3-2-3 Utilization Plan for Existing Facilities of Biochemistry and Geology Departments

Following completion of the facilities of the Biochemistry and Geology Departments, the functions to be moved to the new buildings include the Office of Faculty Administrators, the Biochemistry Department, the Geology Department, and large and medium lecture rooms. Therefore, the facilities currently borrowed by the two departments will be returned to the Mathematics and Botany Departments, respectively. Although most functions of the Geology Department will be relocated into the new building, the existing building will remain not demolished, but will continue to be used. In addition, the Institute of Computer Science will continue to be used in its existing condition.

3-2-4 Examination of Requested Facilities and Equipment

1) Main facilities

(1) Offices and administrative divisions

① Dean's office and its secretary's office

Currently the Dean's office and its secretary's office are located in the building of the Department of Mathematics. The student augmentation plan for the Faculty of Science envisages that both the Dean's office and its secretary's office will be demolished to expand the space of the adjoining seminar room to accommodate an increased number of students for the Department of Mathematics. In conjunction with such an event, the Dean's office and its secretary's office will have to be relocated to another place. Since the Faculty Science's existing facility has no surplus space for these two offices to be provided, provision of a new, corresponding facility will be required.

② Faculty office of administrators

The Faculty office of administrators jointly uses the Dean's secretary's office as the Faculty office of administrators. This office has no seats available for the administrators. It also has no space to

allow administrative office work to be conducted nor teaching materials to be printed. Such a situation will doubtlessly generate incovenience to the administrators in their carrying out office work to implement the teaching and office staff augmentation plan and the student augmentation plan in the future. Thus, it would be essential to provide a new Faculty office of administrators.

(2) Class rooms

① Teaching laboratories

- Currently, the Department of Biochemistry borrows, as its laboratory, the laboratory of the Department of Botany. None of other departments also has no space available for use by the Department of Biochemistry. Due to this, if the student number of the Department of Botany should be increased as per the student augmentation plan for the entire Faculty of Science, there will be little possibility for the Department of Biochemistry to borrow any space. In addition, the Department of Biochemistry will have to have a teaching laboratory for its own use as laboratory education is indispensable for this department. Thus, the team has judged that providing a new, teaching laboratory for exclusive use by the department will be prerequisite.

- Currently, the Department of Geology borrows the lecture room of the Department of Mathematics. This lecture room will have to be used by the Department of Mathematics in the case when it increases students in accordance with the Faculty of Science's student augmentation plan. Therefore, there will be no possibility for the Department of Geology to continue to use lecture room currently borrowed by it nor any other departments have no extra space available for use by this department. In addition, as the department requires a diversity of laboratory education using specimens and because its laboratory works are different from those of the Department of Biochemistry, the department will need a teaching laboratory for its own use. Thus, the team has judged that providing a new, teaching laboratory for the exclusive use by the department will be prerequisite.

② Large and medium lecture rooms

a. State of how the Faculty of Science's lecture rooms have been used

Table 3-1 shows how the Faculty of Science's lecture rooms have been used. For reference, the capacities of lecture rooms are defined as follows:

Large lecture room : 120 ~ 200 students
Medium lecture room : 42 ~ 100 students
Small lecture room : 25 ~ 30 students

As shown in the table, the Faculty of Science's lecture rooms have been used jointly by all of its departments, and, in particular, both large and medium lecture rooms are continuously used almost every hour, very efficiently at a use rate of approximately 60%.

However, depending on the lecture, the full number is exceeded, forcing some students to receive the lecture without seats but having to keep standing.

b. Requirements for new, large and medium lecture rooms

With the Faculty of Science's student augmentation plan (See Table 3-2) implemented in the future, student number will become 2.8-fold in 1992 over 1989 and, eventually, students receiving lectures will increase accordingly, making the existing lecture rooms impossible to accommodate the increased students. Therefore, in order to carry out the student augmentation plan, it will become essential to provide such lecture rooms as having the student accommodation capacities matching the plan.

Taking a view of the freshman number covered by the 1992 student augmentation plan, the minimum number unit of every department, other than the Department of Zoology, is in excess of 30 students, suggesting that requirements for small lecture

Table 3-1 Faculty of Science - Room Allocation 1989

< >: Serial number

Room name		Small Lecture Room			Middle Lecture Room					Large Lecture Room		
		P Small	M 204	M 304	M 6	M 115	M 203	C Small	C 105	P Main	OB 5	C Main
Capacity		25	30	30	42	43	48	70	70	120	120	170
Mon.	8		<5> BC2 (50)			<36> SG (30)	<53> 2S (160)	<81> C3 (120)		<132> Z1 (30)	<161> GG (58)	<179> M2 (200)
	9						<54> ST2 (160)	<82> C2 (120)	<105> ST1 (200	<133> P3 (80)	<162> GG (58)	<180> BC3 (185)
	10				<27> ME (140)		<55> BC3 (58)	<83> Z2 (30)	<106> MB (200)	<134> P2 (80)		<181> MX (200)
	11		<6> ST3 (100)		<28> MC2 (140)			<84> C3 (120)	<107> ST1 (200)			<182> B2 (100)
	12	<1> P3 (80)	<7> BC3 (50)				<56> ST2 (160)	<85> C2 (120)	<108> PB (80)	<135> Z1 (30)		<183> PA (80)
	2				<29> ME (140)	<39> OM (30)	<57> ST2 (160)	<86> B3 (100)	<109> MB (200)	<136> M3 (200)	<163> PS (58)	<184> MX (200)
	3					<40> OM (30)					<164> PS (58)	
	4					<41> OM (30)					<165> PS (58)	
	5											
Tue.	8		<8> BC2 (50)	<26> Z3 (30)	<30> MC1 (140)	<42> EG (30)	<58> ST2 (160)	<87> ME (200)	<110> MB (200)	<137> M3 (200)	<166> OM (58)	<185> MX (200)
	9		<9> BC2 (50)			<43> EG (30)	<59> ME (160)	<88> B3 (100)	<111> MB (200)	<138> B1 (100)	<167> HG (58)	<186> MX (200)
	10		<10> ST3 (100)				<60> ST2 (160)	<89> Z1 (30)		<139> P3 (80)		<187> M2 (200)
	11								<112> M3 (200)	<140> P2 (80)		
	12						<61> 2S (160)					<188> M2 (200)
	2		<11> BC3 (50)					<90> C2 (120)	<113> ST1 (200)			<189> C1 (120)
	3		<12> ST3 (100)				<62> ST2 (160)				<168> PE (58)	
	4										<169> PE (58)	
	5										<170> PE (58)	
Wed.	8		<13> BC3 (50)		<31> 2S (140)	<44> IM (30)	<63> ME (160)	<91> MB (200)	<114> B2 (100)	<141> M2 (200)		<190> MX (200)
	9		<14> BC3 (50)			<45> IM (30)	<64> BC2 (58)	<92> ME (200)	<115> MB (200)	<142> B1 (100)	<171> SG (58)	<191> MX (200)
	10		<15> PB (80)			<46> IM (30)	<65> ST2 (160)	<93> P2 (80)	<116> M3 (200)	<143> Z2 (30	<172> SG (58)	<192> PA (80)
	11		<16> BC2 (50)			<47> IM (30)			<117> ST1 (200)	<144> M3 (200)	<173> SG (58)	<193> C1 (120)
	12						<66> ME (160)	<94> C2 (120)	<118> MB (200)	<145> P3 (80)		<194> MX (200)
	2		<17> ST3 (100)				<67> ME (160)		<119> MB (200)	<146> MX (200)		<195> BC (185)
	3		<18> ST3 (100)				<68> ST2 (160)					<196> BC (185)
	4											<197> BC (185)
	5									<147> M2 (200)		
Thur.	8	<2> P3 (80)					<69> B3 (100)	<95> C3 (120)		<148> Z2 (30)		<198> C1 (120)
	9	<3> PB (80)	<19> ST3 (100)		<32> M3 (140)	<48> IM (30)	<70> ST2 (160)	<96> C2 (120)	<120> Z3 (30	<149> PA (80)		
	10		<20> ST3 (100)		<33> BC2 (50)		<71> ME (160)	<97> M2 (200)	<121> MB (200)	<150> B2 (100)		<199> MX (200)
	11		<21> ST3 (100)			<49> GM (30)			<122> ST1 (200			
	12				<34> 2S (140)		<72> ME (160)	<98> MC1 (200)	<123> MB (200)	<151> M2 (200)		<200> MX (200)
	2					<50> IM (30)	<73> ST2 (160)			<152> M2 (200)	<174> PE (58)	
	3					<51> IM (30)			<124> M3 (200)			<201> C1 (120)
	4					<52> IM (30)	<74> 2S (160)		<125> M3 (200)	<153> M2 (200)	<175> GG (58)	
	5							<99> Z2 (30)	<126> MC2 (200)	<154> Z1 (30)		<202> MX (200)
Fri.	8		<22> M2 (100)		<35> PB (80)		<75> B3 (100)	<100> B2 (100)	<127> M3 (200)	<155> PA (80)		<203> B1 (100)
	9		<23> ST3 (100)					<101> M2 (200)	<128> Z3 (30)	<156> M3 (200)	<176> GG (58)	<204> BC (185)
	10		<24> ST3 (100)				<76> ST2 (160)			<157> P3 (80)	<177> GG (58)	<205> BC (185)
	11						<77> 2S (160)	<102> C3 (120)		<158> M2 (200)	<178> GG (58)	<206> BC (185)
	12							<103> BC2 (92)		<159> M2 (200)		
	2	<4> 2S (100)	<25> ME (100)		<36> MC2 (140)		<78> M3 (160)	<104> M2 (200)	<129> MB (200)	<160> Z3 (30)		<207> MX (185)
	3				<37> M3 (140)		<79> ST2 (160)		<130> ST1 (200)			
	4						<80> ST2 (160)					
	5								<131> ST1 (200)			

