 90% of the number of six years before. Here, 90% of the new pupils are assumed to graduate from school in seven years after entering school.

f. Population growth rate at school ages

This rate is estimated from the population forecast for each province in the population forecast published by the Central Statistics Office based on the national census of 1980. Although the population growth rate for each age group in the

whole country is about 4%, the population growth rate of each school age group in each province is revised considering the concentration of population in the urban areas:

Western Province (location of the Lukona school)	2.2%/year
Eastern Province (location of the Jumbe school)	2.5%/year
Southern Province (location of the Zimba school)	3.3%/year

Based on these conditions, the appropriate scale of each junior secondary school is calculated as follows:

i) Jumbe Junior Secondary School

Enrollment in grade one of 15 primary schools in the Jumbe Junior Secondary School district was 694, as calculated from the lists of the enrollment in each primary school in the Chipata District in 1987 (Table 13). As the pupils in grade seven in 1995 will be the pupils that entered school in 1989, the number of new pupils in 1995 is reached by multiplying the 1987 figure by the population growth rate (2.5%) for two years --

$$694 \times 1.025^2 = 729 \text{ pupils}$$

If 90% of the pupils are assumed to proceed to grade seven and 30.6% of them enter the junior secondary school --

$$729 \times 0.90 \times 0.306 = 201 \text{ pupils}$$

This number is those to be enrolled in the Jumbe Junior Secondary School in 1996, so the total number of pupils of the school with its two grades will be about 400. As 40 pupils compose one class, this school will have five classes in one grade for a total of 10 classes in the two grades. If nine ordinary classrooms are constructed, the facilities can accommodate the pupils of 10 classes by using the special classroom for one class as is being done at present.

ii) Zimba Junior Secondary School

The scale of this school is calculated based on the data from the Kalomo Office of the MGEYS and the 1987 statistics of the

Kalomo District found in the Livingstone Provincial Office. There are 10 primary schools in this school district.

As seen in Table 14, the total number of pupils enrolled in 1987 was 616. The number of new pupils in 1989 will be obtained by multiplying this figure by the population growth rate (3.3%) for two years --

$$616 \times 1.033^2 = 657 \text{ pupils}$$

If about 90% of these pupils are assumed to proceed to grade seven and 30.6% of them continue on to junior secondary school, the calculation is --

$$657 \times 0.90 \times 0.306 = 181 \text{ pupils}$$

This is the number of the pupils who are to enter the Zimba Junior Secondary School in 1996, so the total number of pupils of the school with its two grades will be about 360. This school will have five classes in one grade for a total of 10 classes, with a standard of 40 pupils per class. Thus, this school will consist of nine ordinary classrooms like the Jembe Junior Secondary School.

iii) Lukona Junior Secondary School

The scale of this school is estimated based on the data from the Kalabo Office of the MGEYS, which indicate the enrollment of pupils in primary schools in the catchment area of this school in 1987. There are 15 primary schools in this district.

As seen in Table 15, the total number of pupils enrolled in 1987 was 633. The number of new pupils in 1989 will be found by multiplying this figure by the population growth rate (2.2%) for two years --

$$633 \times 1.022^2 = 661 \text{ pupils}$$

If about 90% of these pupils are assumed to proceed to grade seven and 30.6% of them go on to junior secondary school, the calculation is --

$$661 \times 0.90 \times 0.306 = 182 \text{ pupils}$$

This is the number of pupils who will enter the Lukona Junior Secondary School in 1996, so the total number of pupils of

the school which has two grades will be about 360. This school will have five classes in one grade for a total of 10 classes, with a standard of 40 pupils per class. Thus, this school will consist of nine ordinary classrooms like the Jumbo Junior Secondary School.

TABLE 13 ENROLMENT OF PRIMARY SCHOOLS WITHIN THE CATCHMENT AREA OF THE JUMBE JUNIOR SECONDARY SCHOOL, 1987

NAME	GRADE	1	2	3	4	5	6	7	TOTAL
CHITEMPHA		80	83	95	45	90	79	28	500
KATEMO		49	39	30	31	46	61	52	308
NCHEKA		29	22	37	24	30	25	22	189
JUMBE		80	72	72	66	91	74	120	575
KAWAZA		26	42	30	26	34	35	50	243
KAKUMBI		44	40	41	34	-	-	-	159
YOSEFE		52	48	45	42	51	45	38	321
CHIPAKO		13	21	22	-	23	-	-	79
CHIKOWA		80	80	76	46	56	43	38	419
CHIUTIKA		39	52	52	44	45	47	42	321
NSEFU		43	42	30	36	-	-	-	151
KAMOTO		43	34	45	39	39	46	46	292
CHIWAWATALA		45	43	39	30	-	-	-	157
MFUWE		40	45	50	38	41	37	40	291
CHILONGOZI		31	24	22	15	10	4	-	106
T O T A L		694	687	686	516	556	496	476	4111

TABLE 14 ENROLMENT OF PRIMARY SCHOOLS WITHIN THE CATCHMENT AREA OF THE ZIMBA JUNIOR SECONDARY SCHOOL, 1987

NAME	GRADE	1	2	3	4	5	6	7	TOTAL
NAKOWA		182	166	185	134	134	121	128	1050
MUNKOLO		74	45	40	46	42	40	39	326
MUZYA		42	42	42	42	38	46	45	297
MALIMBA		44	43	43	40	41	39	37	287
SIMANGO		48	46	50	48	47	47	50	336
KAUWE		43	43	46	44	43	45	45	309
MANYEMUNYEMU		50	45	42	43	43	45	40	308
MAYOBA		42	44	41	40	39	41	38	285
KABUYU		49	53	50	50	50	49	56	357
SIAMULUNGA		42	42	37	-	-	-	-	121
T O T A L		616	569	576	487	477	473	478	3676

TABLE 15 ENROLMENT OF PRIMARY SCHOOLS WITHIN THE CATCHMENT AREA OF THE LUKONA JUNIOR SECONDARY SCHOOL, 1987

NAME	GRADE	1	2	3	4	5	6	7	TOTAL
LUKONA		83	58	55	54	45	66	58	419
LITOOMA		46	45	38	35	37	32	41	274
LUPO		43	18	19	26	-	-	-	106
LUSA		41		18		-	-	-	59
LYAPEPA		29	23	32	21	22	16		143
MAYUMBI		21	21	19	17	13			91
MBALALA		39	41	42	39	32	33	40	266
MBUNDE		40	40	28	22	-	-	-	130
MITWI		34	27	26	19	13	21	23	163
NAMATINDI		40	47	43	45	29	38	38	280
NDAYU		45	42	37	37	20	31	42	254
NDOKA		45	43	45	39	32	-	-	204
NANGA		42	35	39	46	35	39	41	277
NUMA		40	44	41	23	26	33	21	228
TAPO		45	44	47	44	45	45	41	311
TOTAL		633	528	529	467	349	354	345	3205

iv) Scale of Dormitories

The percentages of boarding pupils in Eastern Province (Jumbe), Southern Province (Zimba) and Western Province (Lukona), where the three secondary schools of this project are to be located, worked out from the Education Statistics of 1983 (ANNEX, Table A-1) are as follows:

Eastern Province	75.0 %
Southern Province	79.6 %
Western Province	86.4 %

The numbers of boarding pupils in the three secondary schools are calculated by using these percentages as follows:

Jumbe	$400 \times 0.750 = 300$ pupils
Zimba	$362 \times 0.796 = 287$ pupils
Lukona	$364 \times 0.864 = 314$ pupils

Since the Government of Zambia has a plan to transform dormitories into classrooms when the population around the school increases in the future, it has been decided to construct the dormitory building and the classroom building according to the same basic plan. The standard for a classroom building will be three classrooms and one storeroom.

