NO. 4

BASIC DESIGN STUDY REPORT ON THE CONSTRUCTION PROJECT FOR NATIONAL YOUTH SERVICE ENGINEERING INSTITUTE IN THE REPUBLIC OF KENYA

December, 1985

JAPAN INTERNATIONAL COOPERATION AGENCY

PREFACE

In response to the request of the Government of the Republic of Kenya, the Government of Japan decided to conduct a Basic Design Study on the Construction Project of National Youth Service Engineering Institute and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent to Kenya a study team headed by Mr. Shozo OHIRA, Grant Aid Division, Economic Cooperation Bureau, Ministry of Foreign Affairs, from 29th July to 22nd August, 1985.

The team had discussions on the Project with the officials concerned of the Government of Kenya and conducted a field survey.

After the team returned to Japan, further studies were made and the present Report has been prepared.

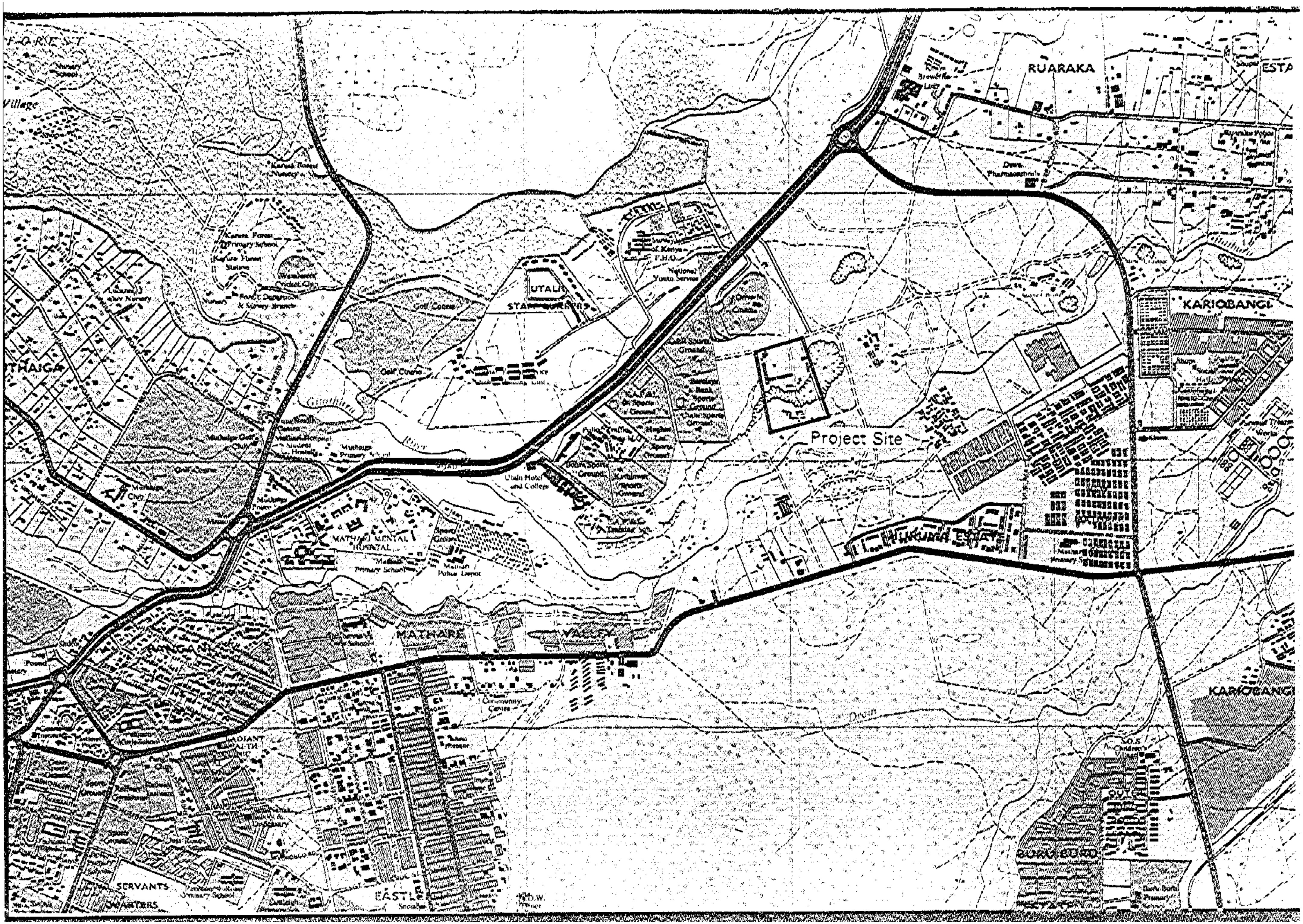
I hope that this Report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

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

December, 1985

Keisuke Arita

Keisuke ARITA
President
Japan International
Cooperation Agency


RUARAKA
KARIOBANGI
Project Site
UTALII
MATHARE
VALLEY
MATHARI MENTAL HOSPITAL
EASTLEIGH
SERVANTS
THAIGA
FOREST
Village
Golf Course
KARIOBANGI
Drain
River

SUMMARY

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The Government of Kenya, in its 5th Five-year Development Plan (1984-1988), puts an emphasis on "the enlargement of employment opportunities in the Republic by an annual average of 3.8%" as one of its important targets. For realizing this target, the Government has revised its educational system from its present 7-4-2-3 system to a new 8-4-4 system, and introduced new vocational training into its primary and secondary educational curriculums.

At the same time, the Government has decided to expand the various types of vocational training schools and institutions of technical education and to review their education and training methods wherein much importance is attached to intellectual and theoretical items and to change them over to a new method wherein importance is attached to the learning of techniques and vocational skills. By this revision, the Government aims at the enlargement of employment opportunities and the attainment of balanced distribution of earnings in the country by nurturing skilled workmen and middle calss technicians who will be able to make direct contributions to the country's production through their physical work.

On the other hand, the National Youth Service (NYS) is having its servicemen and servicewomen engaged in various activities for national building followed by vocational trainings to them. In other words, NYS is a special organization which has two main functions of national building and training. NYS's servicemen and servicewomen are highly evaluated by the Kenyan industrial sector as being well disciplined and skilled.

Based on the above background, the Kenyan Government has also decided to expand the activities of NYS by increasing the number of servicemen and servicewomen to 10,000 from the existing figure of about 7,000. And the expansion of vocational training followed by this will also dissolve the complaints among servicemen and servicewomen who are obliged to wait for oppotunities of vocational training after their contribution to the National Building activities. However, in consideration of the financial burden required for the expansion of training facilities, and the problem

of securing training instructors, it can be said that the attainment of their plan will not be easily implemented.

Thus, the Kenyan Government came to request to the Japanese Government for the establishment of a "NYS Engineering Institute" through a Grant Aid and technical cooperation for nurturing technicians, which has been one of the largest problem for NYS both in terms of financing and in securing the training instructors.

Upon receipt of this request, the Japanese Government decided to conduct studies for the proposed project and the Japan International Cooperation Agency (JICA) dispatched a preliminary study mission for a technical cooperation to Kenya in February, 1985 to study the feasibility and the scope of the technical cooperation.

Again from July 29 to Aug. 22, 1985 the Basic Design Study Team was dispatched to Kenya and conducted a field survey to study the feasibility and the scope of the Grant Aid by the Government of Japan.

Upon returning to Japan, the Team had a series of discussions with the authorities concerned based on the results of the study and the collected data thus formulating an optimum basic design for facilities and equipment to be covered by the cooperation in consideration of feasibility, adequate scale and level, operational system and evaluation of this project.

Outline of the Project

Name of the Project:

The National Youth Service Engineering Institute

Purpose:

A new training institute for training technicians in the National Youth Service.

Executing Organization (client ministry):

Office of the President, National Youth Service.

Location of Site:

A site owned by NYS, which is located about 7 km to the north-east from the centre of Nairobi. The site is located close to the NYS Headquarters and has a area of 68,920 m^2, favorable in ground condition and equipped with substantially complete infrastructure such as electricity, city water, road, etc.

Outline of Facitlities:

Facilities will be of a reinforced concrete structure, and the composition will be as follows:

. Administration block (principal's room, student office, accounting office, conference room, library, etc.)	2 stories	about 960 m^2
. Assembly hall (300 persons accommodated, multipurpose with non-fixed chairs)	1 story	" 460 m^2
. Classroom block (medium and small classrooms, A/V room, drawing room, etc.)	2 stories	" 1,050 m^2
. Workshop (electrical/electronic)	2 stories	" 1,140 m^2
. Workshop (mechanical)	1 story	" 1,040 m^2
. Workshop (motor vehicle /construction plant)	1 story	" 1,840 m^2
. Student dormitory (dormitory, dining hall, kitchen, recreation hall, etc.)	4 stories	" 3,000 m^2

. Other related facilities
(power house, elevated water tank,
welding workshop, etc.) 1 story about 850 m^2

Total floor area " 10,340 m^2

As to part of existing buildings located within the site, they are scheduled to be used as staff recreation block, a garage, central stores, etc.

Training Programme:

5 courses for mechanical engineering, motor vehicle technicians, construction plant technicians, main electrical installation and radio, television and electronics technicians will be provided.
Each course accepts 20 trainees per year and 300 trainees in total with its training term of 3 years. The target of the training is to apply for Technician Part I and II qualifications.

Outline of Equipment:

Training equipment (for each course), audio/visual training aids and transportation vehicles.

Term of Construction:

The term of construction of the project is roughly estimated as follows:

. 3 months for detail design, tender and contract
. 19 months for construction, supply and installation of equipment.

As aforementioned, this project is to be carried out by NYS as one of the training institutes in Kenya for nurturing middle class technicians required for the economic and social development of the country, and it is considered that the execution of this project will further advance the technical level of NYS,which has so far made a great contribution to the

development of Kenya, upgrade the level of training instructors of the existing training facilities and also help enlarge employment opportunities for NYS's servicemen and servicewomen. Therefore it can be said the social and economic effect of this project will be considerable.

NYS is also planning to carry out active training programmes whereby almost all practical training will be conducted within the workshops of the institute, still leaving room for on-the-job training, under the new educational system of 8-4-4, wherein importance is attached to the learning of practical skills together with theoretical subjects. Consequently, this institute is expected to become a model of new training schools under the new educational system and its prompt implementation is strongly awaited. If the Japanese technical cooperation is carried out in giving advice regarding the various kinds of technical matters, preparation of curriculums and the management of facilities, the institute will be more effectively operated and managed.

CONTENTS

CHAPTER 1. INTRODUCTION

CHAPTER I INTRODUCTION

Immediately after its independence in 1963 from Britain, the Government of the Republic of Kenya established the National Youth Service (NYS) and urged promising young Kenyans to participate in activities for building up the nation. At the same time, NYS has been giving vocational training to its members through their service activities and the organization has been making efforts to develop their self-supporting capacities so that they can become full-fledged, responsible citizens.

More than 20 years have elapsed since independence, and the country's economy and society are strongly expected to make further progress; for this purpose, the demand for various necessary techniques, especially for mechanical and electrical techniques of the higher level is becoming large. In response to such demand, the Kenyan Government is carrying out a drastic revision of the country's educational system.

As one of their countermeasures, the Kenyan Government devised a plan for "the construction of a new NYS engineering institute" for the purpose of conducting technician level training which is higher ranked training than the type conducted in NYS at present.

In materializing this plan, the Kenyan Government submitted to the Japanese Government a request for a Grant Aid and technical cooperation by the project system.

Upon receipt of this request, the Japan International Cooperation Agency (JICA) dispatched a preliminary study team for a technical cooperation to Kenya in February, 1985, and the team conducted studies by confirming the contents of the request, discussing matters with the authorities concerned, inspecting related facilities and collecting necessary data. Upon returning to Japan, further studies were made through analyses of the results of their investigation on the feasibility and the scope of the technical cooperation.

Further, based on the result of the studies of the preliminary study team, JICA dispatched the basic design study team headed by Mr. Shozo Ohira, Grant Aid Division of Economic Cooperation Bureau, Ministry of Foreign Affairs, from July 29 to August 22, 1985, to conduct a field survey.

The study team conducted discussions with Kenyan Government on the

background of the project, contents of their request, operational system, etc. and also conducted the field survey of the project site.

Upon returning to Japan, the basic design study team analyzed and examined the contents of discussions with Kenyan agencies, the confirmed matters, the result of the survey of the site and the collected data which were formulated into the Basic Design Report.

This report contains a consolidated summary of the results of the above-mentioned basic design studies; its main objective is to present the result of the studies on the feasibility of this project and a proposal for the optimum basic design for the implementation of this project.

At the end of this report, reference materials such as the list of members of our study teams, their field study schedule and the Minutes of Discussions, etc. are attached.

CHAPTER 2. BACKGROUND OF THE PROJECT

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2-1 Outline of the Country

1) High Population Growth

The population of the Republic of Kenya has been rapidly increasing in recent years. The rate of increase in population, recorded as 3.4%*1 during the period of 1962 to 1969, rose to 3.8%*2 during the following decade from 1969 to 1979.

Furthermore, a higher growth rate is expected from the 1980s. According to the "WORLD DEVELOPMENT REPORT" by the World Bank, the rate of increase in population during the period from 1984 to 2000 is forecast as high as 4.1%, which is ranked the 2nd in the world, following Zimbabwe.

*1, *2 The 5th Five-year Development Plan (1984-1988) page 5

2) Stagnation of National Economy

Since independence in 1963, a conspicuous difference in the economic aspects of the Republic of Kenya can be seen between the former decade from 1963 to 1972 and the latter from 1972 to 1981.

AVERAGE GROWTH RATE

	1964-1972	1972-1981
GDP at factor cost	6.2	4.3
GDP Per capita	3.0	0.8
GDP Agriculture	4.6	2.9
GDP Manufacturing	7.9	7.0
GDP Industry	8.8	5.6
Average share of Gross Investment in GDP	19.53	23.3
Share of Investment financed from domestic savings	80.5	63.0
Current Account Deficit as percentage of GDP	2.7	9.1
Average Terms of Trade (1976 = 100)	106.7	96.3
End of Period Terms of Trade (1976 = 100)	100.0	72.3
Rate of Inflation in consumer prices	2.8	12.7
Exchange Rate (KSh./US$) (End of period)	7.1	10.3

Source - Central Bureau of Statistics

The Kenyan national economy showed a steady growth during the first decade of its history. However, it stagnated gradually owing to the decline in productivity development after the completion of such projects for the activation of land-use of the farms unused from the past years or for ownership transfer of large scale plantation farms to independent Kenyan farmers, and the national economy deteriorated due to the first oil crisis, its resultant worldwide economic recession and a long-term drought from 1979 to 1980.

2—2 Outline of Education, Vocational Training and the Situation of Employment

1) Popularization of Education and Difficulty of Finding Employment

During the period since Independence, Kenya has spread primary and secondary education by modernizing the educational system and achieved remarkable success in raising up the school attendance rate.

SCHOOL EXPANSION AND ENROLLMENT, 1963-81*

Level	1963		1981*	
	No. of Schools	Enrollment	No. of Schools	Enrollment
Primary	6,058	936,000	11,806	4,134,345
Secondary	151	35,000	2,100	464,671
University	1	-	2	6,627

* Provisional
Sources - ILO 1972 and Economic Survey 1982

The national primary school attendance rate, less than 50% in 1963, was raised to 90.5% in 1982. Such a success was attributable to the efforts made by the government agencies and private circles under close cooperation for the establishment of the educational environment.

Especially, activated construction of secondary schools under the promotion of the HARAMBEE MOVEMENT has much contributed to improving the attendance rate of secondary education during these two decades. And in 1981, the respective rate grew up to 13 times higher than in 1963. In connection with this success, the educational budget of the Government has also been increased and it now occupies the 1st position in the national budget. [1963: K£ 6 million,(18%); 1983: K£ 194 million,(30%).]

On the other hand, however, such an abrupt advancement in primary and secondary education has brought about various problems. Especially, an explosive increase in school leavers, in conjunction with the high population growth, has created the difficulty of finding employment. This trend has become prominent since the 1970s in which the rational economic growth started to taper off. And the abrupt spread of

primary and secondary education has caused serious increase in young school leavers without sufficient vocational skills. Such young people tend to leave their local homelands and gravitate to urban areas in the hope of getting better jobs. Consequently, the growth of the unemployment rate during the period from 1976 to 1989 was 16.4%. Under such circumstances, the improvement of vocational training has become an urgent national subject.

LABOUR FORCE IN KENYA ($x10^3$)

	1969	1976	1979	1981
Total Population	10,943	13,847	15,327	16,514
Working Population (Age Group 15-59)	5,034	6,439	7,204	7,762
Labour Force	3,808	5,473	6,123	6,598
Dependency Ratio	1.17	1.15	1.15	1.13

EMPLOYMENT AND UNEMPLOYMENT ($x10^3$)

	1976	1982 (estimated)	% Growth	Share of total Employment 1982
Modern Sector	915	1,126	3.7	18.4
Small-scale Agriculture	2,665	3,122	2.7	51.1
Pastoralists	390	457	2.7	7.5
Rural Non-Farm	990	1,222	3.6	20.0
Urban Informal	125	181	6.3	3.0
	5,085	6,109	3.1	100.0
Labour Force	5,473	6,849	3.8	
Residual as % of Labour Force	7.1	10.8		

SOURCE -- Ministry of Economic Planning and Development.