(Note)
B = Botany
BC = Biochemistry
C = Chemistry
EC = Econimics
ED = Education
G = Geography
PSY = Psychology
PE = Physical Educ.
GG = General Geology
SM = Structural Geology
OM = Optical Mineralogy
PS = Project Seminar
PE = Paleontology
MB = Maths. B
MC = Maths. for Chemistry
ME = Maths. for Economics
PA = Physics A
PB = Physics B
MX = Maths. X
ST = Statistics
Z = Zoology
/P = Practicals
HG = Hydrogeology
GM = Geomorphology
EG = Economic Geology
IM = Igneous of Met-Petrology

P Small = Small lecture room in Department of Physics
M = Lecture room in Department of Mathematics
C = Lecture room in Department of Chemistry
OB5 = Old room in Department of Geology

The maximum time duration of lecture per week is 45 hours.

Table 3-2 Student augmentation plan of the Faculty of Science

Dept.	Grade	1989	1990	199	1992	1993	1993
Bio-chemistry	3rd	15 (150)	15 (150)	15 (150)	30 (165)	35 (170)	50 (185)
	2nd	15 (150)	15 (150)	30 (165)	35 (170)	50 (185)	55 (190)
	1st	15 (150)	30 (165)	35 (170)	50 (185)	55 (190)	70 (205)
	Subtotal	45 (450)	60 (465)	80 (485)	115 (520)	140 (545)	175 (580)
Geology	3rd	20 (48)	20 (48)	20 (48)	20 (48)	25 (53)	30 (58)
	2nd	20 (48)	20 (48)	20 (48)	25 (53)	30 (58)	50 (68)
	1st	20 (48)	20 (48)	25 (53)	30 (58)	40 (68)	45 (73)
	Subtotal	60 (84)	60 (84)	65 (149)	75 (159)	95 (179)	115 (199)
Botany	3rd	40	40	40	80	100	100
	2nd	40	40	80	100	100	120
	1st	40	80	100	100	120	120
	Subtotal	120	160	220	280	320	340
Mathemat-ics	3rd	50	50	120	360	360	400
	2nd	50	120	360	360	400	450
	1st	120	360	360	400	450	500
	Subtotal	220	530	840	1,120	1,210	1,350
Chemistry	3rd	60	60	80	120	120	120
	2nd	60	80	120	120	120	120
	1st	80	120	120	120	120	120
	Subtotal	200	260	320	360	360	360
Physics	3rd	20	20	40	80	80	80
	2nd	20	40	80	80	80	80
	1st	40	80	80	80	80	80
	Subtotal	80	140	200	240	240	240
Zoology	3rd	30	30	30	30	30	30
	2nd	30	30	30	30	30	30
	1st	30	30	30	30	30	30
	Subtotal	90	90	90	90	90	90
	Total	815	1,300	1,815	2,280	2,455	2,670
	Index	100	159.5	222.7	279.8	301.2	327.6
	Rate of increase	0	59.5%	39.6%	25.6%	7.7%	8.8%

Note: Figure in parentheses represents the maximum unit sstudent number including the students from other faculaties and departments.

rooms will decrease, but those for lecture rooms larger than medium rooms will increase.

c. Capacities of new, large and medium lecture rooms

Based on the aforementioned philosophy, the Government of Uganda has requested the Government of Japan to provide at the Faculty of Science a 600-student large lecture room and a 200-student medium lecture room. In Japan, however, with a lecture given at a time, the students covered by it are no more than 200 from the viewpoint of educational effect, and the number is regarded as the limit. Accordingly, a new, large lecture room with the capacity of 600 students would be too large, and the team has judged that an educational effect matching such a large capacity cannot be expected. This philosophy has led to the thought that, as the 185 students of the Department of Biochemistry and the 200 students of the Department of Mathematics (Note 1) at the 1992 point exactly match the capacities in consideration of education effect and also surpass the maximum full number of the existing, large lecture room, it would be considered reasonable for a new, large lecture room to be provided with a capacity of about 200 students.

For a new, medium lecture room, it would be considered reasonable for it to have a capacity surpassing that of the existing, largest, medium lecture room (70 students) so as to accommodate students who are overflowed from the existing, medium lecture rooms, and being less than that of the existing, smallest, large lecture theater (120 students). Therefore, the student number, in terms of the student number receiving lectures at the point of 1992, which surpasses the capacities of the existing, medium lecture rooms but is less than the capacities of the existing, large lecture rooms, corresponds to the 92 students of the Department of Biochemistry, the 100 students of the Department of Mathematics, the 80 students of the Department of Physics and the 100 students of the Department of Botany (Note 2). Therefore, it would be considered adequate for a new, medium lecture room to be given a capacity of abut 100 students.

Note 1 : Although the Department of Mathematics will have 400 freshmen in 1992, lectures would be given to every 200 freshmen because 400 freshmen are excessive as the number receiving a lecture at a time in consideration of educational effect.

Note 2 : When the existing lecture rooms are used by all the departments of the Faculty of Science, lectures are given at the following rates to the student numbers of the respective departments. Based on such rates, the student numbers receiving lectures at new lecture rooms can be derived as follows:

Dept. of Mathematics: 25% or 100 students (of the 400 freshmen for 1992)

Dept. of Physics : 100% or 80 students (equal to the 80 freshmen for 1992)

Dept. of Botany : 100% or 100 students (equal to the 100 freshmen for 1992)

d. Numbers of rooms in new, large and medium lecture rooms

Based on the significance that a new, large lecture room will be intended to accommodate those students who are overflowed from the existing, large lecture rooms, it would be considered reasonable for a new, large lecture room to have a single room which corresponds to the existing, largest (170 students) lecture theater having a single room.