At most 24 boarding pupils are to be accommodated in a room having the same size as a classroom, and eight boarding pupils in the room having the same size as the storeroom. Thus, one building is to accommodate --

$$(24 \times 3) + (8 \times 1) = 80 \text{ pupils}$$

As there is a principle that the number of boys and girls should be the same, the necessary number of buildings and their usage for boys and girls are to be as follows:

Jumbe

$$300/2 + 80 = 1.875 \text{ buildings}$$

to construct 2 buildings

total 4 bldgs. for boys and girls

$$24 \text{ (pupils)} \times 6 \text{ (classrooms)} + 8 \text{ (pupils)} \times 1 \text{ (room)}$$
$$= 152 \text{ pupils}$$

(One small room will be used for a storeroom)

Zimba

$$287/2 + 80 = 1.79 \text{ buildings}$$

to construct 2 buildings

total 4 bldgs. for boys and girls

$$24 \text{ (pupils)} \times 6 \text{ (classrooms)} = 144 \text{ pupils}$$

(Two small rooms will be used for a storeroom)

Lukona

$$314/2 + 80 = 1.96 \text{ buildings}$$

to construct 2 buildings

total 4 bldgs. for boys and girls

$$24 \text{ (pupils)} \times 6 \text{ (classrooms)} + 8 \text{ (pupils)} \times 2 \text{ (rooms)}$$
$$= 160 \text{ pupils}$$

Consequently, all the three schools will have four dormitory buildings, each of which will consist of three boarding rooms and one small room.

3) Number of teachers

The appointment of teachers all over the country is done by the central office of the MGEYS. The MGEYS has two ways to

decide the number of teachers assigned to each school. In general, method (I) is used.

(I) A headmaster + a deputy headmaster + the number of classes x 1.5 + the number of the teachers of special subjects (maximum 3)

(II) Calculation under these conditions: There are 40 periods of lessons per week per class, and the headmaster and the deputy headmaster teach 24 periods a week, and ordinary teachers teach 31 periods a week.

As shown in the curriculum, junior secondary schools have 14 subjects. (16 subjects if art is divided into 3 subjects) In case teachers of each subject are appointed in a small scale school, it may cause an imbalance of the number of assigned classes subject by subject. It is also very inefficient. For this reason, some teachers teach subjects which are not their specialty in order to keep the balance. By this method, the number of teachers can be reduced, though it will lower the standard of the lessons to the detriment of the pupils. This is why the MGEYS intends to avoid the construction of small secondary schools.

The next calculation shows the number of teachers required in the three secondary schools of this project.

First, calculating by the above two methods:

(I) $1 + 1 + 1.5 \times 10 + 3 = 20$ teachers

(II) $(10 \times 40 - 2 \times 24) / 31 + 2 = 13.4$ teachers

There is a nationwide shortage of primary and secondary school teachers, and an effective arrangement of teachers is aimed at in the national development plans. Thus, the number of teachers is estimated according to the MGEYS standard that the maximum hours for a teacher is 30 periods a week.

In Table 16, the number of teachers necessary will be worked out under the condition of 10 classes (the number for the

TABLE 16 REQUIRED NUMBER OF TEACHERS

Courses Subjects	School Curriculum				10-Class School		6-Class School	
	General		Com- merce	Agricul- tural Science	Periods per Week	No. of Teachers	Periods per Week	No. of Teachers
	Boys	Girls						
English Language	8	8	8	8	80	3	48	'1.6
Zambian Languages	3	3	3	3	30	1	18	'0.6
Mathematics	7	7	7	7	70	3	42	'1.4
Religious Knowl.	1	1	1	1	10	1	6	'0.2
Civics	2	2	2	2	20		12	'0.4
History	3	3	3	3	30	1	18	'0.6
Geography	3	3	3	3	30	1	18	'0.6
Woodwork	2	-	-	-	10 or less	*1	6 or less	'0.4
Metalwork	2	-	-	-	10 or less		6 or less	
Homecraft	-	4	-	-	20 or less	*1	12 or less	'0.4
Commerce	-	-	6	-		'1		
Science	6	6	6	6	60	2	36	'1.2
Agric. Science	-	-	-	4		'1		
Art/Craft/Music	2	2	-	2	20 or less	*1	12	'0.4
Physical Training	1	1	1	1	10	'1	6	'0.2
T O T A L	40	40	40	40	400	15	240	8

NOTE : Figures marked with * mean teachers of special subjects and figures with ' mean those teaching two or more subjects concurrently.

secondary schools in the project) and six classes. The appropriate number of teachers in the project schools is to be 17 in 10-class schools, consisting of 15 teachers in charge of subjects, the headmaster and deputy headmaster.

(3) Location and Outline of the Project Sites

In this project, there are three places (sites) chosen for constructing junior secondary schools. The study team conducted investigations twice at each site from the middle of August to early September, the dry season in Zambia.

In this section, the location and situation of each site is described and reviewed.

1) Zimba site

The site of the Zimba Junior Secondary School is near the main road at a point about 400 km southwest of Lusaka. The road could be called the main artery connecting the south and north regions of the country. About 80 km farther south from this point, the road reaches Livingstone, the biggest city in the south of Zambia. There is also a railroad station about 200 meters from the site.

The shape of the site is irregular, facing the main road on the south and the railroad on the north. The land can be estimated at 420 by 550 meters in extent. There is a gradient to the west from the north and east. At the southwest corner of the site, there is a low area, around which there are some trees and five ant hills. The ground is very hard sandy soil.

A power transmission line runs across the northeast of the site, and along the main road runs a telephone line. Zimba has a water supply network, and by installing a water pipe extending about 300 meters from the existing pipe the system will reach the border of the school.

2) Jumbe site

The site of the Jumbe Junior Secondary School is in a wooded area, 1.5 km north of a point 80 km northwest of Chipata on the unpaved road which connects Chipata and Mfuwe. To get to Chipata, it is necessary to drive east from Lusaka about 580 km on the main road.

The site is a 420 by 600 meter rectangle, and the land is rather flat except for the south end and inclines slightly from east to west. There are medium size trees all over the area and are four ant hills. The ground is hard sandy soil. There is no electricity, telephones or water supply in this district.

3) Lukona Site

The site of the Lukona Junior Secondary School is at a place 40 km overland from Mongu, which is about 590 km due west of Lusaka, the capital of Zambia. Between Mongu and Lukona lies a vast flood plain along the Zambezi River. In the rainy season the plain becomes a great river 30 km wide, and in the dry season the river is only 100 meters wide. It is very difficult to find the route to Lukona without a guide because there is no visible road in the plain when it is dry and there are no traffic signs and one must follow winding ruts to avoid the mud. In addition, sandy soil and brooks make it difficult to drive cars there.

On the west (Lukona) side of the Zambezi River, the biggest city is Kalabo. From here to Lukona is about 50 km by land, but there is no road suitable for cars there either, so it takes over 2 hours by 4-wheel-drive car to go to Lukona.

The school site is several hundred meters south of the central part of Lukona, on a sandy hill about 30 meters high on the flood plain. The shape of the site is a rectangle, 500 by 700 meters, and the lay of the land is like a saddle. The site is almost completely covered with bushes about two

meters tall. There is no electricity, telephones or water supply within 40 km from Lukona.

Near the site, there is the old Lukona Basic School (grades one through nine) which has about 550 pupils. Though the school has ten classrooms, the building is very old and because of the shortage of desks and chairs, school activities are carried out in triple shifts.

4) Reviews

The study team conducted field survey based on a check list prepared for the survey including the way pupils and teachers can get to school, the way to manage the schools, the situation and surroundings of the sites, and the construction methods.

This survey revealed that for all three sites there are only a few day pupils who could attend school on account of the sparsity of population around these sites and that there are no houses for rent for the teaching and support staffs.