Such young people have resulted in the creation of a new sector called Urban Informal, and their number is estimated to become as high as 200,000 in 1985. According to the "Report on Employment, Incomes and Equity" by ILO in 1972, these young people are defined as a reserved labour force who anticipate to be employed by Urban Formal Sector, and practically engage in such informal sectors as selling souvenirs, foodstuffs, magazines, newspapers, etc. on the street for family income. And the others are working as daily and temporary labourers in various fields such as construction, manufacturing,

transportation, sightseeing, commerce, etc., with the number of these labourers increasing day by day. In addition to this, if we include those seasonal labourers working in the agricultural and agricultural products processing sectors, especially in the related industry of coffee and tea, the national employment situation is assumed to be more serious than the published unemployment rate suggests.

2) Normalization of Economy, Review of Educational System and Improvement of Employment Opportunities

In view of the present situation, Kenya's Fifth Five-Year Development Plan (1984-1988) has set up the following major targets:

(1) To attain an annual average actual growth rate of GDP of 4.8%
(2) To increase opportunities of employment by an annual average rate of 3.8%
(3) To set an excess of imports at 10.9% of GDP

To achieve those targets, various policies have been put into operation. Of those policies, the following 3 points should be taken into account in the planning of vocational training:

- To give the precedence to labour-intensive industries development over capital-intensive industry development.
- To revise an educational system to promote technical education/ vocational training
- To utilize national products and resources

The policy of giving precedence to labour-intensive industries clearly indicates the Kenyan government's will to improve employment opportunities by building up such industrial structures even if the national productivity may be lowered to a certain degree. It is considered that the policy probably aims at the economic growth based on a long term view by fully utilizing available domestic technologies instead of relying on the automated production facilities owned by foreign capital enterprises.

For this purpose, a large scale revision of the educational system is in progress; the present system of 7-4-2-3 will be changed to 8-4-4, prevocational training being adopted in primary and secondary education, and the conventional method of training or education with emphasis on intellectual and theoretical work, taken in vocational

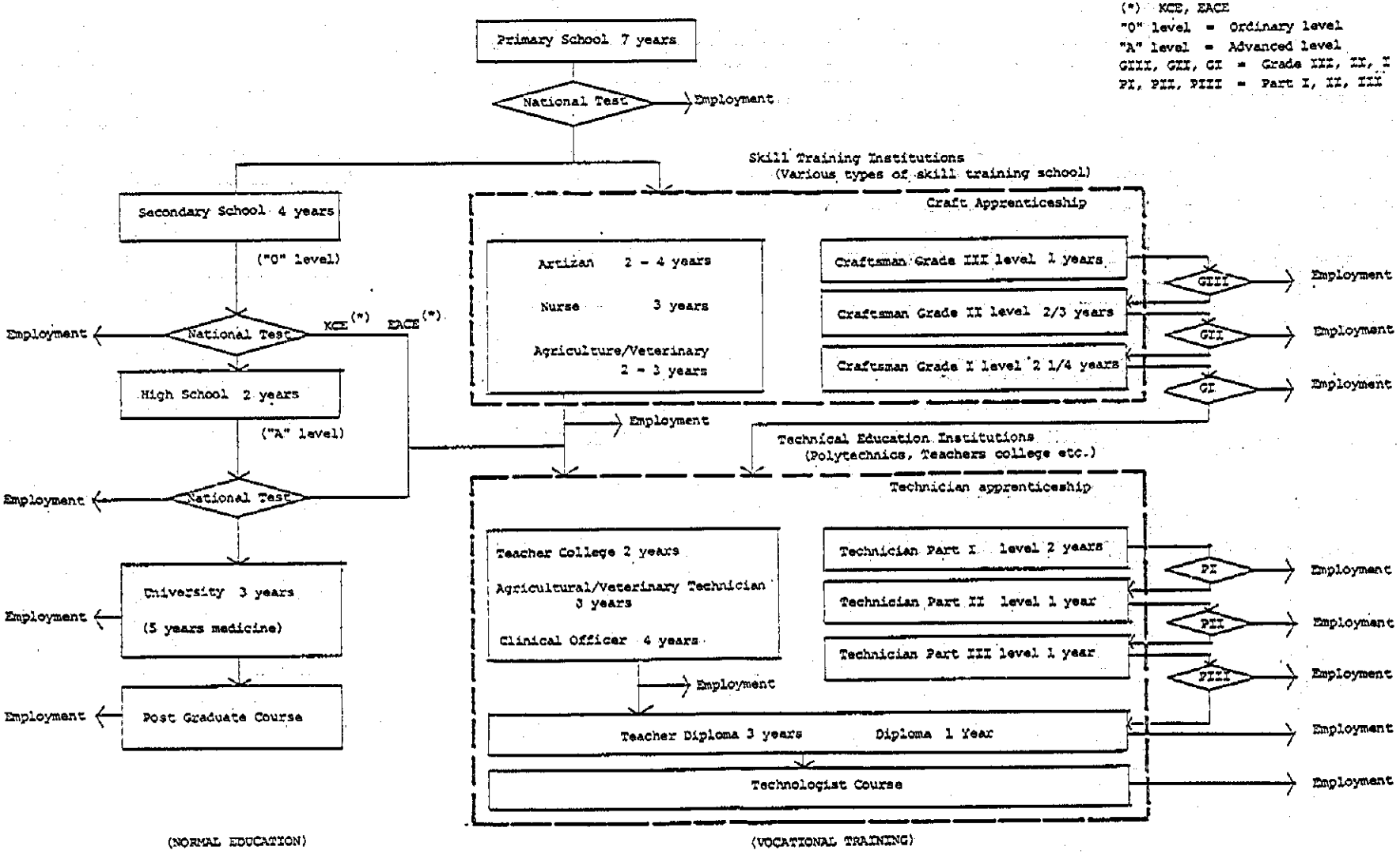
training, technical education and national qualification tests to be changed over to the new method of emphasis on vocational skills and techniques. In the actual industrial field, practical engineers who are able to contribute to the production by their own labour are keenly expected for advancement of economic activities. This aspect is emphasized in the "Report of the Presidential Committee on Unemployment" 1982/83.

3) New Educational System and the Vocational Training

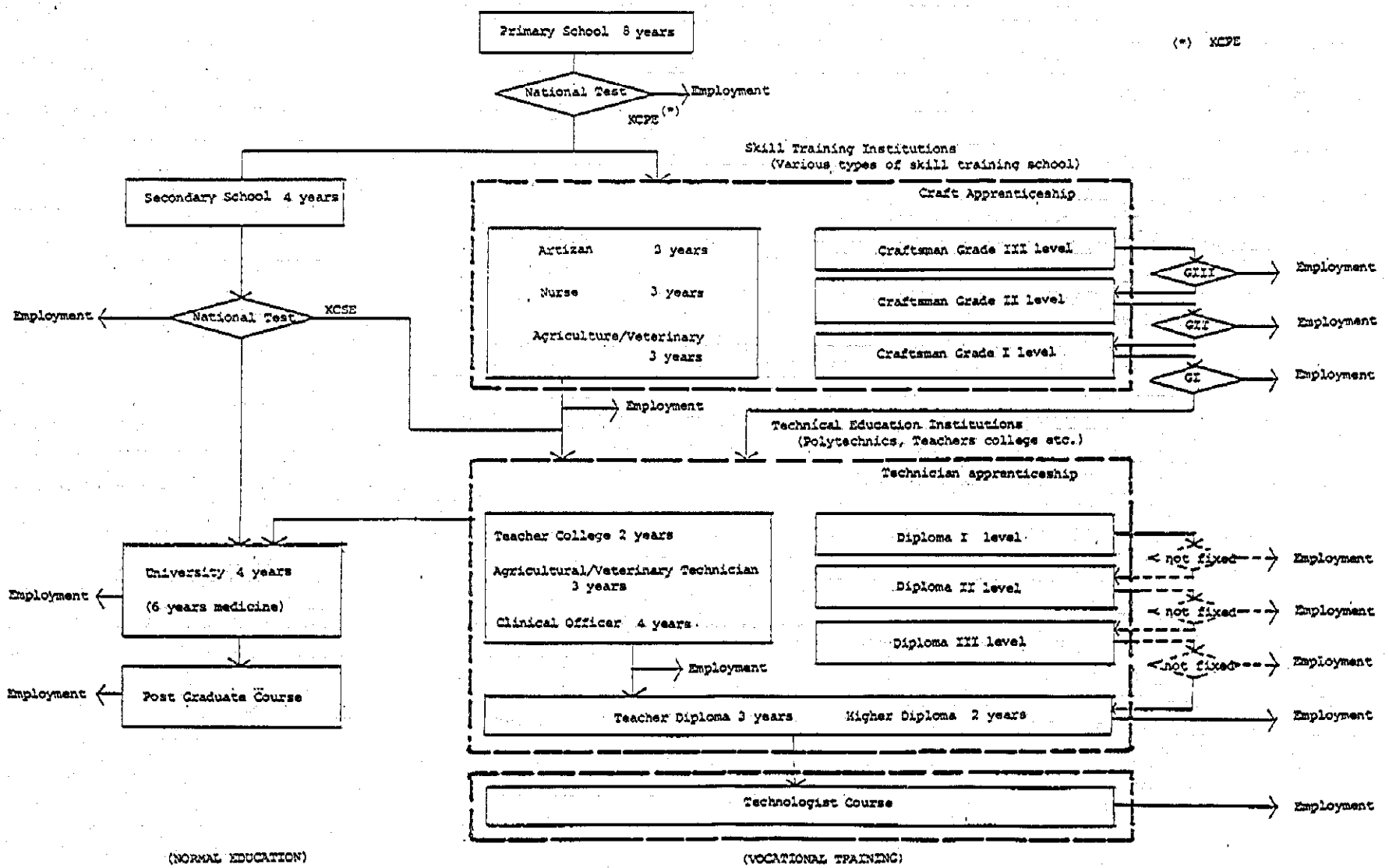
As mentioned, revision of the educational system has been in progress since 1984 and the school system is also being changed from the 7-4-2-3 system to 8-4-4. At present the revision of syllabuses is being made by KIE and other agencies and at the time of this survey, the revision of syllabuses of primary and secondary education was completed and the revision of syllabuses for vocational training and higher education was scheduled to start. There is no doubt that the revision of all these syllabuses will be completed by 1989 in which students of "O" level (FORM IV) under the new system will be graduated for the first time.

The Educational systems (exsiting and new) of Kenya are shown in the following pages.

Education System of Kenya (Existing)



Education System of Kenya (New)



4) Present Condition of Kenya's Vocational Skill Training

A) Vocational skill training level.

Basic vocational skill training is provided in various sorts of training institutes as shown in the following table on such fields of skill as industrial crafts (Trade test Grade-III, II, I), applied arts (artizan training), medicine (enrolled nurse), agriculture and so on. This training is being conducted at various public institutions as well as at those private firms approved by the authorities, but the exact data is not known. In the fields of industry and applied arts, the number of trainees entering into public institutions is estimated at about 25,000 in 1984.

Vocational Skill Training Organization in Kenya

Name	Duration	No of trainee/year
Village Polytechnic	2	22,000
National Industrial Training Institute	3	1,680
National Youth Service	1.75-3.75	1,360
Kenya Industrial Training Institute	1	130

Source - NYS data March 1984
Kenya Industrial Training Institute data March 1984

B) Technical Educational Level

The Kenyan Government has established various technical educational institutions under the direction of the Ministry of Education, the Ministry of Labour and related Government agencies. In connection with the revision of the educational system, the Ministry of Education is trying to promote the systemization (so called "Rationalization") of all these institutions. The entrance qualifications for these training institutes is to be "O" level holders (secondary school graduate). Actually, however, most of those institutes have many students who hold "A" level (high school graduate) but failed to enter into universities. These training institutes cover such a wide range of training as teacher, agricultural technicians, health and sanitary technicians, commerce, livestock farming, clerical work, secretarial work, etc.

The major institutes are shown in the following table:

Technical Education Institutes of Kenya

Name of Institute	Duration	No. of Student per year
Polytechnic (Nairobi & Mombasa)	4	2,400
Harambee Institute of Technology	2, 3, 4	2,000
Jomo Kenyatta College of Agriculture and Technology	4, 4-1/3	180
Teacher Training College	2	6,000
Egrerton College	3	350
Utalii College	2, 4	250
Cooperative Development Training College	2	67
Embu Institute of Agriculture	2	150
Bunkura Institute of Agriculture	2	180
Forestry Training School	3	82
Water Development Training School	NA	NA
Medical Training Center	NA	1,500
Kenya Institute of Mass Communication	1	110
Kenya Institute of Administration, Lower Kabete	NA	50
Government Training Institute, Mombasa	NA	30
Kenya Government Secretarial College, Nairobi	NA	180
Mataga D.D. Centre, Kwale	NA	30
Police Training Centre	NA	70

Source: Second University in Kenya, Report of the Presidential Working Party, Republic of Kenya, Sep. 1981.
NA: Data not available.

C) Technical Education, Advanced Skill Training and National Tests in the Industrial Fields

In accordance with the Industrial Training Act enacted in 1960, apprenticeship was adopted for vocational training to be conducted in Kenya and in 1963, the Ministry of Labour, as an official approving organization, started a technical skill qualification test system for craftsmen and technicians. In conjunction with the revision of the act in 1971, a new system of training levy was introduced and private sectors were obligated to conduct apprentice training and to raise funds for the training.

The apprenticeship training is divided into craft apprenticeship and technician apprenticeship and their outlines are as follows:

a) Craft apprenticeship

This system coveres various fields of skills such as machinery, electricity, textile, etc.

Private sector is obligated to conclude an apprentice contract

with an employee having a certain qualification and provide skill training for the apprentice. The apprentice is to undergo vocational training in the firm approved by the Government as the training institute and in National Industrial Vocational Training Center (NIVTC) etc. located in Nairobi, Kisumu and Mombasa for 3 to 4 years.

Upon completion of a trial employment period of 6 months, the apprentice is qualified to apply for the Preliminary Proficiency Test. The successful apprentices are awarded "Preliminary Proficiency Certificate", and then the training of the regular apprentice is started.

Each apprentice receives OJT (also called In-plant Training) in his firm and the theoretical lectures in an educational institute approved by the Ministry of Labour (the first year; 18 weeks/year, and the second year and after; 6 weeks/year).

In the process of each training, the apprentice has chances to sit for a test of his skill namely preliminary, intermediate and final proficiency test, to be conducted by DIT (Directorate of Industrial Training).

b) Technician apprenticeship

The qualification of application for this system is to have credits on mathematics, English and appropriate science or equivalent.

Firstly, a technician apprenticeship contract is made between a trainee and employer for four years at most.

In the first year, during the first six months, the trial period, in-plant-training is to be provided. After completing this in-plant-training, craft orientation is to be made for three months, and then, advanced in-plant-training is to be given for three months.

In the second and third years, the theoretical training and skill training are to be given alternately to an apprentice in an institute approved by the Ministry of Education and in the plant every 13 weeks.

In the 4th year, supervisory training is to be given at an approved institute and in the plant, and finally, six weeks of management training is to be given.

An apprentice who has completed the training of the 2nd, 3rd and 4th year is qualified to apply for the test of Technician Part I, II, and III respectively and a successful apprentice is qualified as Technician Part I, II and III.

An apprentice is paid a fixed wage and is required to participate in the above technician course.

Technician apprenticeship covers 16 industrial fields, as follows:

Technician Course ------- 16 Courses

1. Electrical Engineering
2. Mechanical Engineering
3. Automotive Engineering
4. Aeronautical Engineering
5. Marine Engineering
6. Telecommunication Engineering
7. Radio, Television and Electronic Engineering
8. Plant Engineering
9. Building and Civil Engineering
10. Agricultural Engineering
11. Water Engineering
12. Land Surveying
13. Science Laboratory
14. Draughtsmanship
15. Refrigeration
16. Air Conditioning and Ventilation

2-3 National Youth Service and Its Vocational Training

1) Outline of National Youth Service (NYS)

National Youth Service was established by the Government of Kenya as a part of the national development activities promoted after independence in 1963, and its actual activity, which started in 1964, includes two functions: one is to contribute directly to the national development by implementing "National Building" work, the other is to provide vocational training for the servicemen and servicewomen to improve their employment opportunities.

Actually, the number of the servicemen and servicewomen is approximately 7,000 which is the maximum number of enrollments limited by National Youth Service Act. However, the Government intends to expand the NYS organization to 10,000 in future.

The entry qualification is to be a healthy young unmarried man or woman aged between 18 to 22. There are no educational background constraints. Selection for enrollment is made in such a manner that a document selection in each district is made initially, then an interview selection is made for each applicant who has passed the document selection by selection officers of NYS.

Servicemen and servicewomen are, once enrolled, provided with full board (food, clothing, accommodations and allowance). An annual vacation of two weeks is allowed and weekened leave is allowed upon permission.

The training in the NYS consists of three gradual classifications: the first is discipline training, the second is participation to National Buidling Work and the third is vocational skill training.

A) Discipline training

Just after enrolling in NYS, servicemen and servicewomen must receive "discipline training" for three months at Gilgil (for men) and Naivasha (for women). The contents of training are a file off, durability training, various sports, daily work on duty, emergency treatment, agricultural work especially for women, etc. During this period, supplementary lessons for primary and secondary education are available and the qualifactions up to secondary education are obtainable in the organization.

B) Participation in National Building

After passing discipline training, the servicemen and Servicewomen have to perform national construction work named "National Building", for a minimum of 12 months (usually 12 to 18 months). During this period servicemen are dispatched to road or barrage construction sites or agricultural farm projects and participate in the practical work therein.

The project sites and farms for National Building are as follows:

Units

The Nairobi Training Unit
The Mombasa Field Unit
The Gilgil Field Unit
The Yatta Field Unit.