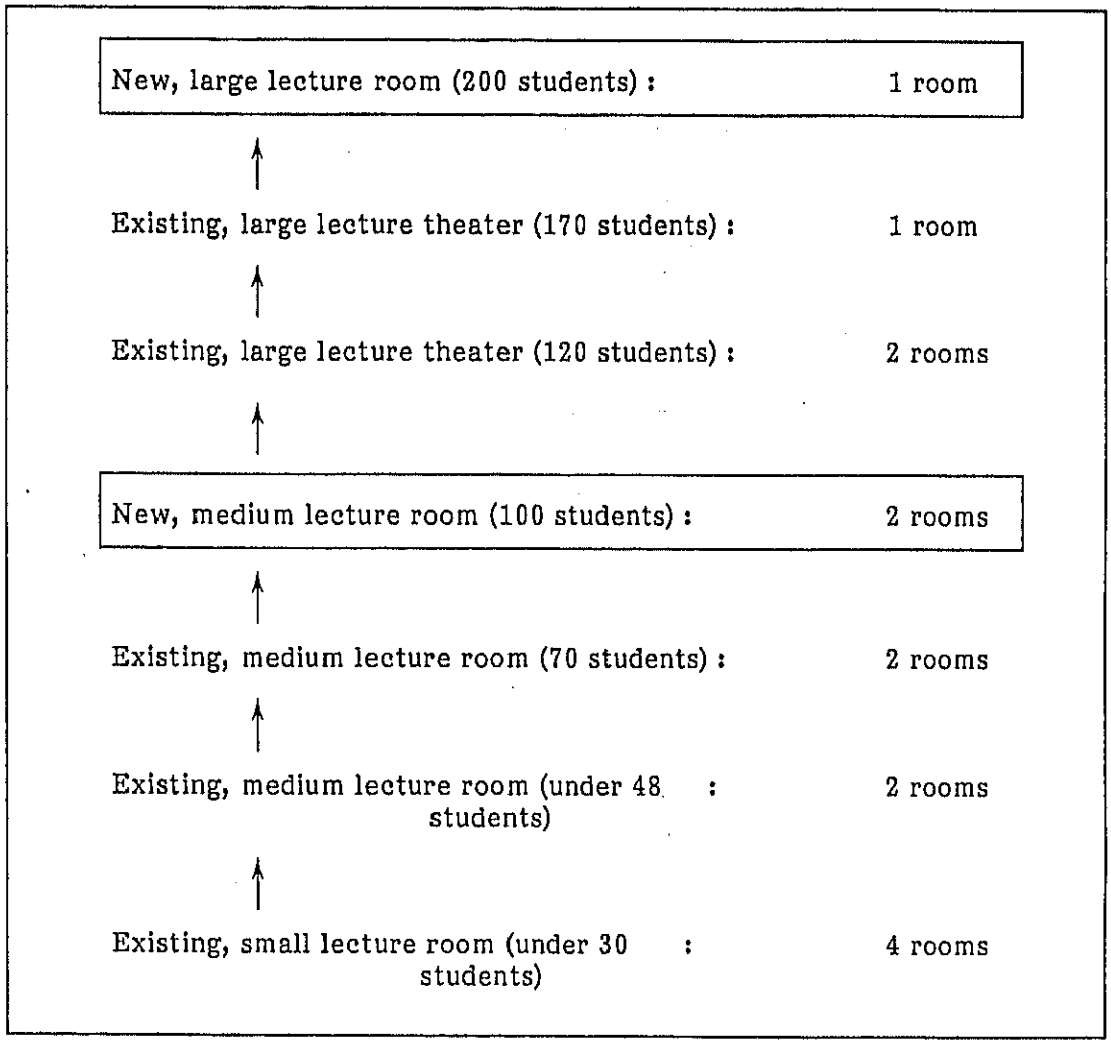
Similarly, in the case of a new, medium lecture room, it would be considered reasonable for it to have two rooms which correspond to the existing, largest (70 students), medium lecture room having two rooms. The team has judged that such new, two rooms should be provided side by side and divided with a sliding wall type partition, so that they can be used with flexibility and in the same way as the new, large lecture room as required.

The new, large lecture room should also be provided with a sliding partition to allow it to create two rooms, each of which can be used as a medium lecture room as required.

e. Positions of new, large and medium lecture rooms

Fig. 3-1 shows the positions of new, large and medium lecture rooms among the existing lecture rooms.

Fig. 3-1 Positions of new, large and medium lecture rooms



As shown in the figure above, new, large and medium lecture rooms are in proper positions from the viewpoints of their capacities and rooms in consideration of carrying out the Faculty of Science's student augmentation plan. Therefore, with the plan

Table 3-3 Faculty of Science - Room Allocation 1992

< >: Serial number
( ) : Number of students taking lectues

Room name		Small Lecture Room			Middle Lecture Theater Room							Large Lecture Room			
		P Small	M 204	M 304	M 6	M 115	M 203	C Small	C 105	NMLR	NMLR	P Main	OB5	C Main	NLLR
Capacity		25	30	30	42	43	48	70	70	100	100	120	120	170	200
Mon.	8			<83> Z2 (30)				<5> BC2 (50)		<1> P3 (80)	<6> ST3 (100)	<81> C3 (120)	<161> GG (58)	<27> ME (140)	<105> ST1 (200)
	9									<86> B3 (100)	<133> P3 (80)	<84> C3 (120)	<162> GG (58)	<29> ME (140)	<107> ST1 (200)
	10			<132> Z1 (30)						<182> B2 (100)	<134> P2 (80)			<28> MC2 (140)	<106> MB (200)
	11								<7> BC3 (50)	<38> SG (30)	<108> PA (80)	<82> C2 (120)		<53> 2S (160)	<109> MB (200)
	12			<135> Z1 (30)					<55> BC3 (50)	<39> OM (30)	<183> PB (80)	<85> C2 (120)		<54> ST2 (160)	<180> BC3 (185)
	2									<40> OM (30)			<163> PS (58)	<56> ST2 (160)	<181> MX (200)
	3									<41> OM (30)			<164> PS (58)	<57> ST2 (160)	<184> MX (200)
	4									<136> M3 (200)			<165> PS (58)		
	5									<179> M2 (200)					
Tue.	8				<26> Z3 (30)			<8> BC2 (50)		<10> ST3 (100)	<88> B3 (100)	<90> C2 (120)	<166> OM (58)	<30> MC1 (140)	<110> MB (200)
	9							<9> BC2 (50)		<12> ST3 (100)	<42> EG (30)		<167> HG (58)	<58> ST2 (160)	<111> MB (200)
	10			<89> Z1 (30)							<43> EG (30)	<138> B1 (100)		<59> ME (160)	<112> M3 (200)
	11								<11> BC3 (50)	<87> ME (200)				<60> ST2 (160)	<113> ST1 (200)
	12									<137> M3 (200)		<139> P3 (80)		<61> 2S (160)	<185> MX (200)
	2									<144> M3 (200)				<62> ST2 (160)	<187> M2 (200)
	3									<186> MX (200)		<140> P2 (80)	<168> PE (58)	<189> C1 (120)	<188> M2 (200)
	4									<190> MX (200)			<169> PE (58)		
	5									<191> MX (200)			<170> PE (58)		
Wed.	8								<13> BC3 (50)	<17> ST3 (100)	<15> PB (80)	<94> C2 (120)		<31> 2S (140)	<92> ME (200)
	9								<14> BC3 (50)	<18> ST3 (100)	<114> B2 (100)		<171> SG (58)	<65> ST2 (160)	<116> M3 (200)
	10			<143> Z2 (30)						<93> P2 (80)	<192> PA (80)	<142> B1 (100)	<172> SG (58)	<68> ST2 (160)	<117> ST1 (200)
	11							<16> BC2 (50)		<91> MB (200)			<173> SG (58)	<63> ME (160)	<118> MB (200)
	12							<64> B2 (58)		<115> MB (200)		<145> P3 (80)		<66> ME (160)	<141> M2 (200)
	2									<118> MB (200)			<44> IM (30)	<67> ME (160)	<194> MX (200)
	3									<119> MB (200)			<45> IM (30)	<193> C1 (120)	<195> BC (185)
	4									<144> M3 (200)			<46> IM (30)		<196> BC (185)
	5									<146> MX (200)			<47> IM (30)		<197> BC (185)
Thur.	8			<99> Z2 (30)						<2> P3 (80)	<69> B3 (100)	<95> C3 (120)	<50> IM (30)	<32> M3 (140)	<97> M2 (200)
	9			<148> Z2 (30)	<120> Z3 (30)					<19> ST3 (100)	<3> PB (80)		<51> IM (30)	<34> 2S (140)	<122> ST1 (200)
	10							<33> BC2 (50)		<20> ST3 (100)	<48> IM (30)	<96> C2 (120)	<52> IM (30)	<70> ST2 (160)	<121> MB (200)
	11									<21> ST3 (100)	<49> GM (30)			<73> ST2 (160)	<124> M3 (200)
	12									<98> MC1 (200)		<149> PA (80)		<71> ME (160)	<125> M3 (200)
	2			<154> Z1 (30)						<123> MB (200)			<174> PE (58)	<72> ME (160)	<126> MC2 (200)
	3									<199> MX (200)		<150> B2 (100)		<74> 2S (160)	<151> M2 (200)
	4									<200> MX (200)			<175> GG (58)	<198> C1 (120)	<152> M2 (200)
	5									<202> MX (200)				<201> C1 (120)	<153> M2 (200)
Fri.	8									<22> M2 (100)	<35> PB (80)	<4> 2S (100)		<36> MC2 (140)	<127> M3 (200)
	9				<128> Z3 (30)					<23> ST3 (100)	<75> B3 (100)	<25> ME (100)	<176> GG (58)	<37> M3 (140)	<130> ST1 (200)
	10									<24> ST3 (100)	<100> B2 (100)		<177> GG (58)	<76> ST2 (160)	<131> ST1 (200)
	11									<101> M2 (200)		<102> C3 (120)	<178> GG (58)	<77> 2S (160)	<204> BC (185)
	12									<104> M2 (200)				<78> M3 (160)	<205> BC (185)
	2				<160> Z3 (30)					<129> MB (200)		<103> BC2 (92)		<79> ST2 (160)	<206> BC (185)
	3									<156> M3 (200)				<80> ST2 (160)	<207> MX (185)
	4									<158> M2 (200)		<155> PA (80)		<203> B1 (100)	
	5									<159> M2 (200)		<157> P3 (80)			