Table 17 shows the outline of construction and management of the school in the three sites. The following contains some important points in the table.

a. Transportation to the Lukona site

There is no problem between Lusaka and Mongu, but there is difficulty in transportation between Mongu and Lukona throughout the year. From January to May, the best way to carry machinery and materials seems to carry them by barges through the canal for 35 km, unload them at Kama, then transport them by land for 11 km. However, since the barges are the property of the Department of Water Affairs and the Ministry of Power, Transport and Communication, it is uncertain if the barges would be available whenever necessary.

From June to December, if the existing transportation means are used, there are only two ways, using cars and ferryboats

over the route (1) Mongu-Senanga-Lukona, or (2) Mongu-Kalabo-Lukona. Although route (1) is open throughout the year, after crossing the river at Senanga by ferryboat, the machinery and materials have to be carried by car for over 150 km through the roadless sandy plain. It is said that the trip over the plain by 4-wheel-drive car takes over 15 hours. Route (2) is shorter than route (1), but can be used only from July to September. Moreover, the ferryboats that have to be used between Mongu and Kalabo at two points can load at most five and three metric tons respectively, some streams in the plain interfere with vehicle transportation, and the sandy soil makes it difficult for vehicles to drive. It takes seven hours to go from Mongu to Lukona by 4-wheel-drive car.

Since it is impossible to transport a lot of machinery and materials at one time between Mongu and Lukona, it is essential to make sure of the means of transportation through the year for a large-scale construction project. For that, two better ways are planned in place of the above two routes to secure reliable water transport between Mongu and Kama. One is to dredge the canal, which becomes shallow in the dry season, and the other is to make special barges and construct a harbor at some place convenient for this plan. It is necessary to confirm if this plan is possible to realise.

b. Procurement of materials for the Lukona Secondary School
On the western side of the Zambezi River, there is no filling station and the groceries available at Kalabo are rather poor in both variety and quantity. Most of the materials necessary for the management of school will be purchased at Mongu, but as mentioned above there are problems in transportation. What is more, as transportation is difficult, the goods will be expensive, a fact which may influence the management of the school.

TABLE 17 COMPARATIVE STUDY OF THE THREE SITES

	Lukona	Jumbe	Zimba
Transport	Possible during January and May, however, may require prompt arrangements to secure barges.	Difficult during November and March	No problem
Procurement of Materials	Fuel and food can be purchased in Mongu but proper transport means need to be provided.	Chipata Some of the materials are sometimes in short supply.	Livingstone or Kalomo
Electricity	Not supplied A generator is needed.	Not supplied A generator is needed.	Supplied
Telephone	Not supplied A wireless telephone system can be installed.	Not supplied A wireless telephone system can be installed.	Supplied
Water	Not supplied A bore hole is needed.	Not supplied A bore hole is needed.	The existing water piping is to be extended for 300 m.
Site Preparation	Some grading work is needed. A lot of bushes need removing.	Hardly necessary A lot of trees need removing.	Some grading work is needed.
Supporting Bed	Loose sand	Hard sand	Very hard sand
Medical Facilities	A clinic nearby	A clinic 6 km away	A small hospital nearby

c. Transportation to the Jumbe site

The road from Chipata to Jumbe, a distance of about 80 km, has only been graded by bulldozers and graders and consists of laterite (clay tuff soil) and stone. Accordingly in the rainy season, from November to March, certain parts of the road sometimes become a waterway or develop very muddy places that make vehicles slip, so it is supposed that transportation by truck will not be easy.

d. Trees in the Jumbe site

The removal of the trees which grow all over the site is within the Government of Zambia's scope of work. There are so many trees that even cutting down only those deemed troublesome to construction work would be a problem and some are so big that the problem is increased.

(4) Summary of the Facilities and Equipment

1) Summary of the Facilities

A summary of the three schools' facilities are indicated in the following list.

	Zimba	Jumbe	Lukona
(Administration rooms)			
Headmaster's room	1	1	1
Deputy headmaster's room	1	1	1
Bursary room	1	1	1
Office	1	1	1
Teachers' room	1	1	1
Clinic	1	1	1
Sick bay	2	2	2
(Educational facilities)			
Classrooms	9	9	9
Science laboratory (preparation room)	1	1	1
Cookery room (preparation room)	1	1	1
Needlework room (preparation room)	1	1	1
Stores (preparation room)	2	2	2
Metalwork room	1	1	1

Woodwork room	1	1	1
Library	1	1	1
(Dining room and kitchen)			
Dining room	dinner:160 meeting:400	dinner:160 meeting:400	dinner:160 meeting:400
Kitchen	1	1	1
Pantry etc.	6	5	5
Office	1	1	1
Tuck shop	1	1	1
Stand-by kitchen	1	1	1
(Dormitories and others)			
Boarding rooms (half boys', half girls')	12	12	12
Ablution block (toilet, shower room, laundry)	2	2	2
(Others)			
Garage	1	1	1
Storeroom	1	1	1
Headmaster's house	1	1	1
Teachers' houses	14	14	14
Staff houses	7	7	7
Electrical equipment room	electricity room	generator room	generator room

2) Outlook of the equipment

The equipment necessary for the lessons in the various subjects and school management are to be provided according to the curriculum for junior secondary schools. The nature of the equipment is as follows:

Educational equipment

- Homecraft : instruments for cooking exercises
instruments for sewing exercises
- Science : implements for experiments in physics
implements for experiments in biology
implements for experiments in chemistry
- Technical art : instruments for metalwork exercises
instruments for woodwork exercises
- Physical training : equipment for outdoor physical training

Agriculture : farming appliances (spades, hoes, etc.)
 A-V equipment : projectors, etc, for audio-visual
 instructions
 Others : furniture for educational purposes
 various kinds of books and bookshelves

Equipment for school management

Kitchen equipment : cooking appliances and tableware

Machinery and materials for maintenance :

instruments for school maintenance

Common equipment : fire extinguishers,
 medical instruments,
 cleaning tools, etc.

Vehicles : vehicles for transporting materials
 necessary for school management like
 petroleum, firewood, foodstuffs, etc.

(5) Operation and Maintenance System; Personnel Allocation

The following number of secondary school teachers will be adapted
 in this plan as worked out in (2) Basic Planning in this section.

	Zimba	Jumbe	Lukona
Headmaster	1	1	1
Deputy headmaster	1	1	1
Teachers	15	15	15
Total	17	17	17

There is an official standard on the number of support staff,
 noted in "Reference File No. ME/101/10/4-11/8/71" which was
 revised afterwards and adopted in the Fifth Education Project.
 In Table 18, the numbers of support staff of the 6-classroom
 scale secondary school and 9-classroom scale secondary school are
 quoted from the former data, and those of the 9 to 12-classroom
 scale secondary school (There is no 6-classroom scale secondary
 school standard in the Fifth Education Project) are quoted from
 the latter data. These figures are thus the standards adapted
 from the Fifth Education Project.

One of the clerks is to be a secretary-typist. The artisans will be in charge of technical maintenance of the buildings and utility systems in the schools. They will operate generators in the Jumbe and Lukona schools.

From this table, it can be seen that the three secondary schools of this project have the same number of support staff. The post of boarding master is to be held concurrently by one of the teachers, so the total number of staff will actually be 28. Of the staff, the bursar, caretaker, clerks, artisans and laboratory assistant are to be dispatched from the central office of the MGEYS, and other staff are to be employed from the inhabitants of these regions.