Sub-units

Tumaini Harambee Farm, Ol Kalou
Waterfalls Narambee Farm, Yatta
Donyo Sabuk Project Unit, Yatta
Shimba Hills Project Unit
Tsavo Park East Project Unit, Voi
North Kinangop Project Unit
Karura Forest Project Unit
Gatundu-South Kinangop Project Unit
Yala River Project Unit
Turbo Field Unit
Yatta Field Unit
Garisa National Road Construction Unit
Garisa National Road Construction Sub-Unit
Buro Field Unit

C) Vocational training

After finishing National Building, the servicemen and servicewomen are allowed to receive a suitable vocational training in the training facilities of NYS in accordance with individual preference and aptitude.

NYS is not the employer of the servicemen and servicewomen;

however, many of the training facilities of NYS are approved by the Ministry of Labour as competent for craft apprenticeship training institutes and authorized craft apprenticeship training is conducted there.

The fields of this training are as follows:

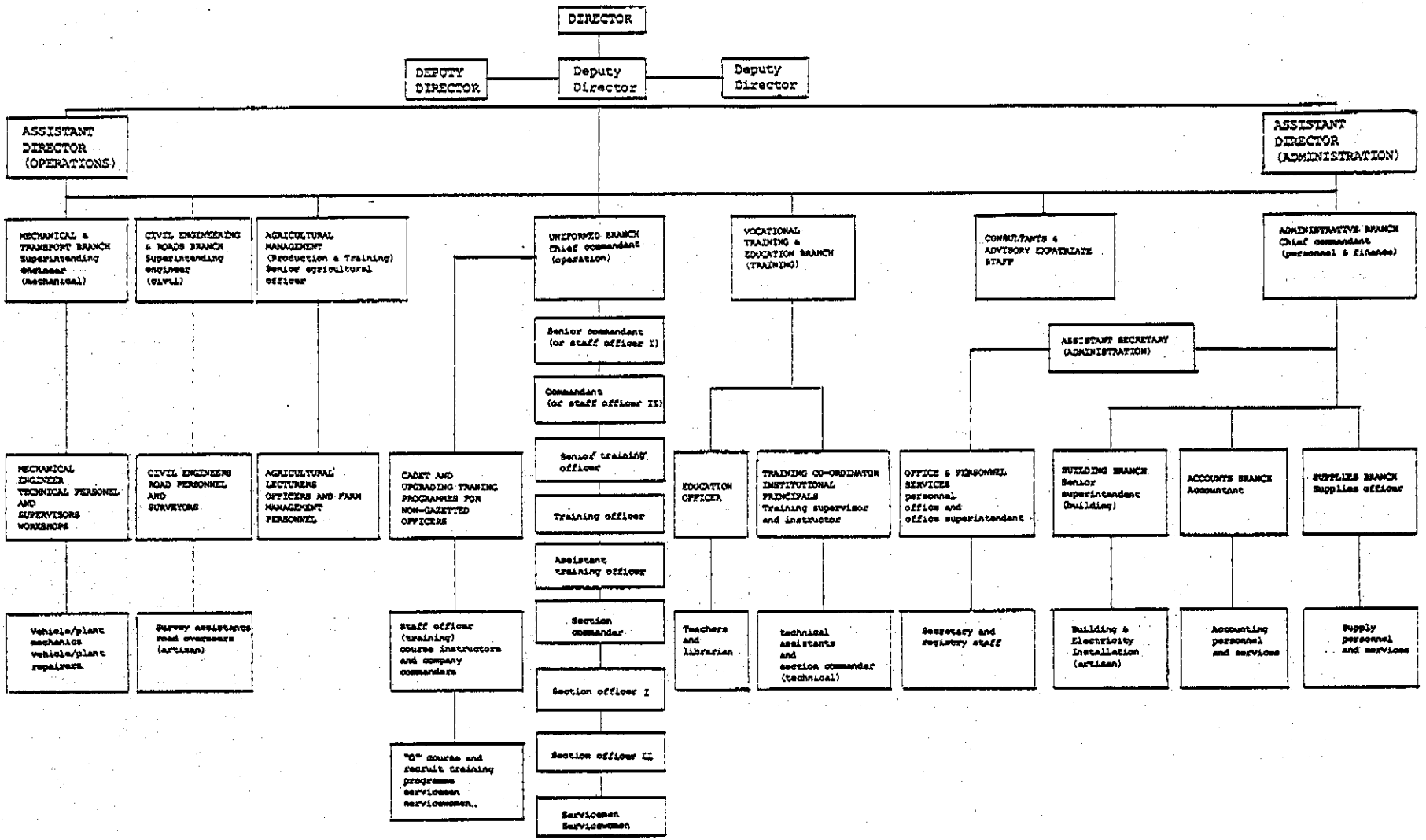
- Lathe work
- Finishing work
- Welding
- Electrical engineering
- Automotive engineering
- Construction plant operation
- Construction plant mechanics
- Masonry
- Carpentry
- Plumbing
- Upholstery
- Motor vehicle electrician
- Tailoring/Dress making

The objectives of the trainings are to gain qualification to apply for the trade test Grade III, II and I. And, the present, there is no technician training institute in NYS.

D) Organization chart of NYS

Organization chart of NYS is shown in next page.

KENYA NATIONAL YOUTH SERVICE ORGANIZATIONAL STRUCTURE



2) Vocational Training Instution of NYS.

The following are the vocational training institution of NYS.

Training Centre:	Place:	Programme:	Duration:	No. of Trainee in 1984	Grade;	Ratio of Trainee/instructor
Mombasa Vocational training Centre (MVTC)	Mombasa	motor vehicle mechanics, welding, masonry, carpentry fitting, electricity plumbing	15 months	476	Government trade test Grade III	16:1
Upholstering Training Centre	Nairobi	Upholstery	12 months	37 (capacity 120)	Grade III	17:1
Advanced Training School	Central Workshops	Further training in: motor vehicle mechanics motor vehicle electricity turning, fitting electricity	8 months	312	Government Trade Test II	17:1
Rural Craftsmen Training Centre	Turbo Field Unit	Blacksmith, fitting, welding sheetmetal, project work Project work	9 to 18 months plus 9 months	120 (capacity 180)	Government Trade Test III Trade Test II	15:1
Secretarial School Nairobi	Nairobi Holding Unit	Secretarial work	24 months	141	E.A.C.E. Examination	8:1
Dressmaking and Tailoring School	Gilgil Training Unit	Tailoring/ dressmaking	12 months plus 8 months	320 (capacity 320)	Government Trade Test III Trade Test II	20:1

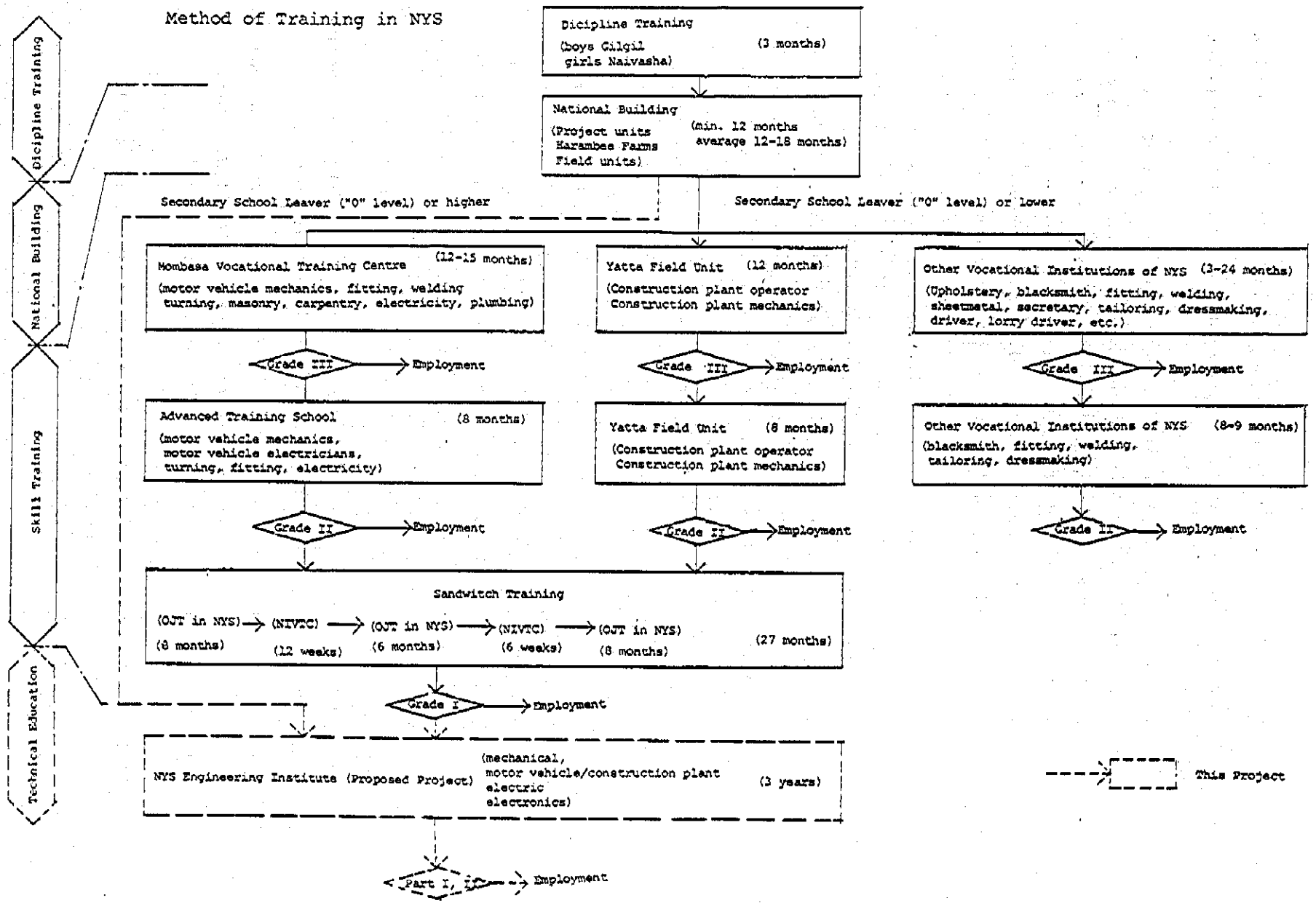
Training Centre:	Place:	Programme:	Duration:	No. of Trainee in 1984	Grade;	Ratio of Trainee/instructor
Driving School	Nairobi Holding	drivers and lorry drivers	3 months	151	Driving Licence Exams	20:1
Agricultural School	Yatta	NA	NA	NA (capacity 400)	NA	N.A
Yatta field unit (T/C of Denmark)	Yatta	Construction plant operator Construction plant mechanic	12 months plus 8 months		Government Trade Tests III Trade Tests II	N.A.

Beside the training listed above, the following craft apprenticeship training is also conducted in NYS.

Training Centre:	Place:	Programme:	Duration:	No. of Trainee in 1984	Grade;	Ratio of Trainee/instructor
OJT training within NYS	each project unit field unit	Craft apprenticeship training All Trade	22 months	320	-	-
Theoretical and skill training at National Industrial Vocational Training Centre (NIVTC)	Nairobi Mombasa Kisumu	Craft apprenticeship training All Trade	18 weeks	216	-	-

Total 2,123 trainees

Functional diagram of training method and training institutions of NYS is shown in next page.


Method of Training in NYS
Dicipline Training
National Building
Skill Training
Technical Education
Dicipline Training
(Boys Cilgil
girls Naivasha)
(3 months)
National Building
(Project units
Harambee Farms
Field units)
(min. 12 months
average 12-18 months)
Secondary School Leaver ("O" level) or higher
Secondary School Leaver ("O" level) or lower
Mombasa Vocational Training Centre
(12-15 months)
(motor vehicle mechanics, fitting, welding
turning, masonry, carpentry, electricity, plumbing)
Yatta Field Unit (12 months)
(Construction plant operator
Construction plant mechanics)
Other Vocational Institutions of NYS (3-24 months)
(Upholstery, blacksmith, fitting, welding,
sheetmetal, secretary, tailoring, dressmaking,
driver, lorry driver, etc.)
Grade III
Employment
Grade III
Employment
Grade III
Employment
Advanced Training School
(8 months)
(motor vehicle mechanics,
motor vehicle electricians,
turning, fitting, electricity)
Yatta Field Unit (8 months)
(Construction plant operator
Construction plant mechanics)
Other Vocational Institutions of NYS (8-9 months)
(blacksmith, fitting, welding,
tailoring, dressmaking)
Grade II
Employment
Grade II
Employment
Grade II
Employment
Sandwitch Training
(OJT in NYS) → (NIVTC) → (OJT in NYS) → (NIVTC) → (OJT in NYS)
(8 months) (12 weeks) (6 months) (6 weeks) (8 months)
(27 months)
Grade I
Employment
NYS Engineering Institute (Proposed Project)
(mechanical,
motor vehicle/construction plant
electric
electronics)
(3 years)
Part I, II
Employment
This Project

3) Expectation for the vocational training conducted by NYS and its problem

A) Technicians who contribute to the production activities through their own labour.

The distinctive feature of the vocational training of NYS is discipline, this feature is supported by the facts; one is that the trainees have passed the discipline training and the service through National Building prior to the application for vocational training, and the other is that most of the servicemen and servicewomen have come from comparatively poor families and are serious workers.

Distinctly neat manners are seen everywhere in the training facilities of NYS, above all, in maintenance of tools and instruments distinguished from other organizations. On this characteristic feature of NYS, the aforesaid "Report of Presidential Committee on Unemployment" is also placing high value as " disciplined and trained". From these facts, upbringing of a technician who contributes to the production work through his own labour is desired both by the Government and by the industrial sector.

Under such circumstances, the Government decided to exapand NYS in 1977, and a long-term development plan of vocational training was made up by Friedrich Ebert Funds in 1979.

Thus, the number of servicemen and servicewomen has gradually been increasing; the number, 4,300 in 1978 and 4,800 in 1979, was approximately 7,000 at the time of the survey, and according to the Government's future plan, it is going to be augumented up to 10,000 in order to increase the National Building activities and to improve employment conditions for servicemen and servicewomen.

B) Three problems

Three problems derived from the expansion of vocational training accompanied by the expansion of NYS, have been pointed out.

i) The expansion of facilities cannot catch up with the increase in the number of servicemen and servicewomen enrolled in NYS.

ii) There is a shortage of training instructors at NYS.

iii) There are no facilities to accord to higher level of training which is sorely needed.

According to the recent increase of servicemen and servicewomen, the expansion of training facilities has become a more serious subject for NYS. However, it has not yet been realized because it requires far more budget than discipline training or participation in the "National Building".

Under such circumstances, the servicemen and servicewomen who have extended their contracts with NYS for 1-3 years in order to wait for vocational training have considerably increased. The average period of waiting for vocational training after accomplishing the service for National Building is 27 months at present. NYS now intends to shorten this period to 18 months at most.

Even though the number of servicemen and servicewoen under vocational training has been raised to 2,200 in 1984 from 1,500 in 1979, the expansion of the facilities has yet catch up with the need and actually 1,500 persons are still waiting.

On the other hand, the number of training instructors has become insufficient in connection with the expansion of the facilities; the shortage of the instructors has caused a cutoff of the enrollment capacity. In NYS, the ratio of instructor to trainees is around 1/15 to 1/20 at present.

In order to raise this ratio to 1/10 even when the enrollment of servicemen and servicewomen is augmented to 10,000, 250 to 300 instructors will be required over the present number.

As NYS depends on recruitment of instructors wholly from other organizations at present, highly skilled instructors are not easily available. Furthermore, the requirement for advanced skill training and technical education which are not available in NYS today has risen in conjunction with the larger enrollment of servicemen and servicewomen.

In such a situation, NYS has planned an establishment of new institute so as to realize the technical education and development of new instructors.

2—4 Contents and Progress of the Requests

1) Progress of the Project

In 1982, the Government of Kenya requested a Grant Aid and technical cooperation in connection with the establishment of new institute for technician training which requires the largest budget and manpower in the expansion programme of NYS.

The request, which included at first the assistance for both agricultural and industrial fields(16 courses), has been reduced to the more realistic level (5 courses) on which Kenyan side and Japanese Preliminary Survey Team for technical cooperation came to an agreement in February, 1985.

The agreed upon items in this preliminary survey with regard to the contents of the new facilities to be established are as follows:

- 5 technician courses shall be included:
  Mechanical Engineering Technician
  Motor Vehicle Technician
  Construction Plant Technician
  Main Electrical Installation Technician
  Radio, Television and Electronics Technician
- The training period shall be 3 years and the technician apprenticeship training in accordance with the Industrial Training Act shall be conducted and the graduates shall be qualified to apply for Technician Part I and Part II.
- Enrollment capacity shall be 300 persons in total
  every course : 20 persons by 3 years - 60
  every grade : 20 persons by 5 courses - 100
- Syllabi to be employed and the target of training.
  (See CHAPTER 3)

2) Requests of Grant Aid

In addition to the request for the technical cooperation, the Government of Kenya also requested the Government of Japan for construction of facilities and the provision of equipment necessary for execution of the technical cooperation.

In response to this request, the Basic Design Study Team of Grant Aid was dispatched to Kenya in August, 1985 and the requested items were confirmed.

The following are the main contents of the request:

- Administration building
- Library
- Dispensary
- Assembly hall
- Classrooms
- Workshop
- Student dormitories
- Recreation hall
- Dining and kitchen
- Training equipment
- Training furniture
- Transportation vehicles

CHAPTER 3. CONTENTS OF THE PROJECT

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3-1 Purpose of the Project

The purpose of the Project is to establish a technical institute under the organization of NYS for middle-class technicians who will combine technical knowledge with skills and also will be engaged in the production activities through their technical leadership and their own trained skills.

As technician training institutes in Kenya, polytechnics are playing the main role at present, but at these institutes an emphasis is placed on a theoretical training rather than on actual skills. It is generally said that the complaints arising from industrial circles about those middle-class technicians are based on this ill-balanced training between theory and skill, and that manpower with technical leadership backed by their own trained skills are most desired by the industrial circle.