Note: This table predicts that the Faculty of Science's lecture room will be used by the students in 1992 based on their 1989 teaching schedules.

The new, medium and large lecture rooms under the project are hereinafter abbreviated as NMLR and NLLR, respectively.

The department of Geology's lectures currently conducted at the lecture theater (M115) belonging to the Department of Mathematics will be transferred to the new NMLR and an old lecture theater (OB5) belonging to the Department of Geology.

How the existing, small and medium lecture rooms which will be used less frequently will be left to an examination by the Faculty of Science.

implemented in the future based on the currently practised curricula, the students in the 1992 term can be allowed to receive all lectures at both the new and existing lecture rooms as shown in Table 3-3.

③ Seminar rooms

Provision of seminar rooms was requested at the time of B/D by the Government of Uganda. Currently, the Faculty of Science has no seminar rooms available fro students, in small units, in their conducting studies, researches, debates or presentations. Therefore, it would be necessary to provide seminar rooms each permitting 20 ~ 30 undergraduate students, graduate students or teaching staff to use it as a place for the pursuit of study, so that the education level of the Faculty of Science can be upgraded.

(3) Libraries

Each of the Departments of Biochemistry and Geology envisages to possess approximately 3,500 books. From the fact that these books will have to be used in daily, educational activities, it would be considered reasonable for each of the two departments to have a departmental library provided in the new facility, so that the perusal of these books be allowed to both teaching staff and students whenever so required.

(4) Facilities for joint use by other departments

Judging from how the existing, teaching and research facilities of the departments have been used, it would be considered necessary to provide preparation rooms, storages, darkrooms, and meeting rooms for exclusive use by teaching staff.

(5) How to treat the Institute of Computer Science

As a result of discussions between the team and the interested personnel of Makerere University, agreement has been reached to the effect that the facilities and equipment requested for provision at the Institute of

Computer Science would be excluded from the scope of the project for the following reasons:

1. These facilities and equipment are not applicable to "Necessary and Urgent" conditions, the requirements for a Grant Aid by the Government of Japan.

2. As following the completion of the Project the Departments of Biochemistry and Geology and the Dean's office, currently located in the existing building of the Department of Mathematics, will be relocated into a new facility, the existing facility will be able to ensure the space required by the Institute of Computer Science.

3. The building of the Department of Mathematics where the Institute of Computer Science is located is subject to the renovation by EEC.

2) Main Equipment

The existing equipment in the two departments covered this time is very poor and outworn, far from being sufficient both in quality and quantity. In addition, because of an imperfect maintenance system, including lack of repair budget and no-existent repair specialists, even defective equipment whose repair seems easy is left as it is. However, since the operable equipment is to be used continually after the facilities have been completed, in this program we aim at supplementing that existing equipment both in quality and quantity. Taking into consideration the present circumstances, it is necessary to provide spare parts and maintenance manuals for the requested equipment including the giving of sufficient instructions to the teaching staff and technical staff on how to maintain and repair the requested equipment upon its delivery to the university, so as to allow them to maintain and repair the equipment by themselves. Furthermore, the required equipment shall be discussed upon showing the situation of existing equipment in each field as follows:

(1) *Laboratory equipment*

① Biochemistry Department

The present situation of the laboratory equipment used in this Department is as follows: Barely serving its purpose for educational laboratory work. Therefore, judging from the laboratory curriculum it seems most appropriate to supplement not only centrifugal separators, spectrophotometers and ice machines that seem quantitatively deficit but also fluorescent spectrophotometers, high-speed liquid chromatographs and electrophoretic devices that is used very frequently for both education and research purposes.

Principal equipment in existence:

• Desk-type centrifugal separator	5
• Cooling-type high-speed	3 (including one centrifugal separatorin failure)
• Balance	6 (including one in failure)
• Gas chromatograph	1
• Spectrophotometer	9 (including one in failure)
• Freezer	5 (including one failure)

- Refrigerator 8 (including one in failure)
- Constant-temperature bath 11
- Calorimeter 13
- Super centrifuge 1
- Dry sterilizer 4 (including one in failure)

② Geology Department:

The present status of the existing laboratory equipment used by this department is as shown below. Except for the X-ray diffraction device and the A.A. spectrophotometer which are in failure at present, the department owns only a few pieces of basic equipment, which have also extremely deteriorated. It would be requisite, therefore, to provide a slice forming machine for preparation of specimens, a supplemental, electric crusher, and Vickers' hardness meters and electronic balances despite their being basic instruments.

Principal equipment in existence:

- X-ray diffraction device 1 (in failure)
- A.A. spectrophotometer 1 (in failure)
- Spectrophotometer 1 (in failure)
- Constant-temperature bath 1 (in failure)
- pH meter 1
- Slice forming machine 1
- Hot plate 1 (in failure)
- Hydraulic crusher 1
- Polarizing microscope 27
- Diamond cutter 1

(2) Field work equipment

① Biochemistry Department:

This department needs no equipment of field work type.