TABLE 18 STANDARD NUMBER OF SUPPORT STAFF

	Reference File No. ME/101/10/4				Fifth Education Project
	9-class School		6-class School		School w/ 9-12 Classes
	Day School	Boarding School	Day School	Boarding School	Boarding School
Bursar	-	-	-	-	1
Boarding Master		No standard			1
Caretaker	1	1	1	1	1
Matron	-	1	-	1	1
Clerks	2	2	1	1	2
Orderlies	2	3	2	3	2
Cooks	-	4	-	2	4
Kitchen Hands	-	4	-	4	6
Watchmen	2	2	2	2	2
Drivers	1	1	1	1	2
Artisans		No standard			2
Lab. Assistants	1	1	1	1	1
Janitors	4	2	4	2	4
	13	21	12	18	29

(6) Technical Cooperation

It is advisable to combine the project with technical cooperation as mentioned below.

In principle, Zambian teachers should be employed for all subjects. In some subjects, however, the number of well qualified Zambians is inadequate. These subjects are physics, chemistry, biology, mathematics, music and fine arts. As an essential condition for national development, in order to raise the levels of science, mathematics and technical art, increasing the number of the teachers of those subjects and improving their professional capabilities are called for, because the absolute numbers of such teachers are especially inadequate.

As of September 1988, 18 JOCV staff members are stationed in primary and secondary schools in Zambia as teachers of science and mathematics. They are highly regarded by the Zambians involved. Thus technical cooperation is wished mainly in this scientific and mathematic field by the JOCV members, and furthermore, as teachers of technical art, fine arts, music or as supervisors of production units.

CHAPTER 4 BASIC DESIGN

CHAPTER 4 BASIC DESIGN

4-1 Basic Design Policy

The following are the basic policies for drawing up the design of the facilities and equipment of the project.

- (1) Consider the objectives, functions and academic activities of the junior secondary schools.
- (2) Design the school facilities along the lines of the "Architectural Brief and Schedule of Accommodation, Fifth Educational Project in the Republic of Zambia" issued by the Building Department of the Ministry of Power, Transport and Communication. The Government of Zambia expressed a strong desire that the design of the schools conform to the Architectural Brief and Schedule of Accommodation so as to assure easy maintenance and the same standards as the same grades in other schools. The project schools will also be designed as the same level in the schools constructed with the funds by the WB and the ADB.
- (3) Arrange the school buildings taking advantages of topographic features of each site to facilitate the site preparation work to be done by the Government of Zambia before the commencement of construction work. Each site has undulations or obstacles like ant hills in the site ground. The Jumbe and Lukona sites are located in woods, and it may require time and expense for excavation, clearing and grading work.
- (4) Use construction materials manufactured in Zambia or nearby countries and local construction methods as much as possible.
- (5) Design the electricity generator system and water supply system for the schools so as to economise the initial and running costs. There are no existing power and water supply systems around the Jumbe and Lukona sites.

- (6) Consider the climate of Zambia (inland plateau, mostly over 1,000 meters above sea level). Design the facilities to provide natural ventilation and to withstand prolonged downpours during the rainy season and temperature differences.
- (7) Consider the customs of the Zambian people and the functions of the schools as public facilities.
- (8) Design the facilities to secure durability and simplicity of maintenance considering the economic situation in Zambia.
- (9) Bear the security against robbery in mind such as installing grids on all of the windows to protect expensive equipment and fittings except for those of lavatories and other rooms which are not regarded necessary.
- (10) Conform to the applicable codes and standards of Zambia for the facility design. If there are no such regulations, the British regulations commonly applied in Zambia shall be complied with.
- (11) Select the equipment to be granted to suit the actual situation of Zambia. In particular, equipment easily maintained in Zambia shall be provided.

4-2 Review of the Basic Design Conditions

In junior secondary schools, one class shall consist of 40 pupils as stipulated by the MGEYS. Based on this standard, ordinary classrooms, special classrooms and other school facilities are standardised in the Architectural Brief and Schedule of Accommodation, and recent school constructions conform to these criteria.

The purpose of the Architectural Brief and Schedule of Accommodation is to reduce the initial costs by adopting commonly used and easily available construction materials in the country; to abolish regional inequalities by standardisation of facilities; and to assure simplicity of maintenance.

The project schools, which will be under the administration of the MGEYS, shall be designed fully respecting the above-mentioned concept and following the said Brief.

As for teaching and support staff housing, the number of rooms, floor areas and utilities are also according to the standards set by the Building Department. The school facilities shall be designed according to the standard design of the Building Department.

4-3 Basic Design

(1) Site Development Plan

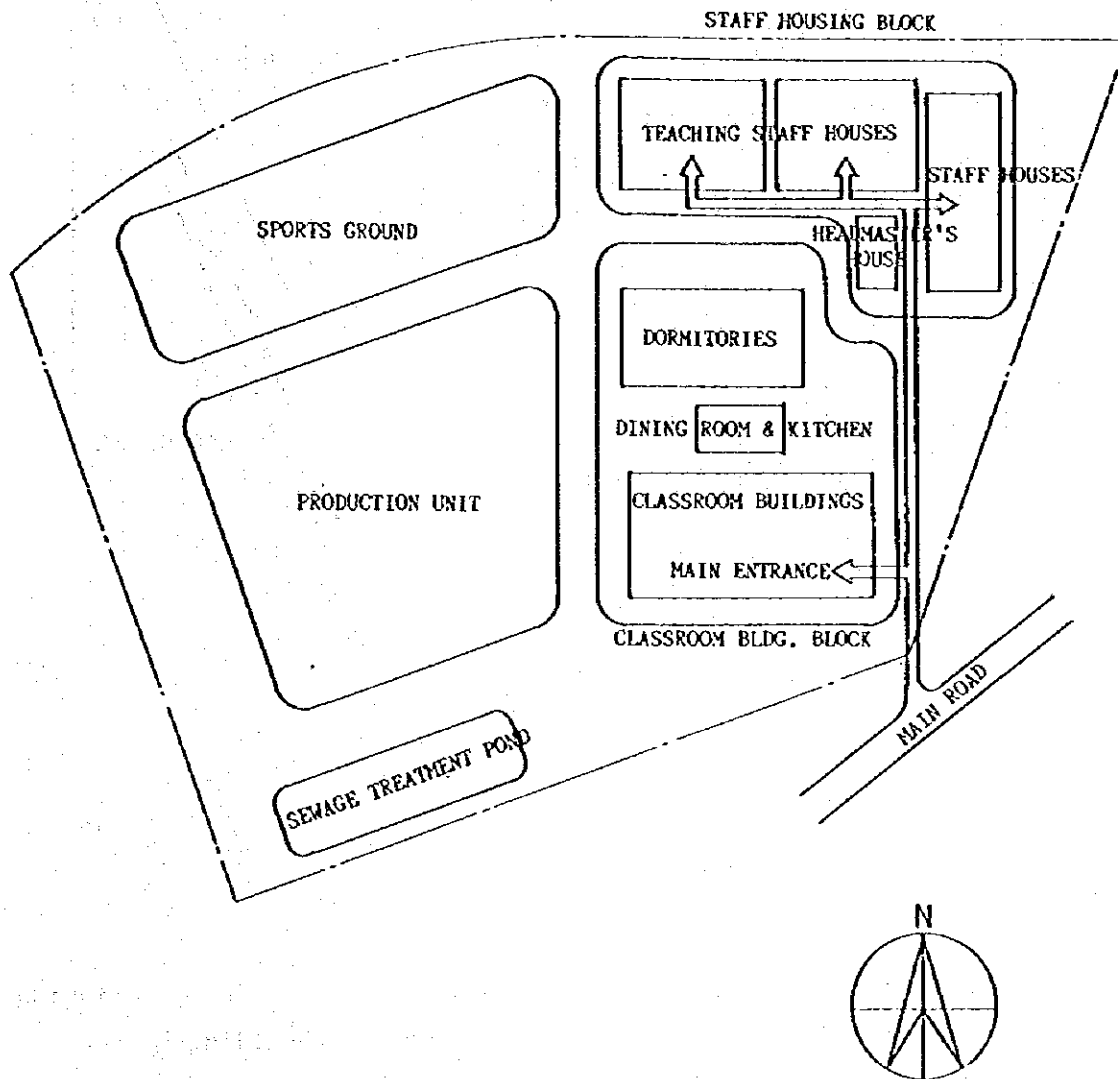
According to the basic design policies mentioned above, the buildings will be arranged in view of the following considerations:

- 1) to coordinate the public nature of the school facilities and individuality of the staff houses, and
- 2) to locate the buildings according to the topographic features of the site to reduce costs of exterior work as well as to utilise the site effectively for the maximum capacity and efficient arrangement.