On the other hand, the shortage of technical instructors is one of the important problems for the expansion programme of the vocational training of NYS. At present the ratio of trainee/instructor is on an average 15/1 in 9 vocational training institutions under NYS. Not only expanding the number of the instructor but also upgrading this figure to about 10/1 is needed to cope with the increasing number of the trainees.

From these points of view, this project will enable to develop new instructors with both technical knowledge and skills for the vocational institutions of NYS.

3-2 Studies on the Project Scheme

1) Propriety of Selection of Courses

The reasons why the 5 courses of Mechnical Engineering Technician, Motor Vehicle Technician, Construction Plant Technician, Main Electrical Installation Technician and Radio, Television and Electronics Technician were eventually selected by both parties are as follows:

- In Kenya's industrial circle, higher priority will be placed on these 5 fields in demanding technical manpower.
- In respect of a Japanese cooperation in vocational training, the successful achievements will be expected.

According to the 5th Five Year Development Plan (1984 - 1988) of the Republic of Kenya, the estimation of growth rate of GDP and the shares in total industrial GDP by sector are shown below.

	The Share in Total Industrial GDP (1988)	Estimated GDP Growth Rate (1983-84)
. Food Industry	22%	33.5%
. Beverage and Tobacco	11%	32.9%
. Textile	11%	42.0%
. Leather	3%	58.7%
. Wood and Wood Products	3%	29.0%
. Paper and Printing	10%	27.1%
. Chemical	14%	24.2%
. Industries based on Non-Metallic Minerals except Petroleum (Pottery, glass, cement, etc.)	3%	39.0%
. Metal and Engineering Industries	23%	34.0%
. Basic and secondary metal products		(35.7%)
. Non-electrical machinery appliances and products		(42.0%0
. Electrical and electronic appliances/ machinery		
. Automotive industry		(32.9%)
. Total	100%	33%

Source: 5th Five Year Development Plan
"Actual and projected GDP in industrial sector"

As shown above, the GDP shares of metal and engineering industries which have the closest relation with 5 selected courses shows the top share of 23% of the total industrial GDP and its growth rate also shows the high figure following leather, textile and non-metallic minerals.

In view of recent increase of imports of automobiles, construction machinery, heavy electrical machinery and home electric appliances, those machines will be required to undergo periodical maintenance services in several years, therefore, it can be said at a high probability that the demand for technical manpower will be sharply increased.

Although it is impossible to show quantitatively the propriety of selection of those courses due to the shortage of available data, the selection of those courses can be considered to be appropriate.

The following are the conclusions obtained as a result of our analysis:

a.) Those courses were selected through discussions between the Kenyan Government and the Japanese Preliminary Survey Team for technical cooperation.

b.) They are such technical fields of industrial sectors that show a relatively high share and growth rate both in actual condition and in near future.

c.) They cover such technical fields in which the demand of skilled technicians will be increased in the near future in view of the recent trend of imports.

2) Propriety of Number of Trainees

A) Total Number of Trainees

According to the "Report of the Presidential Committee on Unemployment 1982/83", the skill pyramid composed of 1 university graduate engineer, 5 technicians and 30 craftsmen and semi-skilled laborers is considered to be a balanced composition ratio. In other words, technician/craftsman + semi-skilled labourer = 1/6.

At present, the number of trainees of those 5 courses in

the total number of trainees of NYS is estimated at 59.6% ... ①

On the other hand, in 3 leading technical training institutes in Kenya, Kenya Polytechnic (Nairobi), Mombasa Polytechnic and Jomo Kenyatta College of Agriculture and Technology (Nairobi), the ratio of the number of trainees of the 5 proposed courses to the total number of trainees will be 61.6% ..... ②

These 3 representative institutes have a different composition ratios of professional courses and they vary somewhat, but their total value can be considered as a reasonable figure.

Those 2 figures of the 5 proposed courses estimated from 2 different sources are relatively close to each other, therefore, a value of 60% is adopted as adequate value of trainee composition for these 5 courses among all industrial vocational trainees.

On the other hand, the ratio between trainees who will enter directly into this proposed institute as the secondary school leaver ("0" level qualified) after National Building period and other trainees through NYS's vocational training institutes with Craftsman Grade I qualification is not fixed. Therefore the calculation will be made based on the assumption that this ratio of those two groups will be 50% each. (Regarding entrance qualifications, see item (4) of this chapter.)

At present, the annual discharge of trainees in all NYS's vocational training institutes in 1984 is about 1960 and therefore the required number of trainees for this planned institute will be calculated by the following formula if the composition of the trainees in NYS is coincided with the ratio of the skill pyramid.

"C" is the annual intake necessary for technician training.

$$C = (1960 - C/2) \times 1/6 \times 60\% \qquad C = 187$$

Based on this result, the necessary annual intake will be 187 trainees and the total capacity will be 561 in 3-year courses. The proposed figure of the total capacity, 300, for this institute is about 53.5% of the required number. But it will not be realistic to construct the facilities to cover the whole demand of technician training of NYS, mainly because of the sharp increase of recurrent budget and the problem of securing enough instructors. It is, therefore, more recommendable to start with the capacity of 300

trainees and to expand its capacity in the future along with the expansion of budgetary scale and the increase of instructors trained in the proposed institute, etc., keeping a balance with the future demands of technicians in different industrial sectors.

B) Number of Trainees by Course

The number of trainees by course (20 trainees) is appropriate to organize the trainees into 2 groups of 10 trainees unit for the execution of effective and safe training with the upgrade instructor/trainee ratio from NYS's existing level of 1/17-20. This figure of 20 is set uniformly anticipating effective use of the facilities. Therefore in case that the demand for the graduated technician increases in a certain field in the future, it will be realistic to expand the number of trainees by 10 trainees (by group unit).

3) Propriety of Training Period

The target of this proposed institute is to obtain the qualification to apply for national examination for technician Part II. For that reason, 3-year training period as regulated in the Industrial Training Act is obligatory uniformly for each course.

4) Entry Qualification

The conditions of entry qualification already agreed between the Kenyan Government and the Japanese Preliminary Survey Mission of Technical Cooperation were set conforming to the technician apprenticeship and they are shown below;

i) Minimum "O" level with credits in mathmatics, English and appropriate science subjects

ii) Or equivalent (Outstanding Final Certificate Achievement.)

Those new trainees with i) qualification will be enrolled directly after the Discipline Training and National Building period

without any career of vocational training. On the other hand, those with ii) qualification will be enrolled through NYS's vocational training institutes and already have a certain level of skill but their academic achievement is unknown.

Therefore a certain countermeasure will be required to give simultaneous training to those different types of trainees in their careers.

Especially in the first year stage, intensive training shall be given in fundamental skills for new trainees with i) qualification and fundamental theories for those with ii) qualification, so that in the second year stage and after the uniform technician training may be started as soon as possible.

Although in this proposed institute a part of skill training covered by"In-plant Training" in the official training pattern of technician apprenticeship, will be basically conducted within the institute, there will be fewer problems on this matter because the consideration was already made in the planning stage of training scheme.

5) Recruitment of the Graduate

Judging from the recruitment situation of the existing NYSAETC (NYS Advanced Engineering Training Centre), it will be prospected that the recruitment of the graduates from the proposed institute will be made in the order of "employment in private firms", "self-employment" and "employment within NYS" and it may be further analyzed as follows;

- The employment within NYS is expected to be increased along with the Expansion Programme of NYS activities. Especially the demands for the instructors in up-grading and expanding vocational training institutions and for other technical manpower in expanding the number of project units for National Building especially in such fields of construction plant and motor vehicles, mechanical and electrical engineering, etc.
- In such fields as motor vehicle, electronics (especially

radio & TV repair works), electrical and a part of mechanical engineering, the number of graduates who will be self-employed will also be expected to increase whether they will be employed in private firms or not.

The remainder will be employed in private firms or in public or parastatal bodies.

3-3 Management Scheme

1) Management Organization

Upon completion of this project, NYS under the Office of the President will be the main managerial body and the NYS Engineering Institute takes care of actual operational works. Practically, the new facility will be ranked at the same level as the other vocational training facilities under the supervision of the Vocational Training & Education Branch.

The headquarters of NYS will decide practical items of management, especially personnel management, finance and the frame of training, and this institute will carry out actual operation as a training institute.

2) Manpower Allotment

The following is the manpower allotment list for the proposed new institute along which NYS will promote the staff recruitment.

Item	No.
Principal	1
Vice Principal	2
Senior Lecturer (HOD)	5
Lecturer	10
Asst. Lecturer I	15
Asst. Lecturer II	10
Lab. Technicians	10
Executive Assistant	1
Senior Clerical Officers	2
Clerical Officers	6
Accountant II	1
Shorthand Typist I	2
Shorthand Typist II	2
Copy Typists	6
Clinical Officer	1
Nurses	2
Librarian	1
Library Assistant	1
Supplies OfficerII	1
Supplies Assistants	2
Storemen	5
Cateress	1
Cooks	5
Telephone Operators	2
Drivers	14
Subordinate Staff	15
	123

3-4 Technical Cooperation

Upon completion of this construction, the technical cooperation by the Government of Japan is planned to start. Although its concrete contents are not yet decided, the following may be said to be a rough outline.

- The Japanese personnel concerned with this technical cooperation project are going to prepare their technical cooperation schedule flexibly in response to the progress of the construction work to be conducted under the Grant Aid. Therefore, the concrete starting time to dispatch experts has not been officially decided yet, but they are making careful preparations for a formal determination as soon as this Grant Aid is started.
- As to the dispatch of long term experts, the following contents are tentatively scheduled:

Team Leader	1
Mechanical Engineering Technician course	2
Motor vehicle technician course Construction plant technician course	2-3
Main electrical installation technician course Radio, Television and electronics technician course	2-3
Coordinator	1

- Short term experts are planned to be dispatched if necessary for the smooth execution of the technical cooperation.
- It is planned to accept 3 to 5 counterparts in Japan every year.
- Since most equipment will be provided through the Grant Aid, the supply of equipment required for this technical cooperation project is scheduled to be limited to a minimum.

3-5 Training Scheme

1) Training Course and Capacity

Following training courses and capacity are scheduled.

Course	Annual Intake	Duration	Number of Enrollment
Mechanical Engineering Technician	20	3 years	60
Motor Vehicle Technician	20	3 years	60
Construction Plant Technician	20	3 years	60
Main Electrical Installation Technician	20	3 years	60
Radio, Television and Electronics Technician	20	3 years	60
Total	100		300

2) Training Pattern and Qualifications to be applied for after graduation.

The objective of a training in the proposed institute is for the graduates to obtain the qualifications for taking the national examinations for Technician Part I and II, and the equivalent training as the following training pattern regulated in the Industrial Training Act will be employed.

1st year	6 months In-plant Training
	3 months Craft Orientation
	3 months In-plant Training
2nd year	13 weeks Approved Institutional Course
	13 weeks In-plant Training
	13 weeks Approved Institutional Course
	13 weeks In-plant Training
*	Technician Part I Examination

3rd year 13 weeks Approved Institutional Course
13 weeks In-plant Training
13 weeks Approved Institutional Course
13 weeks In-plant Training
* Technician Part II Examination

In this project, the In-plant Training in the above pattern will be conducted within the proposed institute instead of in a private firm. This is a method introduced to avoid that the skill levels of trainees may differ to the extent where these In-plant Training will be disputed. Because among those private firms few has well-equipped facilities and instructors for technician training.

3) Syllabuses to be Applied

The syllabuses to be applied for each course are those formulated by EAEC (East African Examination Committee).

Course	No.	Name of Syllabus
Mechanical Engineering Technician	1021	Mechnical Engineering Technician Certificate
Motor Vehicle Technician	1022	Motor Vehicle Technicians Course
Construction Plant Technician	1025	Construction Plant Technician
Main electrical Installation Technician	280-285	Main Electrical Installa- Technicians Course
Radio, Television and Electronics Technician	272	Radio, Television and Electronics Technicians Course

4) *Training Hours*

Annual training hours to be adopted in this proposed institute will not be known definitely until the completion of the curriculum for each course. Therefore the planning will be made assuming that the 1,400 hours of training per year will be most probable considering the local habit, formal holidays and leaves and also the existing conditions in the related institutions.

5) Ratio of Classroom Education and Workshop Training

Since the purpose of this project is to train technicians who will make contributions to the country's economic activities through working with their own hands, the average ratio of workshop training to classroom education under this project is set slightly higher than that of training conducted by those polytechnic schools of Kenya at present (40:60). But considering the fact that Kenya's national examinations for technicians are written ones, the weight of practical training shall not be raised too high. On the other hand, the ratio between classroom education and workshop training varies in training course. Therefore the ratio between classroom education and workshop training for each course has been tentatively set as follows:

	Classroom Education	Workshop Training
Mechanical Engineering Technician	35%	65%
Motor Vehicle Technician	35%	65%
Construction Plant Technician	35%	65%
Main Electrical Installation Technician	40%	60%
Radio, TV and Electronics Technician	45%	55%

(Classroom education at workshop classroom is included in the range of workshop training.)

6) Rate of Operation of Facilities

The rate of operation of workshops and classroom are set at 60% both in consideration of the degree of flexibility of curriculum compilation, especially the number of instructors and the compilation curriculum synchronized with the degree of progress of classroom education and workshop training.

7) The Number of Instructor and Training Unit

In accordance with the manpower allotment programme for this proposed institute, instructors will be allocated as follows:

<table>
<tr><th>Title</th><th>Total No. of Instructor</th><th>No. of Instructor by Course</th><th>Role</th></tr>
<tr><td>Senior Lecturer (HOD)</td><td>5</td><td>1</td><td rowspan="2">Classroom education</td></tr>
<tr><td>Lecturer</td><td>10</td><td>2</td></tr>
<tr><td>Assistant Lecturer I</td><td>15</td><td>3</td><td rowspan="3">Workshop training</td></tr>
<tr><td>Assistant Lecturer II</td><td>10</td><td>2</td></tr>
<tr><td rowspan="5">Lab. Technician</td><td>5</td><td>1</td><td>Tool/parts control</td></tr>
<tr><td colspan="2">1</td><td>Tool grinding</td></tr>
<tr><td colspan="2">1</td><td>Preparation of training materials</td></tr>
<tr><td colspan="2">1</td><td>Material test</td></tr>
<tr><td colspan="2">2</td><td>Physical laboratory</td></tr>
<tr><td>Japanese Experts (planned)</td><td></td><td>1-2</td><td>Adviser to instructors</td></tr>
</table>

As shown in the above table, the number of instructors for the workshop training in each course are about 6 to 60 trainees. This figure (1 instructor to 10 trainee group) is reasonable considering the safe and effective training management.
A small sub-group (5 trainees) can be also organized in some types of workshop training where one instructor will take care of 2 sub-groups simultaneously.

8) Training of Mechnical Engineering Technician Course

A) Target of Training

Trainees, upon the successful completion of the course, will have enough skills and related knowledge:

a) to conduct various cutting and grinding work of metallic materials with machine tools such as lathe, milling machine, etc., and

b) to conduct hand finishing work of machine parts by using hand tools, and

c) to conduct maintenance and installation work of machinery.

B) Priority of Training

Priority will be attached to cutting and grinding, especially to lathe work of which technical applications are extensive, and then to hand finishing. As to maintenance training, the practical training of boiler and pump will be considered.

Trainees will be made to acquire the minimum required skill of welding and heat treatment. A considerable weight is also placed on material tests (destructive and non-destructive tests) and tool grinding which seems to have been relatively neglected in Kenya, for further understanding of the importance of quality control.

C) Contents of Training

a) Basic skill

i) Fundamentals of measurement and marking-off

- Measurement of length
- Measurement of plane and surface coarsenness
- Measurement of angle (includes measurement of taper)
- Measurement of thread
- Measurement of toothed wheel
- Hardness test
- Tension test
- Marking-off of plane
- Marking-off of center
- Marking-off of edge of hollow cylinder
- Equal division of circumference of circle

- Non-destructive test

ii) Machine and tool handling
- Handling of lathe
- Handling of drilling machine
- Handling of milling machine
- Handling of shaping machine
- Handling of grinding machine
- Handling of tool grinding machine
- Handling of metal cutting saw (hand saw machine)
- Handling of electrically operated tool

iii) Basic processing work
- Chipping work
- File finishing work
- Hacksaw work
- Tapping work
- Reamer work
- Scraper work
- Processing work by lathe
- Processing work by drilling machine
- Processing work by milling machine
- Processing work by shaping machine
- Processing work by grinding machine
- Processing work by welding machine
- Heat treatment work
- Solder brazing work

iv) Tool grinding basic work
- Grinding work of working tool
- Grinding work of high speed steel cutting tool
- Grinding work of carbide cutting tool
- Grinding work of drill
- Grinding work of milling cutter

v) Safe and hygienic working method
- Safe working
- Hygienic working

b) Applied practical skill

i) Lathe work etc., with tolerance of approximately $\pm$ 0.01mm and cutting of thread and taper, etc.

ii) Drilling machine works such as hole drilling, spot facing, etc.

iii) Milling machine cutting of plane, groove, indexing, etc.

iv) Grinding machine work of plane, cylinder.

v) Shaping machine cutting of plane, angle, etc.

vi) Simple assemblage of parts.

vii) External inspection and dimensional inspection of mechanical parts.

viii) Operation test of a simple assembly.

ix) Processing works using welding machines.

x) Processing works using other machines.

9) Training of Motor Vehicle Technician Course

A) Target of Training

Trainees, upon the successful completion of the course, will have enough skills and related knowledge:

a) To operate machines and tools necessary for automotive maintenance and rapair, and

b) To conduct inspection, disassembling, reassembling, adjusting, and repairing work.