② Geology Department:

Though field research work is fundamental for this department, at present, they have no equipment necessary for this purpose. It is imperative to possess the necessary equipment to prevent the deterioration of research efficiency.

(3) Audiovisual equipment

As for the audiovisual equipment, we plan to have a 200-person lecture theater and two 100-person lecture theaters (both of which can be combined into one to be used as a 200-person lecture). Therefore, in addition to several projectors owned by each department, it would be necessary to provide a video system, loud speaker used for large classrooms and various types of projects for common use.

(4) Motorcar

① Biochemistry Department:

This department has no requirement for the use of this type of equipment.

② Geology Department:

In Uganda, there are great Rift Valley which are very ideal subjects for geological field work. However, the geology department presently has no vehicle equipment. Therefore, in order to promote field education and research, it seems indispensable to provide vehicles for transport of personnels and survey equipment as well as for local survey work. In light of the bad road conditions and vehicle traffic in the country, it would be most appropriate to provide four-wheel driven vehicles.

(5) Office equipment

Both departments have no office equipment other than typewriters and hand-type calculators. In consideration of the necessity to improve office work, it would be reasonable to provide copiers, rotary presses and data processors as reqúested.

3-3 Project Overview

3-3-1 Implementing Organization, Operating System, Staffing Program, and Students Accommodation Plan

1) Implementing organization

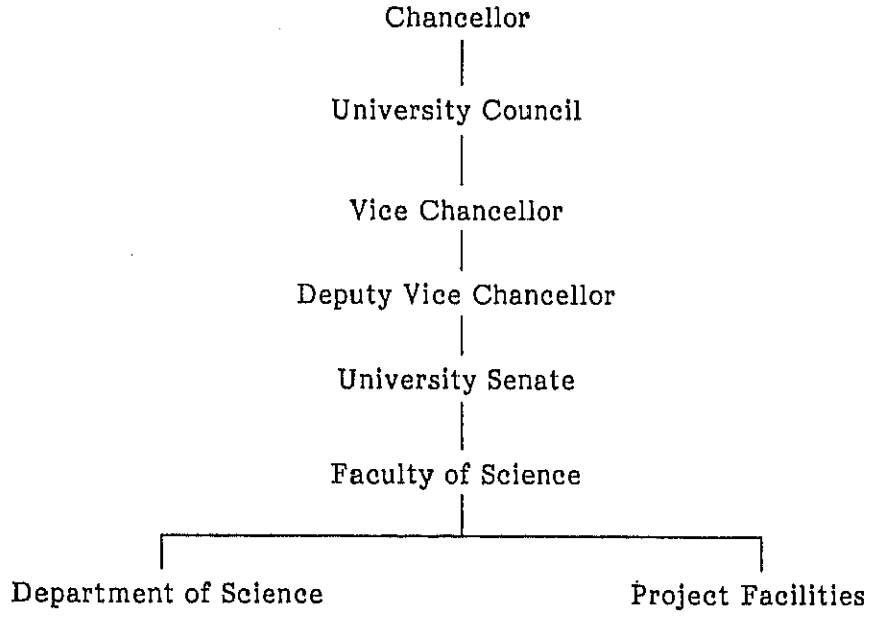
Makerere University will be the organization responsible for the planning and execution of the proposed construction project, and its Faculty of Science will be responsible for the operation and administration of the project after its completion. In addition, Makerere University will take charge of proceeding with the necessary procedures with the competent authorities of the Government of the Republic of Uganda involved in the project, including necessary coordination and negotiation therewith.

The project will be promoted under the direct control of the university's Vice Chancellor and the university will take charge of signing a contract, and carrying out other documentary transactions.

2) Operating organization

The following shows the organization of administering and operating the facilities:

Fig. 3-2 Operating organization



3) Staffing plan

At present, both the Biochemistry and Geology Departments are short of teachers (see Tables 3-5 and 3-6).

Due to this, one teacher assumes greater burden, and, in consideration of the quality of teaching, it is necessary to increase the present number of teachers to the full required number at the earliest possible time.

The following describes the program to train teachers.

(1) Training Program for Senior Staff (Teacher):

Makerere University presently gives teacher's training to those who have teaching qualities, including those students who are expected to acquire a master's or doctor's degree at Makerere University or foreign universities. Since a sufficient budget is ensured to employ the full member of teachers, the university is ready at all times to employ them if they meet the necessary requirements. Makerere University has always been looking for such aiding organizations to assist its teacher training program, and , to date, had received assistance from UNDP, UNESCO, USAID, CIDA, etc. Assistance form such organizations will further continue in times to come.

As the university is still short of its full number of teachers, the project will provide teacher facilities suitable for the 1989 full number.

(2) Training program for intermediate staff

Makerere University has plans to increase its intermediate staff, ideally to a ratio of one staff to 15 students. However, as no actual, authorized plan on the number of staff has been announced to date, the project assumes that the present number of intermediate staff will remain unchanged till 1992.

The tables below show the numbers of staff programmed for increase by the Office of the Dean, the Department of Biochemistry and the Department of Geology.

Table 3-4 Staff increase program for Office of the Dean

(In persons)

Position		1989 Present	1989 Full number	1990 Plan	1991 Plan	1992 Plan
Senior staff	Dean	1	1	1	1	1
	Assistant registrar	1	1	1	1	1
	Administrative assistant	1	1	1	1	1
	Senior personal secretary	1	1	1	1	1
	Subtotal	4	4	4	4	4
Inter-mediate staff	Technician	1	1	1	1	1
	Stenographer	1	1	1	1	1
	Custodians	2	2	2	2	2
	Subtotal	4	4	4	4	4
Group employees	Cleaners	3	3	3	3	3
	Messenger	1	1	1	1	1
	Drivers	2	2	2	2	2
	Subtotal	6	6	6	6	6
	Total	14	14	14	14	14

Table 3-5 Staff increase program for the Department of Biochemistry

(In persons)

Position		1989 Present	1989 Full number	1990 Plan	1991 Plan	1992 Plan
Senior staff	Professor	1	2	2	2	3
	Associate professor	3	2	2	3	3
	Senior lecturers	4	4	4	5	5
	Lecturers	1	6	6	7	7
	Chief technician	1	1	1	1	1
	Subtotal	10	15	15	18	19
Inter-mediate staff	Principal technician	1	1	1	1	1
	Senior technician	1	1	1	1	1
	Technician	8	8	8	8	8
	Secretary	1	1	1	1	1
	Laboratory assistant	4	4	4	4	4
	Trainee technicians	2	2	2	2	2
	Subtotal	17	17	17	17	17
Group employees	Laboratory attendants	3	3	3	3	3
	Cleaner	1	1	1	1	1
	Subtotal	4	4	4	4	4
	Total	31	36	36	39	40

Table 3-6 Staff increase program for the Department of Geology

(In persons)

		1989	1989	1990	1991	1992
Position		Present	Full number	Plan	Plan	Plan
Senior staff	Professor	0	1	1	1	1
	Associate professor	0	1	1	1	1
	Senior lecturers	0	2	2	2	2
	Lecturers	6	5	5	5	5
	Chief technician	1	1	1	1	1
	Subtotal	7	10	10	10	10
Inter-mediate staff	Principal technician	1	1	1	1	1
	Senior technicians	2	2	2	2	2
	Technicians	2	2	2	2	2
	Secretary	1	1	1	1	1
	Laboratory assistant I	1	1	1	1	1
	Laboratory assistant II	1	1	1	1	1
	Draughtsman	1	1	1	1	1
	Curator	1	1	1	1	1
	Subtotal	10	10	10	10	10
Group employees	Laboratory attendant	1	1	1	1	1
	Total	18	21	21	21	21

4) Student accommodation program:

The student accommodation program of the University's Faculty of Science sets out the numbers of new students to be accommodated in its Biochemistry, Geology, Botany and Mathematics Departments as follows:

Table 3-7 New students accommodation program by department

(In persons)

	Biochemistry	Geology	Botany	Mathematics
1990	30	20	80	360
1991	35	25	100	360
1992	50	30	100	400
1993	55	40	120	450
1994	70	45	120	500

The table below shows the existing number of students in the Faculty of Science as of 1989.