The school facilities can be divided into, by function, classroom building block, staff housing block, sports ground, production unit and sewage treatment pond. The classroom building block consists of an administration building, ordinary classroom buildings, special classroom buildings, dining room and kitchen, dormitories, and ablution blocks. The staff housing block consists of the headmaster's house, teaching staff houses and support staff houses. For the site development plan, these buildings and facilities shall be arranged taking into account the following considerations.

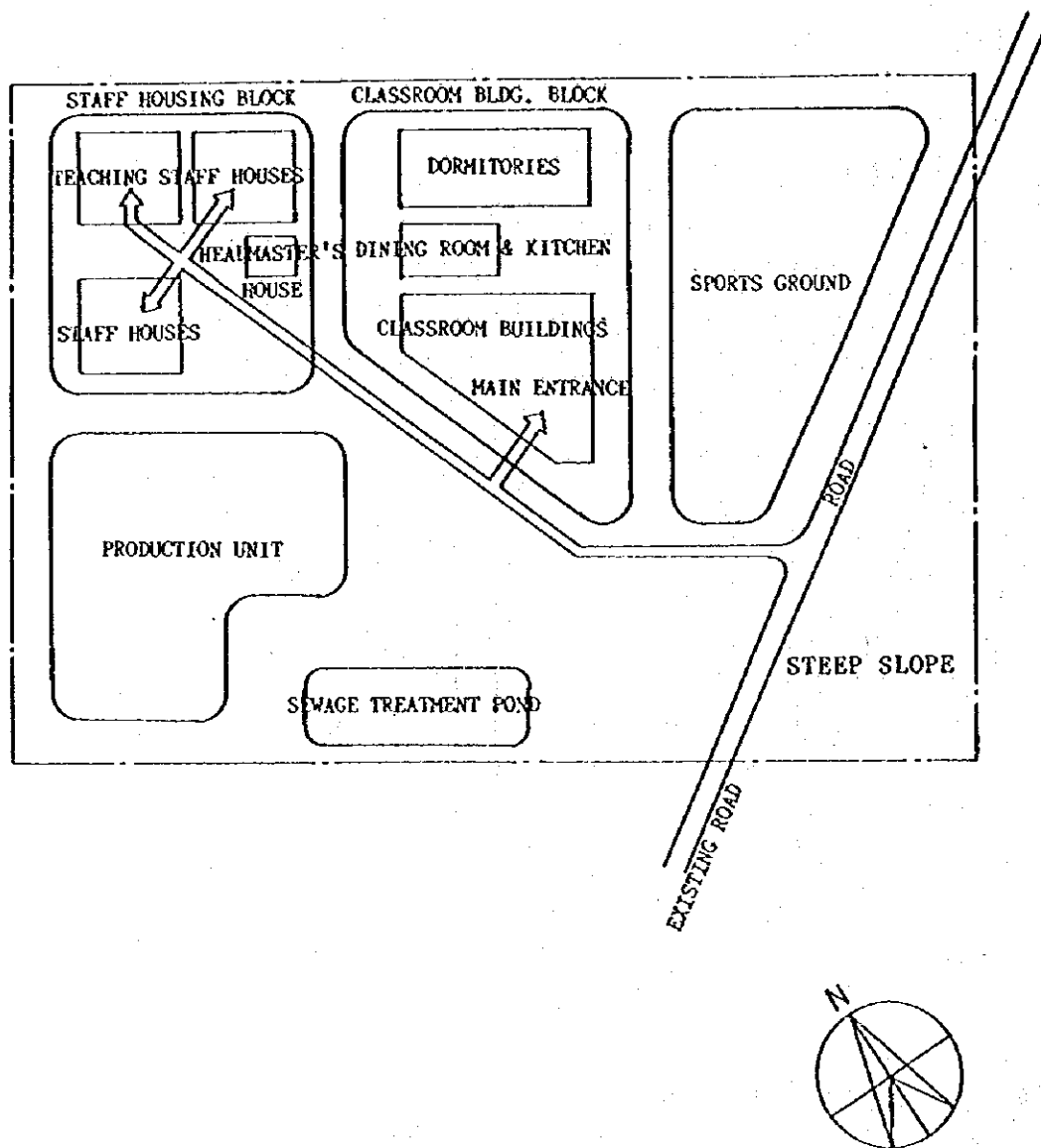
- 1) Locate the administration building near the entrance for the convenience of security control of the entire compound.

- 2) Separate the workshop from other buildings so that noise produced by metalwork and woodwork may not affect them, but considering the easy unloading of tools and materials.
- 3) Locate the dining room, where the boarding pupils dine and all the school pupils can assemble, at the center of all the facilities for the convenience of utilisation. Arrange the kitchen so that cooking odors, noise and exhaust fumes may not adversely affect study and daily living, but considering the easy unloading of food.
- 4) For convenience of supervision, locate the girls' dormitory buildings near the headmaster's house, who will take responsibility for all the facilities.
- 5) Locate the ablution blocks for the convenience of day use from the classrooms and night use from the dormitories, with assurance of enough space for treating sewage.
- 6) Arrange the houses so that sufficient sun shine enters the rooms to cope with low temperatures during the dry season. Windows of the classrooms shall face the north for maximum natural lighting.
- 7) Separate the generator room so that machine noise may not adversely affect the school and dormitories.
- 8) Secure as much land as possible for the production unit to serve for practical training in agriculture.
- 9) Isolate the sewage treatment pond so that its foul odors may not adversely affect other blocks. It shall be located with sufficient gradient so as not to cause pipe blockage.



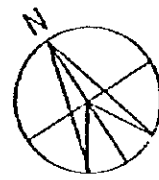
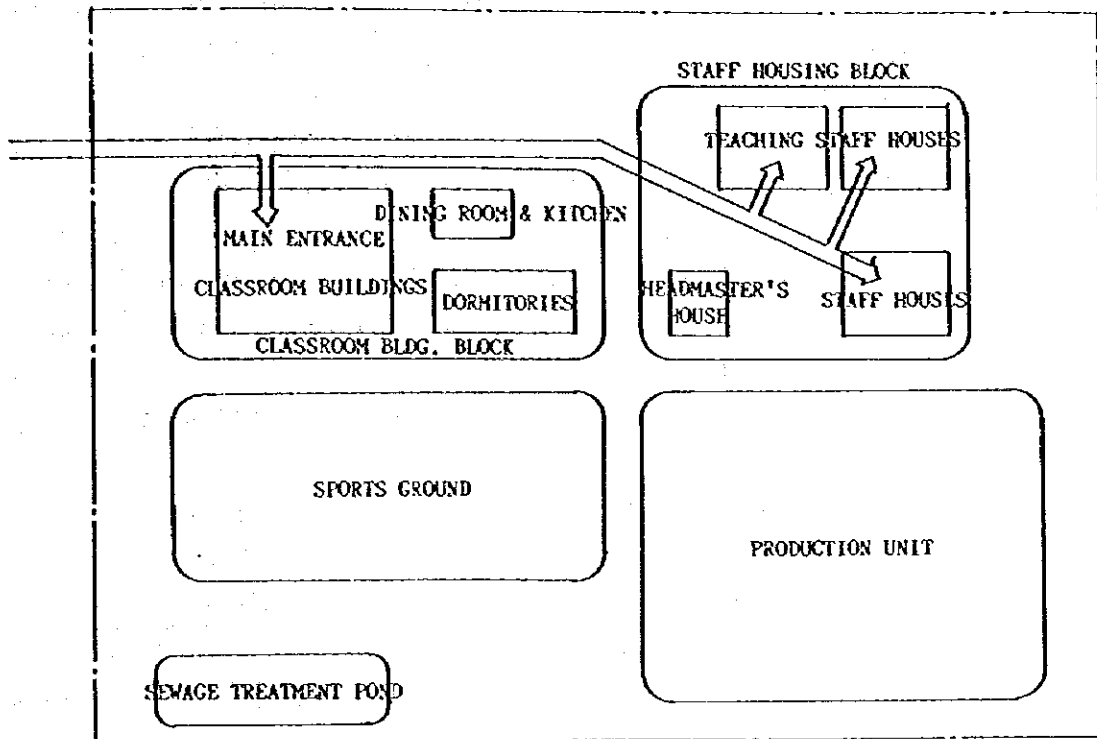
- Site roads can be shortened by arranging an approach from the existing principal road.
- Each building is designed for the higher ground in the site.
- Land for the sports ground is prepared in the northeast of the site where the ground is flat.