B) Priority of Training

After the minimum training on the handling of equipment and tools, various types of training are carried out. It will be appropriate to lay importance on the practical training of engines and chassis. In Kenya, it is considered that the number of graduates of this course employed by large scale automobile plants would be rather small, and the rate of those who work at gas stations, small scale repair shop or at independently-owned shops would be relatively high, except those who will be employed within NYS. Consequently, it is important for them to acquire skills covering the whole fields of automotive maintenance and repair, and it is not realistic to give them training of too specialized skills.

From the above reasons, for hydraulic equipment a simple test is performed and training is given on basic assemblage and disassemblage. For sheet metal repair and painting, training will be limited to partial processing and partial painting.

C) Contents of Training

a) Basic skill

i) Basic measurement work

- Measurement of length
- Measurement of plane
- Measurement of angle
- Measurement of current, voltage and resistance

ii) Machine and tool handling

- Handling of various tools
- Handling of machine for cutting and grinding
- Handling of machines for maintenance and repair of automobile

iii) Basic processing work

- Marking-off work
- Chipping work
- Filing work
- Hacksaw work
- Tapping work
- Reamer work
- Sheet metal work
- Arc welding work
- Gas welding work
- Gas cutting work
- Brazing work
- Painting work

iv) Maintenance and repair work

- Disassembling and reassembling work of engine and its auxiliary devices
- " " of motive power transmission system
- " " of suspension system
- " " of steering system
- " " of braking system
- " " of frame and body
- " " of electrical system
- Trial operation work

v) Safe and hygienic working methods

- Safe working
- Hygienic working

b) Applied practical skill

i) . Engine maintenace and repair work

ii) . Car body maintenance and repair work

iii) . Chassis maintenance and repair work

iv) . Electrical device maintenance and repair work

v) . Air conditioner maintenance and repair work

vi) . Special device maintenance and repair work

vii) . Hydraulic unit maintenance and repair work

viii). Sheet metal and painting work

ix) . Inspection and trial operation work

10) Training of Construction Plant Technician Course

A) Target of Training

Trainees, upon the successful completion of the course, will have enough skills and related knowledge:

a) to operate machines and tools necessary for repairing of construction machinery, and

b) to conduct inspection, adjusting, disassembling, reassembling and repairing work of construction machinery such as bulldozers and motor graders.

B) Priority of Training

The important items required as applied practical skill in construction machinery are abilities to diagnose malfunctions adequately and to repair them in a short time. In addition, abilities to anticipate the malfunctions already under process in construction machinery used in the field from their noise or appearance and to maintain them in the earlier stage are further expected.

To obtain such abilities, it is necessary to be engaged in the actual maintenance and repair works of construction machinery under experienced instructors. Therefore, in this course Field Service Training (FST) is strongly recommended in the second and third year curriculum.

The duration of 3-year training seems to be long, if the training is only conducted within the institute workshop using only training materials. Furthermore, such institutional training requires many different types of construction machinery, a variety of attachments and a lot of spare parts as training materials, resulting in tremendous operational cost increases. Even then it is difficult to obtain such abilities of forecasting the malfunction and carry out quick repair work.

On the other hand, in FST it will be also expected that the spare parts to be used in field repair work are free and effective training materials.

At present NYS owns bulldozers, scrapers, graders, excavators, compactors, rollers, rollies etc., actually working in the various Project Units for National Building. A majority of these were acquired three years ago, and are still under their maintenance period. They will be good training materials for FST, which, in addition, will be able to contribute to National Building profitably.

Normally, field repair can cover 80% of malfunctions of the construction machinery and will be more rational than to transport the machinery to a repair shop. In this sense, FST recommended for this course to be conducted in such a manner as, in principle, trainees will be dispatched to actual fields with workshop car and instructor rather than the broken machinery transported to the workshop of the proposed institute for repairs.

The workshop within the institute will have repair shop functions to a certain degree, and training for the first and second year trainees in particular will be centered on the whole process (except engine) of disassembling, repair, adjustment and reassembling of a bulldozer in one cycle per year in the first and second year stage. In the third year stage, the training will be concentrated on disassembling, repair and reassembling of specialized parts of other construction machinery.

The operation training of construction machinery is not for operators but the required for construction machinery mechanics before and after the maintenance and repair process.

C) Contents of Training

a) Basic skill

i) Basic measurement work

- Measurement of length
- Measurement of plane
- Measurement of angle
- Measurement of current, voltage and resistance

ii) Machine and tool handling

- Handling of various tools
- Handling of machines for cutting and grinding
- Handling of machines for maintenance of repair of construction machinery

iii) Basic processing owrk

- Marking-off work
- Chipping work
- Filing work
- Hack saw work
- Tapping work
- Scraping and fitting work
- Reamer work
- Arc welding
- Gas welding
- Gas cutting
- Brazing work
- Processing work by electric driven and electrical tools
- Forging work
- Painting work

iv) maintenance and repair work

- Disassembling and reassembling work of engine and its auxiliary devices
- " " of motive power transmission system
- " " of braking system
- " " of chassis
- " " of steering system
- " " of hydraulic unit
- " " of electrical system
- Trial operation work

v) Safe and hygienic working method

- Safe working
- Hygienic working

b) Applied practical skill

i) Engine maintenance and repair work

ii) Motive power transmission system maintenance and repair work

iii) Braking system maintenance and repair work

iv) Chassis maintenance and repair work

v) Steering system maintenance and repair work

vi) Hydraulic unit maintenance and repair work

vii) Electrical device maintenance and repair work

viii) Processing by cutting and grinding machines

ix) Inspection and trial operation work

11) Training of Main Electrical Installation Technician Course

A) Target of Training

Trainees, upon the successful completion of the course, will have enough skills and related knowledge:

i) to conduct wiring work of lighting system and its related facilities and repairing work of general electrical apparatus, and

ii) to conduct wiring, rewinding, disassembling, reassembling, insulating and adjusting work of controlling device and electrical apparatus, and

iii) to conduct installation and maintenance work of window type air-conditioners and home refrigerators.

B) Priority of Training

Considering that the course is for the training of technician level, the weight of electrical wiring work and repair of home appliances will not be so large, and the weight of power distribution board, transformer and motor-generator (MG) will rather larger.

Training on wiring work will be limited to wiring board panel training, and as to the repair of home appliances, trainees will be caused to acquire such general repair techniques for general electric home appliances common in Kenya.

As to electrical control, practical training on sequence circuit and others will be considered.

C) Contents of Training

a) Basic skill

i) Machine and tool handling

. Handling machines and tools

. Handling of electric-driven tools

ii) Basic measurement work

- Measurement of length
- Measurement of angle
- Measurement of plane
- Measurement of temperature
- Measurement of voltage and current
- Measurement of electric power and power factor
- Measurement of resistance
- Inspection of general electrical facilities
- Property tests of electrical device
- Experiment of automatic control

iii) Basic processing work

- Marking-off work
- Cutting owrk
- Grinding work
- Boring work
- Tapping work
- Brazing and welding work
- Painting work
- Soldering work
- Handling of electric wire
- Connection of electric wire

iv) Basic repair work of electrical apparatus

- Handling of machines for repair
- Disassembling and reassembling of revolving machine
- " of transformer
- " of power distribution board
- " of rectifier
- " of home electric appliances
- " of control board

v) Basic winding and insulation work

- Tapping work
- Electric motor
- Transformer
- Rheostat

vi) Basic electrical work

- Low voltage indoor wiring work
- Low voltage lead-in work
- Low voltage outdoor wiring work

vii) Safe and hygienic working methods

- Safe working
- Hygienic working

b) Applied Practical Skill

i) Wiring work

ii) Disassembling and reassembling work

iii) Repair and adjustment work

iv) Winding and insulation work

v) Internal wiring work

vi) External wiring work

vii) Experiment of high voltage apparatus

viii) Testing, inspection and maintenance work

12) Training of Radio, Television and Electronics Technician Course

A) Target of Training

Trainees, upon the successful completion of the course, will have enough skills and related knowledge:

i) to conduct disassembling, reassembling and adjusting work of electronic applied apparatus such as a radio receiver and a television receiver, and

ii) to conduct measuring work by using electrical and electronic measuring devices, and

iii) to operate miorocomputers.

B) Priority of Training

Conventionally, an emphasis has so far been placed on the reparing technics of radios and television sets in vocational trainings in developing countries. However, in recent years, the number of radios and television sets incorporating ICs has been rapidly increasing in many countries. The necessity for practical training of various circuits including semiconductors is becoming urgent in vocational training. In view of such situation, training in this course will emphasize practical training on microcomputers, CPUS, digital and electronic controls. The techniques and skills in these electronic fields are rapidly changing. Based on this viewpoint the facility for this course will be planned in a flexible manner to cope with possible future changes.

C) Contents of Training

a) Basic skill

i) Basic processing work

. Connection work such as soldering, etc.

. Marking-off work, boring, tapping and filing work

. Sheet metal processing work

. Handling of electronic parts

. Machining measurement work

ii) Disassembling and reassembling work

. Disassembling and reassembling of simple electronic equipment

iii) Basic measurement work

. Handling and maintenance of measuring instruments

. Measurement of resistance

. Measurement of voltage and current

. Measurement of electric power and magnetism

. Measurement of frequency

. Measurement of static property of semiconductor

. Measurement of property of integrated circuit

. Handling of recording meters

. Measurement of pulse wave

iv) Basic work of high frequency circuit

. LC oscillation circuit

. Crystal oscillation circuit

. Amplifier circuit

. High frequency amplifier circuit

. AM, FM detection circuit

. Power source rectifier circuit

v) Basic work for preparation of circuit diagrams

. Preparation of electronic circuit diagrams

. Sketch and drawing of electronic equipment and parts

vi) Assembling work of basic circuit

. Assembling and adjustment of power rectifier circuit

. Assembling and adjustment of aplifier circuit

. Assembling and adjustment of oscillation circuit

. Assembling and adjustment of logical circuit

. Assembling and adjustment of modulation and demodulation circuit

. Assembling and adjustment of pulse circuit

vii) Safe working method

. Safe working of machine and equipment

b) Applied practical skill

i) Repair and adjustment work of radio sets

ii) Repair and adjustment work of color television sets

iii) Adjustment work of tape recorders

iv) Adjustment work of stereophonic record palyers

v) Adjustment work of video tape recorders

vi) Experiment by a pulse circuit training kit

vii) Experiment by a digital circuit training kit

viii) Experiment by a sequence control circuit training kit

ix) Experiment by a logical circuit training kit

x) Experiment by a television circuit training kit

xi) Practical training of various control systems by means of a microcomputer training kit

3-6 Project Site

1) Location (Site Map is attached following this report)

The project site is located about 7km away from the centre of Nairobi toward Thika, along the Thika road. It is also located at a distance of about 800m from the NYS headquarters.

NYS has purchased the site from a construction company. The site has an area of 68,920 m^2. A part of the site, about 25,000 m^2 in area, is located 1-12m lower than the rest of the site is divided by cliff.

A paved access road about 8m wide is secured to the site and there is no difficulty foreseen for the execution of construction work.

2) The Sub-soil Condition

It is known that a generally firm bed rock (limestone, trachyte) is widely distributed close to the ground surface in the area of Nairobi.

Fig. 1 shows a topographic map of the project site. As it is an old map, surrounding road conditions etc. differ from the present situation, but it is known that there existed old quarries for cutting stone for building around the site area. A cliff of around ten meters high which crosses the site is the remnant of an old quarry.

As shown in Fig. 2, test pits were dug out at 32 points within the site. Test pit Nos. 1 through No. 17 are located in the higher part of the site, the northern part of the cliff, which occupies 2/3 of the total area and Test pit Nos. 18 through No. 32 are located in the lower part of the site under the cliff which is the remnant of an old quarry.

According to the personnel of NYS, geological characteristics of this project site can be roughly summarized as follows:

- In the upper part of the site, bed rock is distributed several tens of centimeters below the surface layer.
- It is pointed out that part of the lower part of the site was formerly used as a dumping ground.

Trial boring was carried out in a manner that a hole of 1 m square was dug by using shovels and picks until bed rock was reached, but even if bed rock did not appeared, when the hole was dug to a depth corresponding to the height of workers (= 1.7m), trial boring was suspended in consideration of the safety and efficiency of work.

The results of trial boring can be summarized as follows:

- In the upper parts of the site, bed rock exists generally 20 to 30cm below the surface. The upper portion of bed rock is weathered, but good bed rock will be available for building foundation by removing the upper portion by a depth of 30cm.
- Abundant wastes, stone and mud which seem to have been dumped from other places were seen at the west part of Pit Nos. 20 through 22, No. 26 and No. 27 in the lower parts of the site and bed rock could not be found at any pit. The top soil of at least 1 to 1.5m in depth seems to be unsuitable for the foundation of a building.
- Bed rock didn't appear at any pit at the eastern part of the lower part of the site, like the western side (Pit was dug to a depth of about 1.7m). The feature of sub-soil of the eastern side differs from the western side as follows:
- At No. 19 and No. 25, murram soil was seen throughout the overall depth of the test pit.
- At 3 pits, Nos. 18, 31 and 32 along the cliff, and Nos. 24 and 29, black cotton soil was seen below the murran layer for 50 to 70cm. This layer is estimated to be about 3m deep but the confirmation and the countermeasure will be necessary for this black cotton layer in the Basic Design stage.