Table 3-8 Number of students in Faculty of Science in 1989

(In persons)

	Freshman	Sophomore	Senior	Total
Biochemistry	15	15	15	45
Geology	20	20	20	60
Botany	40	40	40	120
Mathematics	120	50	50	220
Chemistry	80	60	60	200
Physics	40	20	20	80
Zoology	30	30	30	90
Total	345	235	235	815

Based on the data above, the change of numbers enrolled in the Faculty of Science between 1989 and 1994 can be derived as shown in the Table 3-2.

5) Examination of student increase program for Botany and Mathematics Departments in the returned space:

(1) Botany Department:

Space to be returned to Botany Department is 263.5m^2 as shown in Table 2-13. According to a collection of building design materials, an area of 1 ~ 1.3m^2 per students is adequate. Here, the required area for one student is regarded as 1.3m^2. On the assumption that the area to be returned should be used effectively by modification etc., the number of students that the Botany Department can accommodate can be shown as: 263.5m^2 ÷ 1.3m^2/student = 203 students. The Botany Department envisages the number of incoming students for 1989 to be 40, and 120 for 1994. Thus, the number of students planned for increase is as follows:

Number of students envisaged to be increased = 120 students - 40 students = 80 students

$\therefore$ 203 students > 80 students

From the above, it is evident that the area to be returned is large enough for the Botany Department to accommodate the increased number of students.

(2) Mathematics Department

The area to be returned to the Mathematics Department can be considered as follows:

The area to be returned to Mathematics Department = Dean's office (19.5m^2) + Secretary's office (14m^2) + The area occupied by the Geology Department (273m^2)

= 306.5m^2

Assuming that the area to be occupied by one student is 1.3m^2,

Accommodable number of students = 306.5m^2 ÷ 1.3m^2/student

= 236

The Mathematics Department envisages the number of incoming students for 1989 to be 120, and 500 for 1994. Thus, the number of students envisaged for increase is as follows:

Number of students envisaged for increase	500 students - 120 students = 380 students
	$\therefore$ 236 students < 380 students

From the above, in the case of the Mathematics Department, the area to be returned will be insufficient to increase beyond a maximum of only 236 students, and therefore it could be necessary for this department to reduce the envisaged number or ensure a new, additional area.

If the envisaged number should be reduced, the number of incoming students must be set at a maximum of 350 (= 120 + 236), while in the case of ensuring an additional area, another 187.2m^2 (=(380 students - 236 students) × 1.3m^2/student) will be required.

3-3-2 Overview of Facilities and Equipment

In order to achieve the objective of the project, the facilities and equipment that follow would be required.

1) Facilities

In consideration of the required functions under the project, it would be necessary to include the following rooms and offices in the scope of the project.

3-storied reinforced concrete building

①	Educational and laboratory facilities	Classroom and educational laboratory room respectively for Biochemistry and Geology Departments
②	Material and information facilities	Libraries
③	Lecture theater	Large and medium-size lecture theaters
④	Administrative facilities	Office rooms, Dean's office and Head's offices

2) Equipment

①	Laboratory equipment	Necessary to conduct tissue culture and analysis (Biochemistry Department), and measure the hardness of minerals, the reflection of metal surfaces, etc. (Geology Department).
②	Field work equipment	Hammers, magnifying glasses, tents, magnetic needles, etc. required in sampling in field work.
③	Audiovisual equipment	Projectors, microphones, amplifiers, speakers, VTR, OHP, etc. for provision in lecture theaters.

④	Motorcars	4-wheel driven passenger cars to be used for carrying research equipment and researchers engaged in field work.
⑤	Office equipment	Dry type copiers, rotary presses, data processors, typewriters.

3-3-3 Project Site Overview

1) Construction Site

The site is also located at an area with the highest elevation on the campus and is free of facilities which cause airing interruption, noise generation or air pollution. The ground conditions such as soil, drainage efficiency, groundwater level, etc. involve no problem.

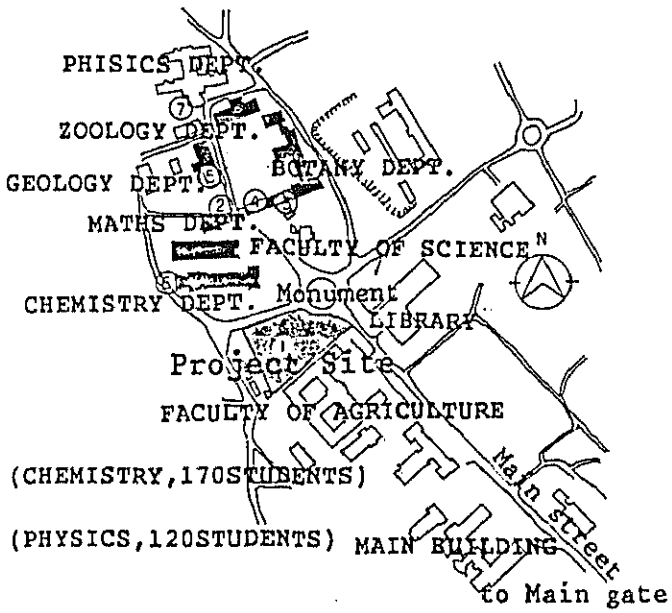
The site is approximately 3,500m^2 with a gentle slope towards the south. Its ground surface is generally flat and has almost no non-utilizable area, thus not interfering with the arrangement plan.

The site is also located at an area with the highest elevation on the campus and is free of facilities which cause airing interruption, noise generation or air pollution. The ground conditions such as soil, drainage efficiency, groundwater level, etc. involve no problem.

Soil, drainability, groundwater level, etc. are all good, and thus the ground conditions are satisfactory.

The block plan below locates the existing facilities of the Faculty of Science at Makerere University, and the project site. Those marked with oblique lines are the buildings to be rehabilitated by EEC. The rehabilitation of the buildings of the Departments of Botany and Zoology is currently under way, but that of the buildings of the Departments of Mathematics and Chemistry has not yet been commenced.

Fig. 3-3 Local of the Existing Facilities



2) Present Status of Infrastructures

a. Power receiving

① The 11KV high tension transmission line is provided under the campus road south of the site.

② It is possible to branch out from this transmission line in order to install service lines into the project building.

③ Proper countermeasures should be taken to deal with power outage which occurs two or three times every month, as well as voltage fluctuations (above or below 15%).

b. Water supply

① There is water supply piping laid under the main road south to the site, and it is possible to branch out from the existing piping.

c. Drainage

① Sewage and drainage from the project building will be discharged through new piping to the existing sewage pit near the Agriculture Faculty's building south of the site.

② Rainwater will be discharged through new piping to the existing collection pit at the south corner of the site.

③ Special drainage (toxic) will be collected in polyvinyl containers, and disposed of separately.

d. Gas supply

There is no city gas service available, and therefore L.P.G. will be supplied.

3-3-4 Maintenance and Control Plan

1) Maintenance and Control of Facilities

It is desirable that the maintenance and control of the facilities under the Grant Aid be carried out by technicians specifically assigned thereto.

In order to maintain and control the facilities properly and effectively, it is important that daily maintenance and inspection, and dealing with breakdowns, of the equipment are conducted in accordance with the instruction manuals by technicians familiarized with the equipment. Thus, it is necessary to ensure and/or train technicians in order to provide them with proper, technical knowledge about the equipment.

① Managers for maintenance of facilities and equipment

The extent to which building and mechanical managers understand all the systems installed in the facilities, their maintenance and control methods, and how to deal with equipment in abnormal condition, will affect the life of the entire system. If such matters are not properly dealt with, it may seriously confound the teaching and research functions.