FIGURE 5 ZIMBA SITE CONCEPT PLAN



- A sports ground is located as a buffer zone between the existing road where various people pass and the classroom building block.
- The steep slope in the south of the site will remain as it is.
- As there are a lot of trees and ant hills in the site, each building needs to be located so that felling and clearing work may be minimised.

FIGURE 6 JUMBE SITE CONCEPT PLAN



- The ground of the site is high along the center of the east-west axis and low on the north and south sides, like the shape of a horse saddle. Thus, each block will be located parallel to the east-west axis in the middle of the site.
- An approach is designed from the Lukona Basic School side.

FIGURE 7 LUKONA SITE CONCEPT PLAN

(2) Facility Plan

The school facilities shall be designed considering the required functions of each block, coordination of all the complex and convenience of utilisation.

1) Administration building

The administration building shall consist of two wards: one accommodating the headmaster's room and the other the teachers' room. Major rooms involved in the administration building will be --

Headmaster's room (also serving as the interview room)

Deputy headmaster's room

Office (also serving as the reception area)

Bursary room

Storeroom

Lavatories (one each for men and women)

Teachers' room (also serving for teachers' meetings and includes hot water service)

Clinic

Sick bays (one each for boys and girls)

Lavatories (attached to the clinic)

2) Ordinary classrooms

One classroom will have an area of 63 m² for 40 pupils. A classroom building will consist of three classrooms and one storeroom. The windows will be designed as large as permitted from an overall structural standpoint to get sufficient natural lighting and ventilation for study. A chalkboard will be installed in the front of each classroom and a pin board in the back. The storeroom will be provided with wall shelves for stocking materials.

3) Workshop

Rooms with a capacity for 20 pupils each will be designed for woodwork and metalwork.

4) Science laboratory

The science laboratory will be about 100 m² large for 40 pupils, to be used for physics, chemistry and biology experiments. Concrete work tables with stainless steel laboratory sinks will be installed on three of the walls. Shelves, a chalkboard and a pin board will also be provided. A storeroom will be attached for stocking both poisonous and non-poisonous chemicals, other materials and instruments as well as for preparations for experiments.

5) Homecraft building

The homecraft building will consist of two rooms, a cookery room and a needlework room, each of which can accommodate 20 pupils. The cookery room will be equipped with sinks, food preparation tables, stoves, a chalkboard and a pin board, while the needlework room will be equipped with work tables, a chalkboard and a pin board. Storerooms with shelves on the walls will be attached to each room for preparation and stocking of materials.

6) Library

The library will be of the open-stack type to utilise space efficiently and to let the pupils come in touch with the books. It will have sufficient space to allow about half the pupils of a class to use the library at one time.

7) Dining room and kitchen

The dining room will be designed for serving daily meals to the boarding pupils, assemblies of all the pupils, performances, lectures, ceremonies, examinations, pupils' evening activities, etc. It will have sufficient floor area for 320 boarding pupils to dine at on a double shift basis, and 400 pupils to gather there for assemblies.

The energy source for the kitchen equipment will be electricity in the Zimba site, where there exists an electrical wiring network, and firewood or charcoal in Jumbé and Lukona to keep running costs low, although the generators will be

installed. A stand-by kitchen using firewood or charcoal will be designed for Zimba in preparation of power failure.

The kitchen will have a staff office, pantry, lavatory and a tuck-shop to sell daily commodities and stationery to the boarding pupils, in addition to a service yard for the slaughter and preparation of livestock.

8) Dormitories

The dormitories will be designed with the same construction basis and space as the classrooms for easy conversion into classrooms in the future. Each building will accommodate 80 pupils.

9) Ablution block

Lavatory facilities will be in a separate building between the classrooms and dormitories for odor and sanitation isolation. Boys' and girls' facilities will be separately provided. The number of toilets will be determined according to that of the pupils. A non-flushing type system will be provided to save water consumption and to avoid pipe blockage due to hard paper since proper toilet rolls may be scarce around the site areas. Open space will be prepared near the ablution block to bury sludge removed from the septic tank for regular maintenance.

10) Garage and storeroom

For the vehicles to be granted, a garage with a store for spare parts and tools, and storerooms for accessories to be used in the school activities will be located in one building.

11) Electricity room and generator room

An electricity room where a switchboard is located will be provided for Zimba, and a generator room equipped with two generators will be provided for Jumbe and Lukona. These rooms will be minimum in space and quality to meet the requirements.

12) Pump room

A pump room will be provided only in the Zimba site for a pump to lift water up to the elevated tank.

13) Pit latrines

In preparation for water shortages or toilet congestion, pit latrines will be provided for supplementary use.

14) Teaching and support staff houses

The teachers' and support staff houses are standardised by the Building Department as to the floor areas, the number of rooms and the grade of utility system, etc. as "type A" for the headmaster's house, "type B" for teaching staff and "support staff house" for non-teaching staff house. In this project, the type B and support staff houses will be designed combining two houses into one ward in order to reduce construction cost, without largely deviating from the standard in size and the number of rooms. Kitchen equipment is to be installed in these houses. Electric cooking stoves are designated for Zimba and firewood or charcoal type stoves for Jumbe and Lukona.

(3) Structural Plan

The project will adopt a structural system using local construction materials and methods based on the standard design for school buildings set by the Building Department of the Ministry of Power, Transport and Communication. Economy and durability will also be considered. "The Republic of Zambia Standard" and "British Standard" will be applied in principle for structural design.

1) Foundation

The ground of the site is sandy soil which is not expected to provide a high soil bearing capacity, but as all the project buildings are to be flat, a spread foundation system is deemed appropriate. The permissible soil bearing capacity is taken between 3.0 tons/m² and 5.0 tons/m².

2) Framing

A concrete block structure system will be recommended, as it is commonly adopted for school buildings in Zambia. Floors shall be concrete slabs directly supported on the ground and roofs shall use a reinforcing bar truss (spider truss) with asbestos cement boards.

3) Structural materials

Reinforcing bars: to be purchased locally based on the British Standard

plain bar $f_y = 250 \text{ N/mm}^2$

deformed bar $f_y = 410 \text{ N/mm}^2$

where: N is the newton in the SI unit system (1N = 0.102 kgf)

Concrete : ordinary cement with

$f_c = 20 \text{ N/mm}^2$

(4-weeks compressive strength)

Cement : ordinary Portland cement

(Zambian Standard ZS001)

4) Design loads

Design loads shall be in accordance with the Zambian Standard for Loading for Building, ZS016, Part 1.