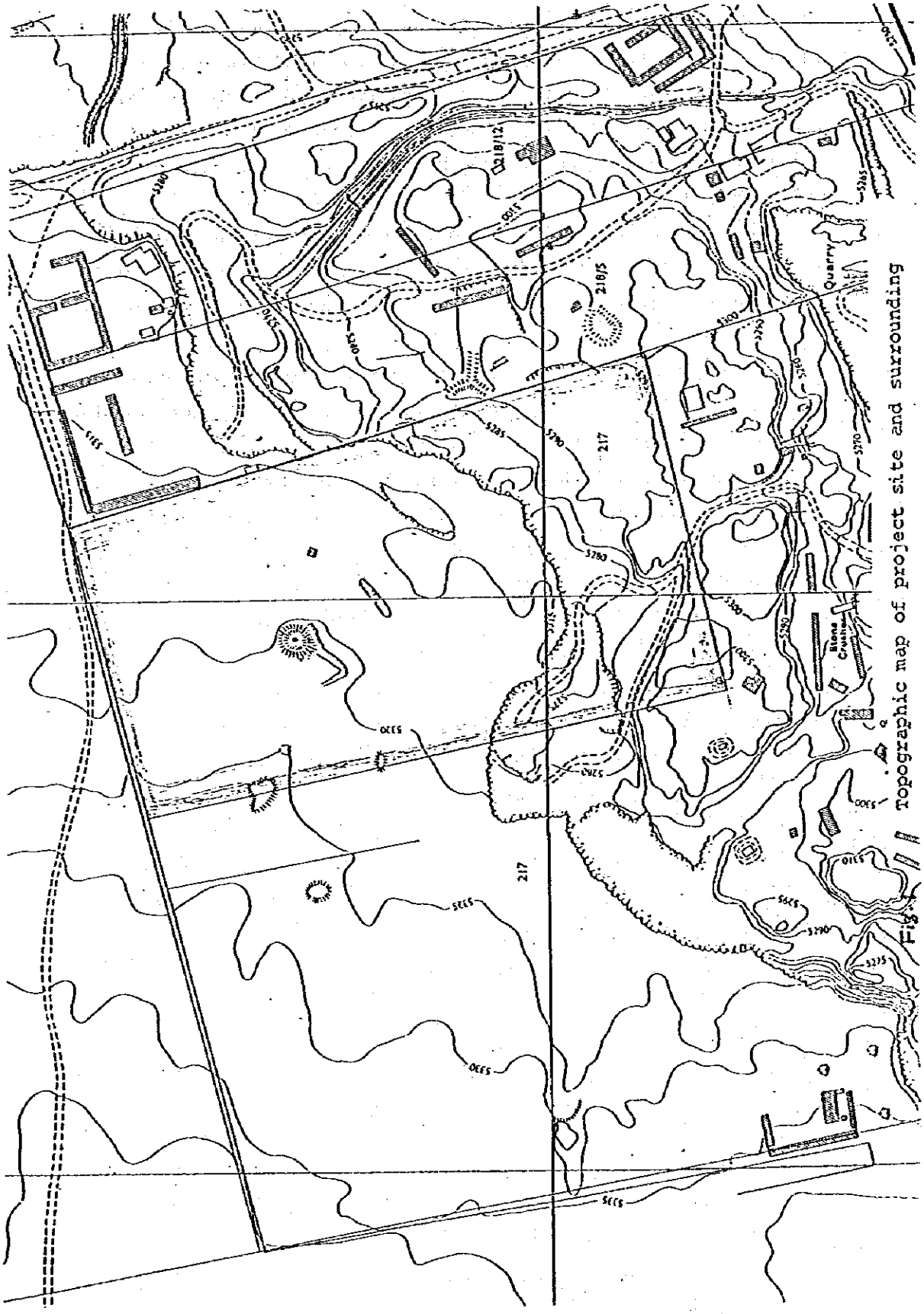


Fig. Topographic map of project site and surrounding

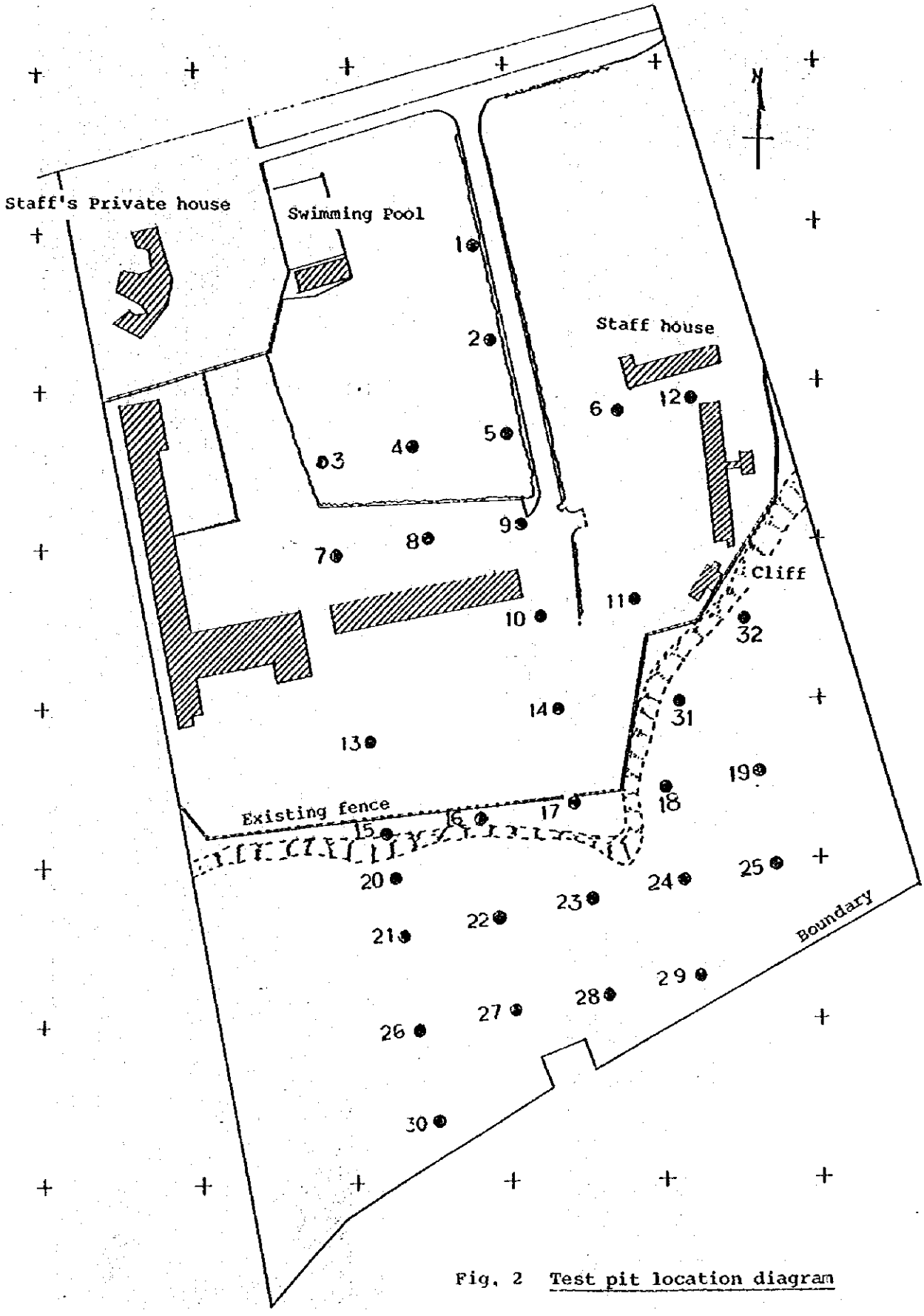
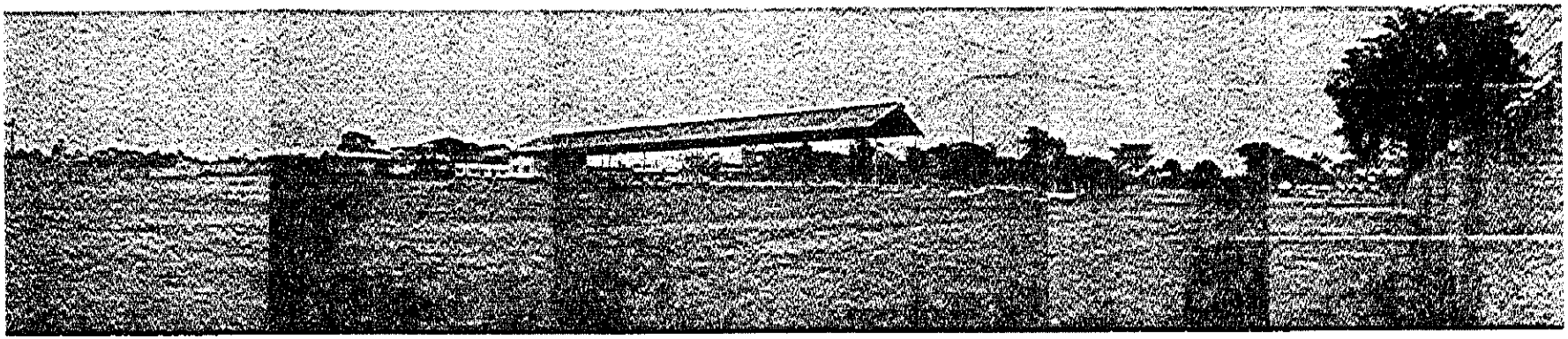
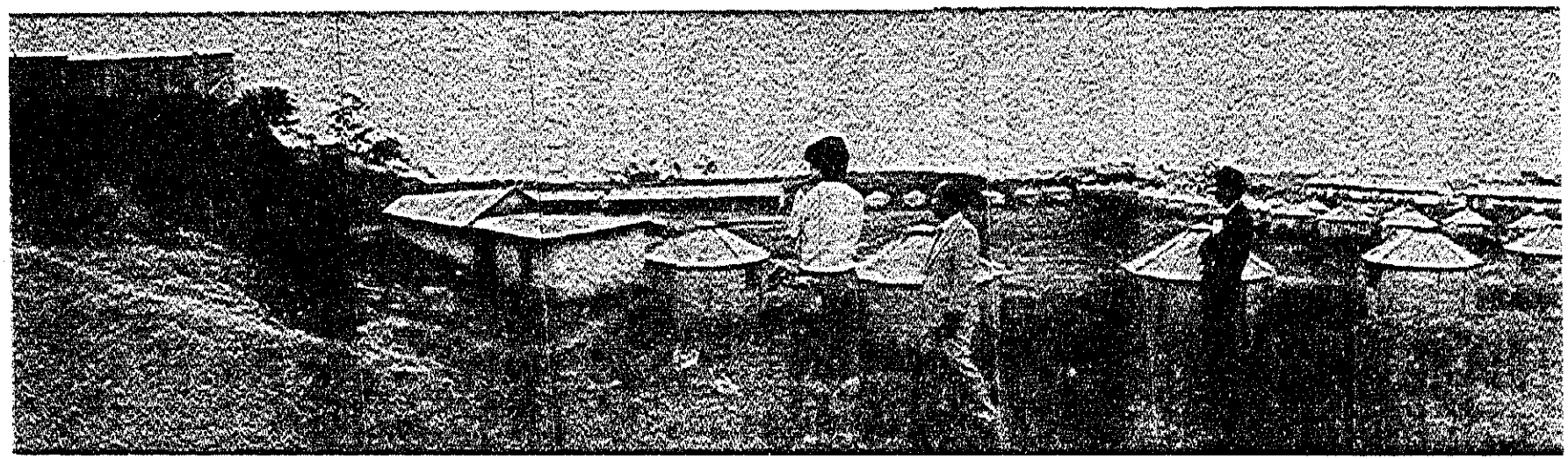


Fig. 2 Test pit location diagram



Existing Condition of Upper Part of the Project Site
(group of existing facilities)



Existing Conditions of Lower Part of the Project Site
(cliff of 10m high and temporary houses)

3) Condition of Existing Buildings

Existing buildings are from (A) to (O) as shown in the map and the following requirements including the site layout plan are proposed by NYS.

(A) is a residence surrounded by a separate fence within the site and it is occupied by Deputy Director of NYS. NYS desires it to be used as it is.

(B) is a relatively clean swimming pool with good facilities and NYS desires to use it as part of recreational facilities for the staff.

(C) is a garage which is relatively well maintained and NYS desires to retain it if it is possible in relation to the site layout.

(D) is a one-story building of masonry structure which was used as an administration building of a construction firm, and NYS desires to renovate it and use it for staff recreation and as a staff dining room. It is in relatively good condition.

(E) is a two-story building of RC partly masonry structure with some cracks on the wall, but is in sufficient condition to be used as a warehouse. NYS desires to modify and use it as a central warehouse.

(F), (G) are vehicle sheds of mainly steel structure but their floors are slanted and roofs damaged. Demolition is recommended also due to their unfavorable location.

(H), (I) are one-story houses of masonry structure which are presently occupied by NYS staff, but each unit is very small and considerably dilapidated. NYS desires to remove them.

(J) is a two story guard house of RC, and this will be renovated and reused for the same purpose.

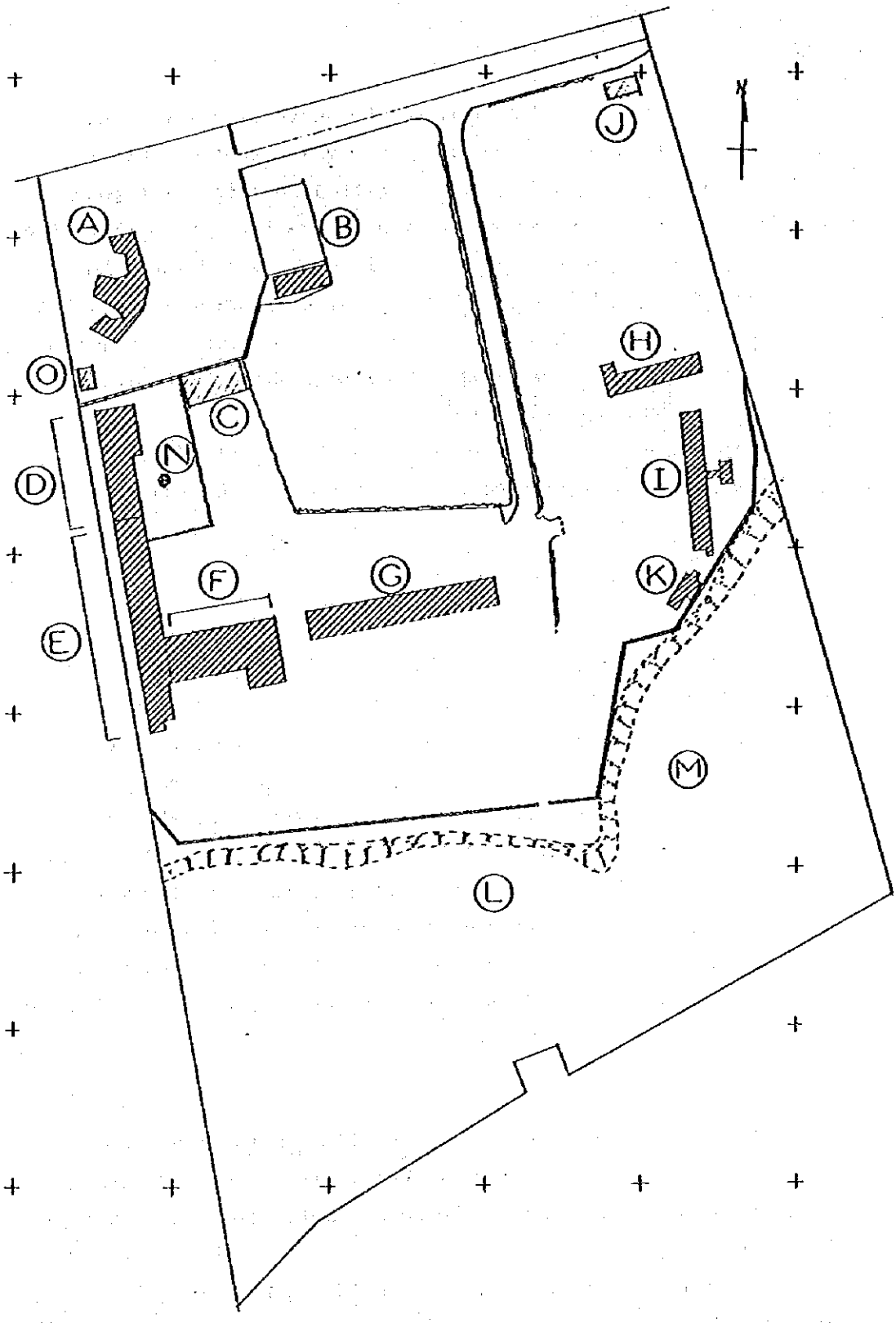
(K) is a one-story wooden house occupied by the care-taker of the site, but NYS desires to remove it, as it is quite old.

(L) is a group of temporary huts made of tin and (M) is a wooden temporary house. These will be removed.

(N) is a wireless antenna. This antenna and wireless facilities within (D) will be continuously used as they are in good condition.

(O) is a generator room for emergency. The generator will be moved and used in a new power house as it is in good condition

All items mentioned above except (O) will be executed by the Kenyan side.


A
B
C
D
E
F
G
H
I
J
K
L
M
N
O

4) Existing Conditions of Infrastructure

A) Electricity

Along Thika road 300m away to the north from the site, an overhead electric power line of 66,000 V and that of intermediate voltage of 11,000 V are installed, and electric power required for the proposed facilities is available from that line.

At present, electric power of 11,000 V is led into the site and is stepped down to 415V/240V by a transformer (450 KVA) mounted on a pole within the compound of an existing private house at the north-west corner of the site, from where it is distributed to the existing buildings.

Further, an emergency generator of 135KW (415V/240V) is installed in the existing generator room near the transformer mounted on the pole.

B) Water supply

A main water supply pipe of 225mm$^{\phi}$ (9 inches) is installed along Thika Road in the north side of the site. Water pressure is normally 1.5kg/cm^2 and it is possible to secure sufficient water for the proposed buildings, except during the dry season. For the existing buildings, the main pipe is led into the site with a diameter of 100 mm$^{\phi}$ (4 inches) at the north-east corner and immediately after the flow meter, the main pipe is separated into two, one to the private house and office building with a diameter of 1 1/4 inches and the other to the workshop and staff quarter with the same diameter of 4 inches.

C) Sewerage

Along the Gitahuru river located 100m to the south from the site, a public sewer of 24 inches is installed and this is a sufficiently large diameter to be connected from the proposed facilities.

A part of sewer water from the existing buildings is discharged into an existing public sewer branch line of 9-inch

diameter installed along the west side boundary of the site. This line is buried at a sufficient depth of about 4.5m.

D) Telephone

An overhead main telephone line is installed along Thika road at the north side of the site. The condition of telephone communication is not necessarily good, although it is being improved. However, it would be possible to secure public lines necessary for the proposed buildings.

A total of 4 public lines, one exclusively issued for private houses and 3 lines for existing offices, are installed to the existing buildings as an overhead line. A PABX is located in the existing office with the capacity for extension lines.

CHAPTER 4. BASIC DESIGN

CHAPTER 4. BASIC DESIGN

4—1 Basic Design Principles

Based on the results of the Basic Design Survey, the following principles were adopted as Basic Design Planning.

1) Site layout with clear zoning

Site layout plan shall be made with clear zoning of main functions utilizing respective features of existing conditions because the site is divided into two parts by the cliff of about 10 m high and the nature of sub-soil conditions of upper and lower parts are considerably different.

2) Rationalized functional relations

Functional studies shall be made to minimize the movement of staff and trainees, especially the walking distance of trainees in daily life between workshops and classrooms.

3) Effective utilization of existing facilities

Efforts shall be made to reduce the quantity of work to be borne by the Kenyan side by effectively utilizing some of those existing buildings scattered around the site, and careful attention shall also be paid to the overall functional linkage of buildings.

4) Planning for utilizing existing vegetation

Facilities with attractive landscaping shall be devised by utilizing the existing vegetation as much as possible.

5) Planning with much attention paid for energy saving

Facilities shall be so designed that the consumption of energy may be reduced by adopting the natural lighting and ventilation and fully utilizing the favourable climate conditions of highland Africa.

6) Rational structural plan

Rational floor and roof structure systems with an economical span shall be devised in consideration of different sub-soil conditions, columnless structure and overhead crane, etc.

7) Adoption of local materials

Locally produced materials with reasonable availability and cost shall be adopted as much as possible.

4-2 Basic Design Planning

1) Space Requirement

Rooms and spaces necessary for the proposed institute were set as follows based on the training scheme studied in Chapter 3.

A) Administration block

The calculations of floor area necessary for the rooms of Administration Block were based on the manpower allotment list.

a) Principal, vice principals, and chief adviser rooms

° For the above four executives, private office rooms of two different types will be allocated.

Principal, vice principal (39 m^2 each)
Vice principal, chief adviser (26 m^2 each)

° For every 2 executive rooms, secretary room (20 m^2) and waiting room (20 m^2) will be allocated for common use.

b) Executive assistant, Chief accountant, and Coordinator rooms

° Private room without secretary, waiting rooms will be allocated. (13 m^2 - 20 m^2 each)

c) Office rooms

° About 5 m^2/staff will be allocated for the proposed office staff shown in the manpower allotment list.

°	Officer/Clerk	Typist	Total	(Floor area)
Student office	5	3	8	(40 m^2)
Accountant office	3	2	5	(25 m^2)
Supply office	3	1	4	(20 m^2)

d) Conference room

° A conference room capable of accommodating about 30 persons will be planned for executive staff meeting and the meeting of chief class instructors and advisers.

° An oval type of meeting table with the combination of

2 - 3 persons table with enable the allocation of floor area per person about 2 m^2 (60 m^2)

° For a larger-scale conference, Assembly Hall etc. can be used.

e) Library

° An independent book storage is not considered. The book-shelves will be located along the walls with the capacity of 1,500 - 2,000 books excluding magazines.

° The reading area is planned to allocate enough space for trainees of 2 classes (40 trainees) for self-study with 1.9 m^2 per person.