Therefore, by allowing them to participate in actual technical discussions during the construction period in order to accumulate field experience, it will be possible that, after completion of the building, any building and/or mechanical system failure can be dealt with promptly and accurately. In this way, it is conceivable that the maintenance and control know-how for the facilities and equipment could be transferred to such local managers throughout the construction period.

This is the optimum way to transfer equipment control know-how as it is necessary to know the design policy and detailed phases of construction in order to achieve the proper maintenance and control of the facilities.

Therefore, it is important that technical managers responsible for the maintenance and control of the facilities and equipment be appointed prior to the commencement of construction, so that they are ready to receive technical instructions immediately from the outset of construction.

② *Procurement of perishable equipment parts:*
Whenever it is necessary to obtain perishables and equipment parts, places of contact should be clarified so as the university may obtain them easily.

2) Maintenance and Control of Equipment

The selected pieces of equipment do not include such equipment requiring expensive perishables or those perishable hardly available in the country. The focus is on the teaching equipment suited to the laboratory work conducted by students at the university, and therefore provision thereof under the Grant Aid will not greatly increase the maintenance and running costs of the university.

However, from the view point of effective use of the equipment provided, the spare parts similar to perishables and the basic replacement parts to deal with possible troubles, will be included in the project in the quantities shown below.

Attention should be given to the following points:

① Supply of necessary perishables (similar to spare parts) should be envisaged for one-year consumption.

② Necessary replacement parts should be envisaged for three-year consumption.

③ The maintenance and control managers of the university should be trained to familiarize themselves with the methods of storage and care of the perishables and replacement parts supplied under the Grant Aid.

④ All equipment should be provided with the corresponding English operating and maintenance instructions and simple service manuals.

⑤ Upon delivery and installation of the equipment, the methods of operating, storing and servicing the equipment should be thoroughly instructed by Japanese engineers with a wealth of experience.

⑥ Servicing the equipment after delivery.
Makerere University should be strongly advised to ensure service technicians, budget, etc.

3) Facility Maintenance Expenses and Their Assessment

(1) Facility Maintenance Expenses

Outline of necessary facility maintenance expenses is as follows:

Details of each item are shown in ATTACHMENT 15. Incidentally, amounts in each year multiplied by the commodity index make it difficult to know their real values, so therefore, all values from 1989 through 1993 are shown by the 1989 value.

Table 3-9 Facility Maintenance Expenses

(Covered into 1989 prices)

(Unit: USH)

Item	1991	1992	1993
① Personnel emoluments (increased)	1,635,408	1,727,205	1,727,205
② Electricity fee	463,680	463,680	463,680
③ Water service	231,902	232,317	232,317
④ Gas	233,035	240,768	245,993
⑥ Telephone charges	88,320	88,320	88,320
⑥ Clerical expenses (increased)	123,574	282,818	212,370
⑦ Laboratory materials purchased (increased)	137,700	311,100	225,675
⑧ Building maintenance	15,500	15,500	628,500
⑩ Educational materials supplemented	0	5,508,000	5,508,000
Total (annual)	2,929,119	8,869,708	9,332,060
A. Total excluding personnel expenses	1,293,711	7,142,503	7,604,855

Note: The number of increase in school staff in 1993 was not announced. We assumed the number to be the same as in 1992. the values of ①, ②, ③, ⑤ and ⑩ in 1993 were assumed to be the same as in 1992.

(2) Evaluation of Facility Maintenance Expenses

When the facilities are completed and managed, additional expenses shall be charged to Makerere University. Share of facility maintenance expenses borne by Makerere University is evaluated by obtaining a ratio of the additional expenses to the actual expenses (in 1988).

Table 3-10 All Actual Expenses of makerere University in 1988 (excluding personnel expenses)

Item	Expenditure of Makerere University in 1988
② Electricity fee	24,081,540 USH
③ Water service	5,318,460 USH
④ Gas (LPG)	600,000 USH
⑤ Telephone charges	46,416,886 USH
⑥ Clerical expenses	162,459,100 USH
⑦ Laboratory materials purchased	319,583,982 USH
⑧ Building maintenance	110,214,900 USH
⑨ Special gas	300,000 USH
⑩ Educational materials supplemented	12,246,100 USH
B. ② ~ ⑩ Total	681,220,968 USH

Note: Data on the overall personnel emoluments of Makerere University is not made public.

Comparison between the total a of facility maintenance expenses, excluding personnel emoluments , and the actual expenses B of Makerere University in 1988 is as follows:

Table 3-11 Comparison between Additional facility Maintenance Expenses and Makerere University's actual expenses

1991	1992	1993
$\frac{1,293,711}{681,220,968} \times 100$	$\frac{7,142,503}{681,220,968} \times 100$	$\frac{7,604,855}{681,220,968} \times 100$
= 0.2%	= 1.0%	= 1.1%

As such, ratios of additional facility maintenance expenses to Makerere University's actual expenses in 1988 are expected to be 0.2% in 1991, 1.0% in 1992 and 1.1% in 1993. If increase in expenses should be as such, it would be possible for Makerere University to obtain a budget for the maintenance of the facilities.

3-4 Technical Cooperation

Because the Biochemistry and Geology Departments of the Faculty of Science at Makerere University are short of teachers and equipment, it is impossible for the university to provide the students with adequate teaching and research opportunities.

After the completion of the project, sufficient teaching equipment will be set up, enabling the establishment of satisfactory education as required.

With the two departments being short of teachers, a small number of teachers must devote themselves to educating a large number of students, preventing the teachers from having time to do their own research. There is also the problem of shortage of research equipment. As such, research activities for teachers and postgraduates are not satisfactory. Under these circumstances, Makerere University requested to the investigation team that Japan should extend technical cooperation for the training of its teachers, technical staff and postgraduates.

The type of technical cooperation has been proposed in the following alternatives:

① To send teachers, technical staff or postgraduates from Makerere University to a Japanese university for receiving training, or

② To send professionals from a Japanese university to the two departments of Makerere University, to give training to the teachers, technical staff as to teaching and research technology.

SECTION 4 BASIC DESIGN

SECTION 4 BASIC DESIGN

4-1 Design Policy

(1) Software for the project facilities

① To have sufficient functions to satisfy teaching and research activities.
② Facilities to be organically and effectively arranged in operating and administering teaching and research activities.
③ To be furnished in an appropriate manner with various installations as a national university.
④ Facilities to be of the construction capable of permitting their maintenance and administration at low cost.
⑤ After completion, the maintenance of the facilities to be possible without special techniques or qualifications.

(2) Hardware for the project facilities

① Facilities to be such as will match the natural features of the region.
② Facilities to have emphasis on functionality.
③ Consideration to be given to a lower, initial cost and also a running cost, so that the facilities can be operated with a lower life-cycle cost when judging comprehensively.
④ In determining the methods of carrying out the various types of work, priority should be given to safety and easy maintenance, and local methods should be employed to the maximum extent.
⑤ Sufficient countermeasures to be considered for rainwater, insect control, sunlight and security in compliance with existing, local practices. In particular, security measures should be of a sufficient nature.
⑥ Building style should reflect the functional advantages of the local building style, but should provide a good, residential environment.
⑦ In selecting building, electrical and mechanical materials, the use of local products should be given first priority, but consideration should be given to their accuracies, weather resistance, availability and qualities. Therefore, import of Japanese products should only be considered as the case arises.
⑧ In procuring those products and materials, consideration should be given to the fact that Uganda has used building materials, and electrical and

mechanical equipment imported from Kenya. These local ones should be regarded as identical.

4-2 Consideration of Design Condition

4-2-1 Basic Policy for Determination of Building Scale

The following policy will be observed in determining the scale of facilities as a whole and calculating the scale of individual rooms.