5) Seismic force

A seismic zone lies around the country's borders, especially along the border with Tanzania and Malawi, the area from Lake Kaliba to Mozambique and the area by the Kafwe River. Some earthquakes have been recorded, however, they have mostly been small ones (about magnitude 3), with the largest recorded one being about magnitude 6.

Since the project sites are distant from the seismic area, no seismic force needs to be considered except for the elevated tank structure. As for the lateral seismic force for the design of the elevated tank structure, $K=0.05$ will be applied.

6) Wind force

The average wind speed shown in the Meteorological Data for the Building Industry issued by the Zambia Meteorological Department is about 5.0 m/sec. Since the project buildings are flat, with concrete block masonry, wind force need not be considered.

(4) Material Plan

Materials scheduled to be adopted in this project are as shown below. Local products and materials will be used as much as possible, unless there are disadvantage as to quality, price and supply conditions, the aims being economy and easy construction and maintenance.

1) Structural materials (main elements)

Material	Member	Zambia/Japan	Reference
Reinforced concrete	Foundations, lintels	o	
Concrete with steel mesh	Slab ends	o	
Plain concrete	Slab centers	o	
Concrete blocks	Walls	o	
Steel trusses	Span trusses	o	quality, supply
Reinforcing bar trusses	Purlins	o	

2) Exterior finishing materials

Material	Member	Zambia/Japan	Reference
Asbestos cement boards	Roofs	o	
Concrete blocks, EP	Exterior walls (classroom)	o	
Cement mortar, EP	Exterior walls (houses)	o	
Steel sashes, OP	Windows, entrances	o	
Wooden doors, OP	Entrances	o	

Colored mortar with hardener, trowel finish	Floors	o	
Bitumen	Foundation surfaces	o	for conc. protection
Polyethylene sheets, 0.15 mm thick	Bottom of floor slab	o	

3) Interior finishing materials

Material	Member	Zambia/Japan	Reference
Asbestos cement boards t=6 mm, painting	Ceilings (houses)	o	
Mortar w/ trowel, paint	Walls, baseboards	o	
Exposed block, paint	Walls	o	
Semi-porcelain tiles (100 mm square)	Walls	o	
Mortar w/ trowel finish	Floors	o	
Colored mortar with hardener, trowel finish	Floors	o	
Concrete with hardener, trowel finish	Floors	o	

4) Exterior finishing schedule

- Classroom buildings

Member	Finish
Roofs	Ribbed asbestos-cement board
Exterior walls	Concrete block, EP
Doors and windows	Steel sash, OP
Doors	Wooden door, OP
Corridor floors	Colored mortar with hardener, trowel finish
Corridor ceilings	Ribbed asbestos-cement board
Corridor ceilings	Reinforcing bar truss, OP
Corridor columns	Steel frame, OP
Corridor columns	Asbestos pipe, EP (concrete pouring)
Grids	Steel, OP
Foundation surface	Bitumen

- Teaching and support staff houses

Member	Finish
Roofs	Ribbed asbestos-cement board
Ceilings	Asbestos-cement board, EP
Exterior walls	Mortar with trowel finish, EP
Doors and windows	Steel sash, OP
Doors	Wooden door, OP
Floors	Colored mortar with hardener, trowel finish
Eaves (plancier)	Exposed roof material
Eaves (plancier)	Wooden board, OP
Foundation surface	Bitumen

(5) Utility Plan

Aiming at long-term usage of school facilities, the utility systems are planned for durability, easy maintenance and low operation and maintenance costs in accordance with the regional situations of the sites.

1) Plumbing system

a. Water supply system

i) Zimba site

A water main runs to about 300 meters east of the site and will be extended as one of the responsibilities of the Government of Zambia. The water supply pipes within the site area will be installed in this project.

The pipe will be equipped with a main valve and a water meter at the site border. Water will be stored in a reservoir tank, lifted up to the elevated tank by a lift pump and distributed to each building by a gravity type supply system.

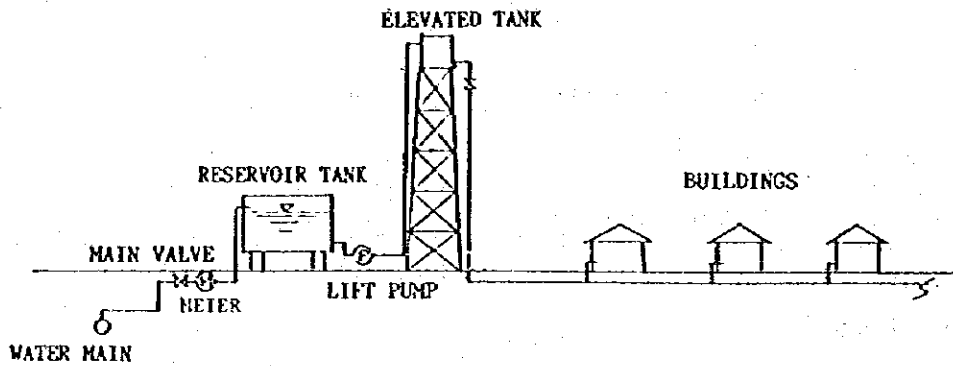


FIGURE 8 WATER SUPPLY SYSTEM AT THE ZIMBA SITE

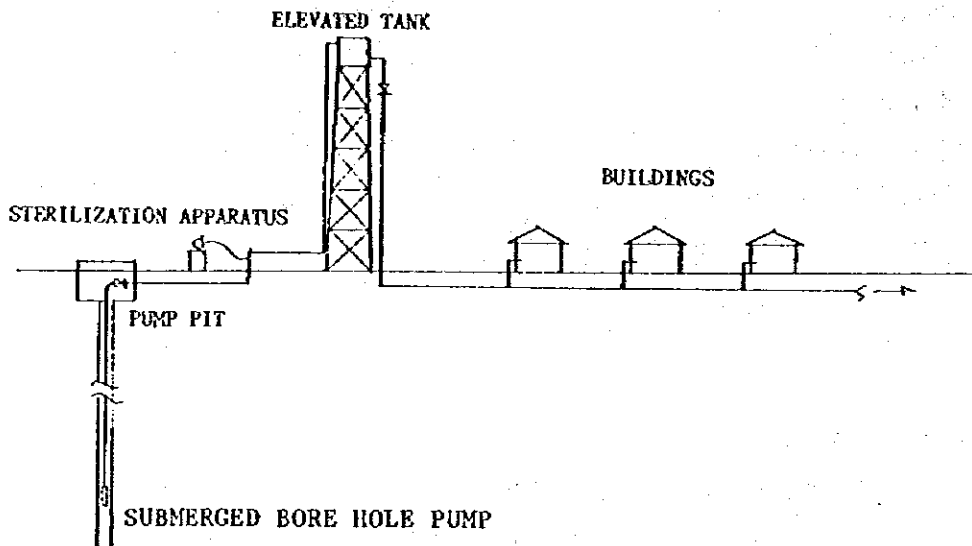


FIGURE 9 WATER SUPPLY SYSTEM AT THE JUMBE AND LUKONA SITES

ii) Jumbe and Lukona sites

These sites are located apart from towns and have no water supply networks nearby. Two bore holes (one is Zambian responsibility) will be drilled in each site and equipped with submerged bore hole pumps. Water will be lifted up to the elevated tank and distributed to each building by a gravity type system. A disinfectant dripping apparatus using sodium hypochlorite will be attached to the water supply system.

iii) Amount of water supply (common to the three sites)

Staff houses (including family members)

22 houses x 6 pers./house x 120 liters/pers/day = 15,840 liters/day
Boarding pupils 320 pers. x 120 liters/pers/day = 38,400 liters/day
Day pupils 80 pers. x 30 liters/pers/day = 2,400 liters/day

T o t a l 56,640 liters/day

Capacity of the bore holes (Lukona and Jumbe sites)

Amount to be pumped 2.0 liters/sec. (according to the Dept. of
Water Affairs)

2.0 liters/sec. x 60 sec. x 2 wells = 240 liters/min.