° Within the library, counter and library office (15 m^2) will be planned.

f) Dispensary

° As NYS is a boarding institute, all trainees, staff and their family members will use this facility. Therefore, a rest and observation room with 4 sick bays with simple pharmacy and a dispensing room and a treatment room and a waiting corner will be planned (total 78 m^2).

g) Other rooms

° Printing room for photocopying and preparation of teaching materials will be allocated. (25 m^2)

° Telephone exchange room with operators will be allocated (20 m^2)

° Staff rest room for drivers or other subordinate staff (30 persons) will be planned with 1 m^2 per person. (30 m^2)

° Toilets, pantries, storage will be planned.

B) Assembly Hall

° An assembly hall will be able to accommodate 300 trainees and a part of staff, 40 staff, and will be used not only for assembly or orientation purpose but also for simple indoor sports. For this reason non-fixed type seating is adopted.

° The conditions regulated in Kenyan Building Code are to be cleared and 1.2 m^2 per person will be allocated. (415 m^2)

° The storage area for storing folding type chairs and changing room will be provided. (45 m^2)

C) Classroom Block

In this block the following rooms will be planned according to the types of the classroom education.

a) Classrooms (medium)

- The rooms are for 40 persons and will enable the joint classroom lessons of 2 classes for common subjects.
- The rooms are planned to be able to be divided in the middle into 2 small classrooms for 20 trainees by an accordion partition.
- The allocation of floor area per person will be 2.6 m^2 per trainee, a bit larger than the usual size in consideration of the future expansion in number of trainees. (104 m^2, rooms)

b) Classrooms (small)

- The rooms are for 20 persons and will be used for specialized subjects for each course.
- The allocation of floor area per trainee will be the same 2.6 m^2 (52 m^2, 4 rooms).

c) Drawing room

- The room is for 20 persons and will be used for the drawing lessons of mechanical, motor vehicle, and construction plant courses.
- The size of a drawing board will be A 1 size and the allocation of floor area per trainee will be 5 m^2 (104 m^2).
- The drawing lessons of electrical and electronic courses will be conducted in classrooms, as drawing lessons in those courses differ from other courses.

d) Audio visual room (A/V room)

- The room is for 40 persons and will be equipped with a video system and a 16 m/m film projector with floor area allocation of 2.6 m^2 per trainee. (104 m^2)

e) Laboratory equipment storage

- Laboratory equipment will be stored next to the classroom of 40 trainees where the laboratory lessons will be conducted. (90 m^2)

f) Material test laboratories

- A destructive test room and a non-destructive test room will be planned related to the training of welding, heat treatment and cutting and grinding.
- A destructive test room will be equipped with a universal test machine, a washing sink, etc., for preparations. (32 m^2)
- A non-destructive test room for an X-ray flaw detector, an ultra-sonic flaw detector, a magnetic flaw detector and for different types of hardness tests, a metallurgical microscope, etc. (15 m^2)
- Other ancillary rooms such as a dark room (7 m^2) and a staff room (11 m^2) are also included.

D) Mechanical Engineering Workshop

According to the contents of training, the space for each of the following types of training will be planned.

a) Space for cutting and grinding work
- Space for 16 sets of lathe, 5 sets of milling machine and other cutting and grinding machines. (365 m^2)

b) Space for hand finishing and marking-off
- Working tables for 20 and surface plates will be installed. (80 m^2)

c) Space for maintenance work training
- Boiler with pumps etc. will be equipped. (80 m^2)

d) Space for heat treatment training
- Quenching and annealing baths for heat treatment work will be planned. (60 m^2)

e) Space for cutting sheet materials and preparing training materials
- Different types of metal saw work with a material storage area will be planned. (60 m^2)

E) Motor vehicle and construction plant workshop

(Motor vehicle)

a) Space for a car inspection line
- Break tests, side slip test, headlight test etc. will be conducted. (100 m^2)

b) Space for basic disassembling and reassembling training
- Training for the first year trainees of disassembling,

reassembling, inspection, maintenance and repair (for 4 passenger cars) will be planned. (200 m^2)

c) Space for disassembling and reassembling

- Training of disassembling, reassembling, inspection, maintenance and repair work using car lifts (for 4 different types of car lifts) will be planned. (200 m^2)

d) Space for engine maintenance and repair

- Training of engine inspection, maintenance and repair using measuring apparatus, engine models and dismounted engine will be planned. (125 m^2)
- Training of engine repair using various types of repair machines will be planned. (50 m^2)

e) Space for training fo sheet metal and painting works

- Training will be basically conducted outdoors.

(Common)

a) Space for basic training for tool/equipment

- Working tables for 20 trainees will be planned. (50 m^2)

b) Space for testing engine

- An engine dynamometer room with noise insulation will be planned. (40 m^2)
- A fuel injection pump test room, with noise insulation will be planned. (20 m^2)

c) Space for electrical devices training

- An electrical device test room (30 m^2), a battery room (15 m^2) and a compressor room (10 m^2) will be planned.

(Construction Plant)

a) Space for basic operation training

- Training will be conducted outdoors in the operation field. (- 3,000 m^2)

b) Space for engine maintenance and repair

- Training of engine maintenance and repair using engine models and dismounted engine will be planned. (75 m^2)

c) Space for chassis maintenance and repair

- Training for disassembling, inspection, repair, adjustment and reassembling of truck frames, transmission etc. will be planned. (130 m^2)

d) Space for disassembling and reassembling lanes

- Training for major disassembling and reassembling using overhead cranes, 3^t and 5^t will be planned. (130 m^2)

e) Space for process and repair

- Training of sheet welding for front-attachment and welding for repairing of truck link etc. will be planned. (150 m^2)

f) Space for hydraulic components

- Training of disassembling, tests and reassembling of various types of hydraulic devices will be planned. (50 m^2)

F) Main Electrical Installation and Radio, TV and Electronics workshop

(Main Electrical Installation)

a) Spare for high voltage training

- Training of different types of power distribution boards and breakers will be planned. (25 m^2)

b) Space for transformer training

- Training of one-phase and three-phase transformer and their combination will be planned. (25 m^2)

c) Space for electrical wiring training

- Training by electrical wiring panel boards and its preparation work will be planned. (50 m^2)

d) Space for motor-generator training

- Training using different types of motors, generators and their combination will be planned. (65 m^2)

e) Space for coil winding training

- Training using coil winding machines, drying over and balancing test machine etc. will be planned. (25 m^2)

f) Space for manual work training

- Working table for 6 trainees for various types of manual work. (10 m^2)

g) Space for electrical control training

- Training using experiment devices for a sequence circuit and other different types of circuits and the training in

a shield room will be planned. (50 m^2)

h) Space for electrical home appliance repairs

° Training for repair of electrical appliances such as a room air conditioner, refrigerator etc. will be planned. (50 m^2)

(Radio, TV and Electronics)

a) Space for radio repair training

° Training for the repairing work using actual radio receivers and panel mounted radio will be planned. (50 m^2)

b) Space for television repair training

° Training for repairing work using actual color television receivers and panel mounted television will be planned. (50 m^2)

c) Space for, digital and microcomputer training

° Working tables for 20 trainees and shelves to store training materials, measuring devices will be planned. (50 m^2)

d) Space for electronic control training

° Training using SCR, pulse, logic and other electronic circuits experiment devices will be planned. (50 m^2)

e) Space for electrical and electronic measurement training

° Working tables for 20 trainees and shelves to store measuring devices will be planned. (50 m^2)

(Ancillary rooms for all workshops)

For each workshop building the following rooms will be planned.

a) Instructor room

° For each course one large instructor room to accomodate 1 senior lecturer (HOD), 2 lecturers, 5 assistant lecturers and 1-2 technical cooperation experts(total 10 persons) will be planned.

° The floor area allocation will be 5 m^2 per person (50 m^2)

b) Workshop classroom

- Workshop classroom for 20 trainees will be planned within the workshop building for lectures necessary during workshop training hours.
- The floor area allocation will be 2.5 m^2 per trainee. (50 m^2)
- For electrical and electronic courses, one common workshop classroom will be planned because in these courses many of the workshop lessons can be conducted in the workshop rooms.

c) Tool/parts store and storage

- For the centralized control of spare parts and tools, tool/parts store with working space for tool/parts store keeper will be planned.
- For each course, its own storage for equipment and training materials will be planned.

	Tool/parts Store	Storage	Total
Mechanical engineering	25 m^2	40 m^2	65 m^2
Motor vehicle, construction plant	60 m^2	65 m^2	125 m^2
Electrical	50 m^2		50 m^2
Electronical	50 m^2		50 m^2

G) Welding workshop

Welding workshop in common use for mechanical, motor vehicle and construction plant courses is to be planned as an independent building.

a) Space for arc welding training

- 10 sets of arc welding training unit will be planned. (50 m^2)

b) Space for gas welding and cutting equipped with 5 sets of gas outlets. (50 m^2)

c) Space for gas cylinder storage

- Next to the welding workshop, centralized gas cylinder storage

will be planned according to the local regulation. (30 m^2)

H) Student dormitory (including a dining hall, a kitchen and a recreation hall)

As NYS is a boarding institute in principle, a dormitory to accommodate all trainees (300 persons) will be planned. The separation of trainees by year and sex will be arranged. The ratio of girl trainees is estimated to be 10% of the total trainees but the plan will be so arranged that the separation is possible even when the ratio differs each year.

a) Dormitory unit

- One unit is for 4 trainees with 2 double decker beds and 4 lockers, but study desks will not be installed because centralized study rooms will be planned on each floor.
- Allocation of floor area per trainee is 3.2 m^2.

b) Study rooms

- Study rooms to accommodate one study table for every 3 trainees will be planned on each floor.
- Allocations of floor area are as follows:

  For boys - 24 study table/floor (45 m^2, 3 rooms)

  For girls - 8 study table/floor (25 m^2, 3 rooms)

c) Toilets, shower and laundry

- Those are planned as common use and in each floor room are distributed in two locations in boys' section and centralized in girls' section.
- Allocation of sanitary fixtures are as follows:

Stools	1 for 8 boys	1 for 6 girls
Urinals	1 for 8 boys	-
Shower	1 for 8 boys	1 for 6 girls

- Laundry will be equipped with washing machines etc.

  Washing machines 2 set/floor for boys

  1 set/floor for girls

- In addition a washing basin will be planned in each laundry.

d) Recreation hall

° The space for recreation of trainees such as TV-watching, table tennis and darts will be planned. (115 m^2)

e) Dining hall

° In principle, space for 2 sitting of dining by self-service and to-wagon returning system will be planned.

° Allocation of floor area per trainee is about 1.6 m^2. (245 m^2)

f) Kitchen

° The space to prepare 900 portions per day with a refrigerator room (6 m^2), a different type of food storage (5 m^2, 3 rooms), a kitchen office (10 m^2) and a WC/locker room (10 m^2) will be planned. (total 150 m^2)

g) Boiler room

° A boiler for supplying hot water to showers in the dormitory will be planned. (50 m^2)

h) Care-taker's office

° A care-taker's room of dormitory with rest bed will be planned. (12 m^2)

i) Other rooms and spaces

° Common toilets for dining hall and a recreation hall will be planned. (For boys 20 m^2) (For girls 12 m^2)

° A garbage deposit will be planned outside.

I) Other ancillary facilities

a) Garage

° A garage for 6 construction machinery and heavy vehicles will be planned. (300 m^2) The garage would be devided such that one portion will be left as a paining booth and will be provided with infra-red drying facility.

b) Car washer plant

° A car washer plant will be planned outdoors both for motor vehicles and construction machinery.

c) Gas station

° A gas station with underground tanks and filling pump facilities for normal and diesel fuel will be planned.

d) Power house

- A power house with a transformer room (25 m^2), a low voltage distribution board room (50 m^2), an emergency generator room (45 m^2) to which the existing generator will be transferred and installed and an oil tank room (5 m^2) and a storage (25 m^2) will be planned.

e) Dangerous article store

- A store for engine oil, machine oil, paints and kerosene will be planned. (20 m^2)

J) List of floor area

Administration Block

		(m^2)
. Principal room		39
. Deputy principal room		39
. Deputy principal room		26
. Chief adviser room		26
. Secretary room	4 rooms	20
. Waiting room	2 rooms	20
. Coordinator room		13
. Supply office		20
. Accounting office		25
. Chief accountant office		13
. Conference room		60
. Library		75
. Library office		15
. Dispensary		78
. Student office		40
. Executive assistant office		20
. Printing room		25
. Telephone exchange room		20
. Staff rest room		30
. Student waiting corner		20
. Storage		30
. Toilets, pantries	2 sets	52
. Corridor, stairs		224
Sub total		960

Assembly Hall

	(m^2)
. Hall (with stage)	415
. Storage, changing room	45
	460

Classroom Block

		(m^2)
. Classroom (medium)	2 rooms	208
. Classroom (small)	4 rooms	208
. Drawing room		104
. A/V room		104
. Laboratory equipment storage (incl. staff room)		90
. Non-destructive test room		52
. Destructive test room		32
. Dark room		7
. Staff room		11
. Toilet	2 sets	78
. Corridor, stairs		156
Sub total		1,050

Mechanical Engineering Workshop

	(m^2)
. Space for cutting and grinding work	365
. Spare for hand finishing and marking-off	80
. Space for maintenance work training	80
. Space for heat treatment training	60
. Space for cutting sheet materials and preparing training materials	60
. Instructor room	50
. Workshop classroom	50
. Storage	40
. Tool/parts store	25
. Toilets	25
. Aisle, corridor	205
Sub total	1,040

Motor Vehicle and Construction Plant Workshop

	(m^2)
(Motor Vehicle)	
. Space for car inspection line	100
. Space for basic disassembling and reassembling training (1 st year)	200
. Space for disassembling and reassembling (2nd, 3rd years)	200
. Space for chassis dynamometer	50
. Space for engine maintenance and repair	75
. Space for engine repairing machines	50
. Storage	40
. Workshop classroom	50
. Instructor room	50
(Common)	
. Space for basic training for tool/equipment	50
. Engine dynamometer room	40
. Fuel injection pump test room	20
. Electrical devices test room	30
. Battery room	15
. Compressor room	10
. Tool/parts room	60
(Construction Plant)	
. Space for engine maintenance and repair	75
. Space for chassis maintennace and repair	130
. Space for disassembling and reassembling lane	130
. Space for process and repair	150
. Space for hydraulic component	50
. Storage	25
. Workshop classroom	50
. Instructor room	40
. Aisle, corridor	250
Sub total	1,840

Main Electrical Installation and Radio, TV and Electronics Workshop

(Main Electrical Installation)	(m^2)
. Space for high voltage training	25
. Space for transformer training	25
. Space for electrical wiring training	50
. Space for motor-generator training	65
. Space for coil winding training	25
. Space for manual work training	10
. Space for electrical home appliances	50
. Tool/parts store, storage	50
. Instructor room	50
(Common)	
. Space for electrical control training	50
. Space for electronic control training (incl. shield room)	50
. Space for electrical and electronic measurement training	50
. Workshop classroom	50
(Radio, TV and Electronics)	
. Space for radio repair training	50
. Space for television repair training	50
. Space for CPV, digital and microcomputer training	50
. Tool/parts store, storage	50
. Instructor room	50
. Corridor and stairs	340
Sub total	1,140

Welding Workshop

	(m^2)
. Space for arc welding training	50
. Space for gas welding training	50
. Space for gas cylinder storage	30
Sub total	130

Student Dormitory

		(m^2)
(Dormitories)		
. Dormitory units	75 rooms	975
. Study rooms (boys)	3 rooms	135
. Study rooms (girls)	3 rooms	75
. Toilets, shower rooms and laundries (boys)	3 rooms	80
. Toilets, shower rooms and laundries (girls)	3 rooms	60
. Storage	e rooms	30
(Dinning hall, kitchen and recreation hall)		
. Dinning hall		245
. Toilet (boys)		20
. Toilet (girls)		12
. Kitchen		110
. Refrigerator room		6
. Food storage	3 rooms	15
. Kitchen office		10
. Toilet/locker room		10
. Recreation hall		115
. Boiler room		50
. Care-taker's office		12
. Storage		10
. Corridor, stairs, pilotis		1,030
Sub total		3,000

Outside Corridor	(m^2)
Sub total	250

Power House	(m^2)
. Transformer room	25
. Low voltage distribution board	50
. Emergency generator room	45
. Oil tank room	5
. Storage	25
Sub total	150

Garage	(m^2)
Sub total	300

Dangerous Article Store	(m^2)
Sub total	20

Grand Total	10,340	(m^2)

2) Site Layout Plan

Four different zonings of training zone, staff housing zone, student dormitory zone and outdoor facility zone will be planned by grouping necessary functions and will be located as follows:

Upper part of the site - training zone, staff housing zone
Lower part of the site - student dormitory zone, outdoor facility zone.

Following attention will be paid for the site layout.

° Existing vegetation will be preserved as much as possible leaving the existing area along the in-site approach road and around the swimming pool as a green area or as a car park.

° Among the existing buildings, those which are located along the western site boundary will remain and used as central store and staff recreation block after renovation.

° Staff housing zone will be planned in the eastern part of the higher site separated by the existing centre road.

° Sports field will be planned in the western part of the lower site because the sub-soil of the area contains waste, and the student dormitory and the operation field of construction machinery will be planned in the eastern part.

° Student dormitory zone will be planned in the lower site separated from the staff housing zone by a cliff, considering local customs, but the overbridges to the upper floor of dormitory will secure the functional linkage between the training zone and the student dormitory zone.