Pumping time

56,640 liters/day ÷ 240 liters/min. ÷ 60 min. = 3.93 hours

b. Sewage system

A cesspool type sewage treatment system (sewage treatment pond taking advantage of natural disintegration) will be designed in each site as an integral treatment system. Lavatory facilities for pupils will adopt a non-flushing type system to save water consumption and to avoid the pipe blockage due to solid wastes. A sedimentation pit will be provided under the toilets and sewage water broken down through putrefaction will be discharged into the sewage treatment pond. The sludge on the bottom of the pit will be drawn out by the sludge pump and buried in an open space. Drainage from the shower rooms and lavatory basins will also be discharged into the pit.

Water closets will be provided for the staff houses. A septic tank will be installed in each housing zone, and sewage through the pit will be discharged into the pond.

Drainage from the kitchens will be treated in the same way.

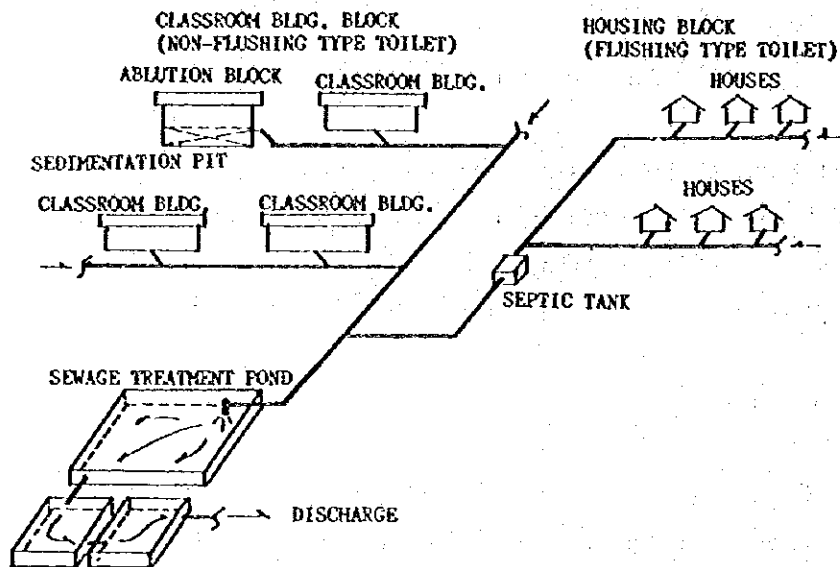


FIGURE 10 OUTDOOR SEWAGE TREATMENT SYSTEM

c. Hot water supply system

A hot water supply system will be provided for the kitchen in the classroom building block and the teaching staff houses. The heating equipment will be solar panel units collecting solar heat to reduce energy cost equipped with a hot water tank, and will be installed on the roof. From this unit, hot water will be supplied to each hot water faucet through the hot water piping.

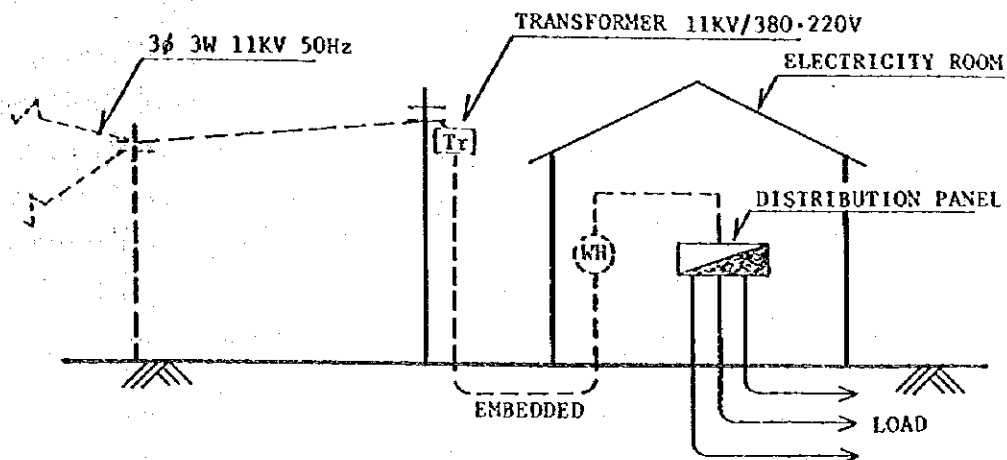
d. Fire system

The fire system will be installed within the classroom building block. This system will consist of fire hoses connectable to the water supply pipe for common use.

2) Electric system

a. Power intake system (the Zimba site)

An intake power line will lead into the distribution panel from a transmission line (aerial, 3 ϕ 3W 11,000V) through a transformer of 3 ϕ 4W 380/220V to be installed by the Zambia Electric Supply Corporation. Cost for the power intake system will be included in the project cost. Electric power of 3 ϕ 4W 380/220V will be distributed through the distribution panel to each building.



Note: Intake work to the distribution panel will be undertaken by ZESCO and its cost will be included in the project cost.

FIGURE 11 POWER INTAKE SYSTEM AT THE ZIMBA SITE

b. Generator room (the Jumbe and Lukona sites)

A generator room will be equipped with two diesel generators each with the capacity for more than half the total required power demand. Operation of the generators is to be controlled manually according to the electricity consumption rate.

Power for the training and science laboratory equipment will be supplied from a separately installed small generator to deal with different time periods for daily consumption and to save utility costs.

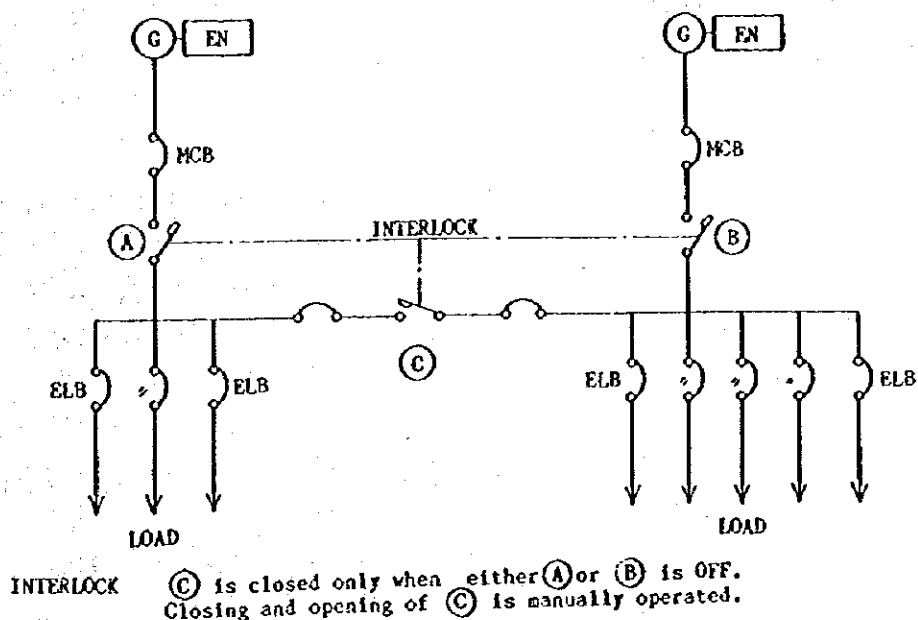


FIGURE 12 DISTRIBUTION DIAGRAM AT THE JUMBE AND LUKONA SITES