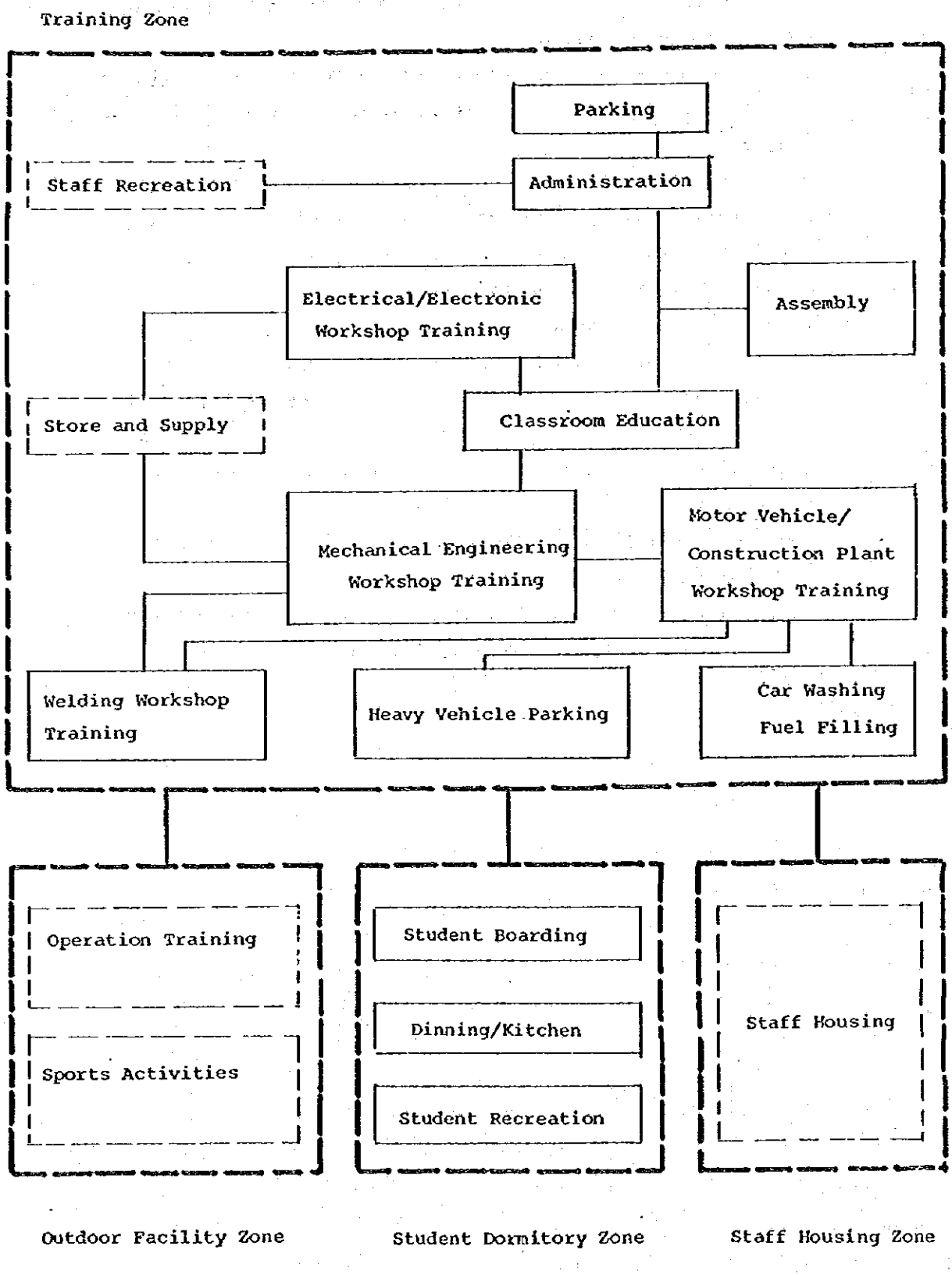
° Operation field of construction machinery will be located in the lower site considering dust and noise, and slope will be constructed to approach machinery to its workshop.

° Back site entrance will be planned at the south-eastern corner of the site to secure the carrying-in route for heavy construction machinery without giving damage to the pavement of the in-site approach road.

° Back site entrance will be so arranged not to lead any direct road from the planned motor-road by Nairobi City Council which will run along the southern site boundary.

- Group of administration block, assembly hall and electrical/ electric workshop will be located in the northern part of the site so that they can enjoy relatively calm atmosphere next to the green area.
- Classroom block will be located in the middle of the training zone so that trainees may move between classrooms and workshops easily.
- Motor vehicle workshop, construction plant workshop and electrical workshop, electronic workshop will be accomodated into one workshop respectively because they will share many common facilities and equipment.
- In front of Motor vehicle and Construction plant workshop, sufficient open area will be secured for miscellaneous purposes and garage will be located confronting that open space.
- In the abovementioned open space etc, gravel will be laid instead of of asphalt paving considering damages caused by heavy vehicles.
- Power house will be located near the workshop, with a large electric load for cost saving purposes.
- Elevated water tank will be located in such a place as to be able to give a visual effect as a symbolic tower.

Zoning and Functional Diagramme



3) Architectural Plan

The following attention will be paid to the architectural planning work.

A) Administration block

- Rooms frequently accessed by students will be planned on the ground floor.
- A staff entrance will be located on the north side of the block from where the existing garage and staff recreation block are easily accessible.
- Rooms less frequently accessed by students, like executive offices, a conference room and other office rooms, will be planned on the first floor.

B) Assembly hall

- A stage, locker room and storage space will be provided.
- Emergency exits will be secured for direct access to the outside.
- A unified linkage between entrance hall and assembly hall will be considered.

C) Classroom block

- Classrooms (small) will be planned on the ground floor because they will be mainly used by the 2nd and the 3rd year trainees for specialized lessons with closer linkage to workshops.
- Classrooms (medium) will be planned on the first floor because they will be mainly used by the 1st year trainees for common lessons with less closer linkage to workshops.
- Material test rooms will be located on the ground floor near mechanical engineering workshop because testing materials will be carried in from there most often.
- Toilets will be located centralized in the centre of the block facing the central corridor.

- Open corridor will be planned on both sides of classrooms for easy movement of trainees.
- Three stairs will be planned to secure smooth movement to and from the upper floor and emergency exit of the trainees.

D) Mechanical Engineering and Motor Vehicle/Construction Plant Workshops

- Flexibility to the changes of equipment layout will be considered by adopting columnless structure in the centre area.
- Independent rooms like workshop classrooms, instructor rooms, storage, tool/parts stores etc. will be planned in the north part of the building so that the floor height or structure may be rationally planned and be less expensive.
- Spaces where overhead cranes are equipped will be centralized sharing columns so that rational planning may be possible.
- Common spaces like engine dynamometer room, fuel injection pump test room, compressor room, electrical device room, battery room etc. will be located in the central part of the building.

E) Main Electrical Installation/Radio, TV and Electronics Workshop

- Radio, TV and Electronics workshop, where heavy articles are seldom carried in, will be planned on the first floor.
- Electrical/electronic measurement room, radio-television repair spaces and digital/micro-computer spaces will be planned as a group so that measuring and testing tools and equipment may be commonly used.
- Continuous spaces will be planned for transformer and motor-generator training because many combination practices will be conducted.

F) Student Dormitory (incl. Dining hall, Kitchen and Recreation hall)

- Dining hall and recreation hall will be so arranged as to open to the courtyard between the cliff and the dormitory building so that in case of necessity, students may be able to take lunch, etc., outside to reduce the constraints of curriculumn caused by two sittings of dinning.
- Kitchen will be arranged so as to face its longer side of the space to the dining hall so that the self-service food supply system may be easily conducted and also arranged to face the recreation hall so that the snack and coffee service may be available directly from the kitchen.
- Kitchen area will be planned as one storied considering the kitchen exhaust through the roof.
- Dormitory will be planned securing the two different types of separation, by sex and by grade. And to secure the flexibility to the annual change of boys and girls proportion, adjusting area will be set and by changing the doors locked for the separation by sex, the capacity of girls can be either 12, 20, or 24 per year.
- On the ground floor pilotis will be left open so that the future expansion of the dormitory capacity will be possible to a certain degree.

4) Cross-sectional Plan

The floor height of the classroom block, administration block and electrical/electronics workshop will be approximately 3.35m. This is slightly lower than a general floor height due to brick embedded slab method in which the ceiling will be unnecessary and a smaller height of RC beam can be realized arranged in the form of lattice.

Workshops (mechanical, automobile and construction plant) will be one-story buildings without ceilings and base materials for roofing will be directly finished. The height

under the beam will be about 4m. However, at the disassembling/reassembling lane of construction machinery, the height under the beam will be about 6m, since an overhead traveling crane will be installed and under which large machines will be disassembled and reassembled there.

The floor height of a dormitory will be about 3.35m and it will be arranged so that the floor level of the 3rd floor portion will come to near the same level as the surface of the upper part of the site so that the student may move directly to and from training zone through overbridges.

5) Structural plan

A) Foundation system

The sub-soil condition of the upper site differs from that of the lower site. Since the sub-soil of the upper site is in good condition, footing base will be positioned about 1m below GL and they will be connected together by footing beams. Therefore, the floor of the ground floor portion will be planned as slab-on-grade. .... Fig. 1

In the lower site, black cotton soil exists to a considerably depth along the cliff, therefore, it will be necessary to lower footings level until the bearing layer under black cotton soil.

Since the bearing capacity of black cotton soil can hardly be expected, considered its feature of shrinkage and swelling the ground floor slab will be a structurally independent RC floor system. ... Fig. 2

Fig. 1

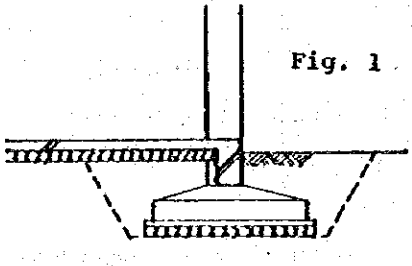
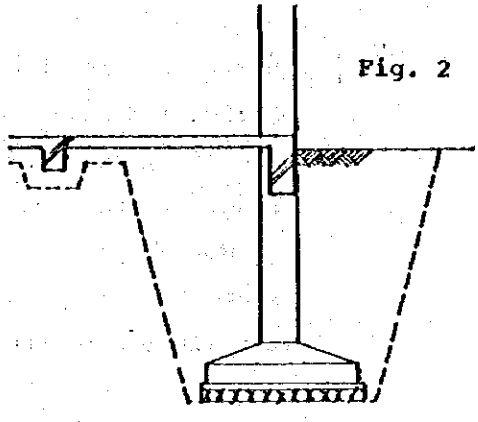


Fig. 2



B) Structural System

Since there is little possibility of earthquakes in Nairobi area, the pure-rahmen system will be adopted and RC resisting wall will not be considered. Since structural span differs with each building, the structural system will be individually set to each building as follows:

	No. of floor	Column, beam	Upper floor slab system	Roof system
Adm. Block	2	RC	RC-brick embedded	wooden truss
Assembly Hall	1	RC	-	Steel truss
Classroom Block	2	RC	RC-brick embedded	wooden truss
Electric/Electronic Workshop	2	RC	"	"
Mechanical Engineering Workshop	1	RC	-	steel truss
Motor vehicle/ Construction Plant Workshop	1	RC (crane girder	-	"
Student Dormitory	4	CB block	-	"
Garage	1	steel	-	steel truss

6) Building Facility Plan

A) Electrical facilities Plan

The basic policies of an electrical facility plan will be as follows:

- Locally manufactured products will be used if they can be easily procured and have no problem in quality. For other products, Japanese products will be used.
- Those systems, equipment and machines will be selected from such view points as safety, reliability and high efficiency as well as easy maintenance.
- Local regulations, standards and norms shall be abided, but for such items for which local regulations have not enacted, Japanese domestic regulation will be applied.
- Tools and spare parts necessary for the maintenance and control of equipment and facilities will be properly planned.
- A plan shall be such that it will be able to cope with possible changes of training equipment in the future.

a) Power in-taking facility

An electric power lead-in will be branched from an aerial wire of 3-phase, 3-wire 11 KV located along the road 300 m away to the north of the site and drawn into poles to be newly erected within the site. From the pole, the power line will be buried in the ground to a new power house.

Like the power line, a telephone lead-in will also be branched from an aerial telephone wire installed along the above road and led in overhead upto telephone poles to be newly erected within the site. After that, the telephone wire will be buried in the ground to an MDF inside a new adm. block.

b) Power receiving and transforming facilities

A transformer will be provided in the newly constructed power house to step down the power from 3-phase, 3-wire 11 KV into 3-phase, 4-wire 415V-240V and to supply to necessary loads. The voltage of power distribution will be 3-phase 415V 50Hz for motive power and single-phase 240V 50Hz for lighting and outlet.

c) Power generator facility for emergency

The existing power generator will be inspected and overhauled and will be moved to the new power house to be reused. Its ratings are 3-phase, 4-wire, 415-240V, 50Hz, 135Kw.

d) Main and motive power feeder facility

From a new power house the power will be supplied as general motive power, motive power for training equipment, lightings and outlets. The operation of motive power will be centralized as less as possible to enable the spot operation where motive power is used.

e) Lighting and outlet facility

Lighting facility will be an effective system with fluorescent lamps used as a primary light source, but incandescent lamps for an assembly hall etc., mercury lamps for outdoor lighting, for rooms with high ceiling height and other light sources will be properly utilized as needed. It will be arranged to reduce power consumption as much as possible by dividing lighting groups into a small unit. Outlets fixtures will be properly positioned in consideration of the type of power source of equipment and their position of use, etc.

f) Telephone facilities

A new telephone exchanger will be provided in the administration block to provide communication within and outside the institute. In principle telephone receivers will be installed in the office rooms in adm. block, instructor rooms in workshops etc. where the telephone is absolutely required. Public telephone for common use will be also provided at several points.

g) Public-address system

A public-address system with an amplifier, a speaker, etc. will be installed for information and urgent messages within a building. In assembly hall and dining hall an

independent public-address system will be provided.

h) Interphone facility

An interphone system will be installed for management (guard house-adm. office) and for maintenance (electrical, machine rooms-adm. office) purposes.

i) Common TV receiving facility

A television common antenna will be installed on the roof and received signals will be distributed through outlets at necessary places.

j) Electric clock facility

Proper kind of clock (electric or battery type) will be installed at necessary places like classrooms, workshops and other public spaces.

k) Lightning arrester and grounding facility

A lightning arrester will be provided at the top of an elevated water tank from where a conductor wire will be grounded.

l) Automatic fire alarm facility

An automatic system which detects the occurrence of a fire and automatically sounds an alarm will be provided to detect a fire early enough and prevent the expansion of damage.

B) Ventilation facility

Basic policy for ventilation facility is to provide a minimum of mechanical ventilation by adopting natural ventilation as much as possible.

When the facility is absolutely required due to the shape of the function of a building, such a system as can be individually operated will be provided at a minimum range.

a) Ventilation facility

A mechanical air ventilation facility will be provided in workshops, toilets where dusts, heat and odor will be

noticable and the principal's office and conference room etc. where smokers may gather. A dust removing device will be provided for ventilation of the welding booth.

C) Water supply, drainage and sanitary fixture plan facility

In principle, a water supply, drainage and sanitary fixture facility plan will be devised in accordance with the local standard and engineering method, so that its maintenance can be easily carried out, but Japanese standard will be partially adopted in consideration of the improvement of durability of the facility.

a) Water supply facility

In consideration of the local water supply situation, especially the water shortage during dry season, water reservoir with the capacity of roughly one day water consumption shall be installed. City water obtained from a main service water pipe will be once stored in a water reservoir, installed on the ground for easy maintenance, and then it will be pumped up to an elevated water tank and supplied to necessary places by natural water head pressure.

b) Drainage facility

A drainage facility will be divided into a system of living and draining waste water and rain water drainage systems.

Living and draining waste water will be directly discharged into a public sewer and rain water will be discharged into a road gutter on the south side of the site.

For draining waste water including harmful substances exceeding the standard of discharge, a separator will be provided.

c) Hot water supply facility

A gas boiler with LPG used as fuel and a hot water storage tank will be provided to supply hot water to a kitchen and shower rooms of the student dormitory. Portable hot water will be individually supplied by an electric water boiler to be installed in pantries.

d) Gas facility

A large LPG tank will be installed outdoors for the kitchen and gas boiler. Special gas cylinders will be installed in gas storage next to the welding workshop.

e) Fire fighting facility

In accordance with the local regulations, fire fighting facilities such as hose reel, outdoor hydrants, etc., will be installed.

7) Building Material Plan

Major finishing materials are as follows:

Item	Finishing Material	Place
External Wall	- Nairobi stone (hard machine cut and fair faced	All Blocks
Roof	- Cement roof tile + roof board + wooden truss	Adm. block, classroom block Electrical/Electronic Workshop.
	- Cement roof tile + steel keystone plate + steel truss	Mechanical workshop, Motor V./Co. Plant Workshop assembly hall
	- RC slab + synthetic high-modules waterproofing	Flat roof (part)
Partition Wall	- Concrete block + motor + EP	All Blocks
Ceiling	- LGS + plaster board + rockwool insulation board	Ceiling of upper most floor
	- RC slab brick embedded + motor + EP	Ceiling of other floor
	- Without ceiling (keystone plate + OP)	One storied workshops
Internal Floor Finish	- PVC tile + PVC base board	Office, classroom, workshop (Electrical/Electronic) dormitory, dinning hall etc.
	- Terrazzo in situ + Terrazzo base board	Water section, stairs, kitchen, outside corridor
	- Colorcrete + mortar base board	One storied workshops
	- Flooring + wooden base board	Assembly hall
External Doors and Windows	- Aluminium door and window	All Blocks
	- Steel shutter	Workshop door
	- Steel door	Machine room etc.
Internal Doors and Windows	- Wooden door and window	All Blocks
	- Steel door	Where fire-resistance is required