1) Determination parameters

(1) Accommodation capacity (numbers of teachers and students)
(2) Curricula.
(3) Republic of Uganda Design Criteria etc.
(4) Reference materials
  ① Teaching schedules (Biochemistry and Geology Departments)
  ② Teacher and student increase programs
  ③ Existing facilities (scales, purposes of use, and time duration of use)
  ④ Similar facilities (in Uganda and Japan)
  ⑤ Collection of building design materials (Japan)
  ⑥ Architectural system (Japan)
  ⑦ Practical design examples
(5) Adequate scales
  ① For the purpose of moving the Biochemistry and Geology Departments, laboratories and offices will be of the same scales and qualities as those of the existing facilities.
  ② In consideration of the Faculty of Science's future student increase programs, large and medium lecture rooms will be on the scale of capacities somewhat greater than the existing lecture rooms currently used by the faculty.
  ③ In consideration of their functions and layouts, the rooms other than those mentioned above, such as a rock polishing room, store room and a hot-water service room, etc. will be properly determined.
  ④ Corridors and staircases will be provided with proper widths in accordance with the provisions of Japan's Building Standard Law, so that they connect the respective rooms of the Project facility functionally.

⑤ The scale of the entire facility will be finalized with proper adjustments following the calculation of the required scales for rooms, corridors and staircases.

(6) Considerations

Consideration will be made as to the presence or absence of interference when operating based on the existing curricula.

4-2-2 Determination of Room Sizes

Room sizes required:

(1) Dean's office and its secretary room

Function: Performance of the Dean's official duties, secretarial activities and receipt of interviews.

Seats : One seat for a Dean.
One seat for a senior personal secretary.

Spaces for furniture:

Dean's office - Space for a desk, a chair, a cabinet, and a set of reception furniture.
Secretary's room - Space for a desk, a chair, a cabinet, and a reception area.

Applicable standard :

According to a Collection of Building Design Data published in Japan, the floor area required for an official's room is 18 ~ 25m^2 per person, and that for general office work is 4.5 ~ 7m2 per person.

Calculation: The floor area of the Dean's office with pieces of furniture in place and after arrangement of individual rooms in the new buildings will be 20.52m^2 (the existing Dean's office: 19.5m^2), and the secretary's room will be 13.68m^2 (now 14m^2) including the reception and passage area (5m^2).

(2) Office of faculty administrators

Function : Administration of the Faculty of Science, performance of operational office work, and printing of teaching materials.

Seats :

Assistant registar	- 1 seat
Administrative Assistant	- 1 seat
Technician	- 1 seat
Stenographer	- 1 seat

Spaces for furniture:

4 desks and chairs, 1 data processor, 1 copier, 1 rotary printing press, and 5 filing cabinets.

Applicable standard:

According to a Collection of Building Design Data published in Japan, the floor area required for general office work is 4.5 ~ 7m^2 per staff.

Calculation: $5m^2 \times 4 = 20m^2$. The floor area of this office with pieces of furniture in place and after arrangement of individual rooms in the new buildings will be $22.8m^2$. (No office of faculty administrators is in existence.)

(3) Teaching laboratories

Having a large number of students perform laboratory work in a laboratory at a time is dangerous in their management. Therefore, the sizes of individual laboratories should be as follows on the basis that students will be divided into plural teams, not by setting up units of 100 and 200 students as in the case of large and medium lecture theaters, so that laboratory work may be conducted by each group. Consequently, the sizes of laboratories should be as given below:

a. Teaching laboratory (Department of Biochemistry) No. 1

Function : As a teaching laboratory where basic, biochemical education is given for freshmen and sophomores.

Seats : 56 seats (7 laboratory tables × 8 students).

Spaces for furniture, etc. :

7 laboratory tables (900mm × 3,600mm each), draft chamber, sink, blackboard, and commodity storage.

Applicable standard :

According to a Collection of Building Design Data published in Japan, the typical floor area of a laboratory is 2.2m2 per student.

Calculation : Based on the student augmentation plan of the Faculty of Science, the number of freshmen belonging to the Department of Biochemistry in the year 1992 when the construction of the Project facilities will be commenced, is 50. With this number taken as the number of students forming one group to obtain the typical, required floor area, 2.2m2 × 50 student = 110m2, suggesting that the proper floor area of this laboratory with the abovementioned pieces of furniture arranged in place and after arrangement of individual rooms in the new buildings will be 108m2 (the existing laboratory measures 90m2).

b. Teaching laboratory (Department of Biochemistry) No. 2

Function : As a teaching laboratory where biochemical laboratory work of a higher level is conducted by seniors.

Seats : 32 seats (4 laboratory tables × 8 students).

Spaces for furniture, etc. :

4 laboratory tables (900mm × 3,600mm each), blackboard and commodity storage.

Applicable standard :

According to a Collection of Building Design Data published

in Japan, the typical floor area of a laboratory is 2.2m2 per student.

Calculation : Based on the student augmentation plan of the Faculty of Science, the number of freshmen belonging to the Department of Biochemistry in the year 1992 when the construction of the Project facilities will be commenced, is 30. With this number taken as the number of students forming one group to obtain the typical, required floor area, $2.2m^2 \times 30$ student = $66m^2$, suggesting that the proper floor area of this laboratory with the abovementioned pieces of furniture arranged in place and after arrangement of individual rooms in the new buildings will be 57m2 (the existing laboratory measures $44m^2$).

c. Teaching laboratory (Department of Biochemistry) No. 3

Function : As a teaching laboratory where the teaching staff makes preparations for laboratory education as well as graduate students perform biochemical laboratory work. In addition, some teaching staff members of the Department of Biochemistry use this laboratory as their office.

Seats : 1 seat for a senior lecturer.
6 seats for lecturers.
1 seat for a chief technician.
12 laboratory tables.

Spaces for furniture, etc. :
3 laboratory tables (1,200mm × 2,400mm each), chemicals storage, commodity storage, and sink.

Applicable standard :
According to a Collection of Building Design Data published in Japan, the typical floor area of a laboratory is 2.2m2 per student.

Calculation :The number of teaching staff in a leading position in laboratory education includes 10 senior staff and 12 intermediate staff excluding secretaries. Therefore, this laboratory will be used by a minimum of 22 teaching staff, but used actually by about 12 teaching staff because not used by all of the 22 teaching staff at one time. Thus, the typical floor area required as a laboratory area will be $2.2m^2 \times 12$ teaching staff = $26.4m^2$. In addition, the number of teaching staff who uses this laboratory as their office will be 8, and the typical floor area required as a teaching-staff office area will be 4.5m2 × 8 = 36m2 on the basis that general office work requires the floor area of 4.5m2 per person. Therefore, the 26.4m2 of the laboratory area plus the $36m^2$ of the teaching-staff office area will total 62.4m2, and the floor area with the abovementioned pieces of furniture in place and after arrangement of individual rooms in the new buildings will be $57m^2$. (The existing floor area composed of No. 1 research laboratory, No. 2 research laboratory and a radio isotope gas laboratory totals 59.5m2.)

d. Teaching laboratory (Department of Geology) No. 1

Function : As a teaching laboratory where laboratory work on the basic and speciality geology is conducted for freshmen and sophomores.

Seats : 20 seats.

Spaces for furniture, etc. :

2 laboratory tables, 2 equipment storages, work-benches and sinks.

Applicable standard :

According to a Collection of Building Design Data published in Japan, the typical floor area of a laboratory is $2.2m^2$ per student.

Calculation : Based on the student augmentation plan of the Faculty of Science, the number of freshmen taking geological lectures in 1992 is 50. On the assumption that laboratory education is given to individual 20-student groups, the typical floor area required for one 20-student group will be 2.2m2 × 20 students = 44m2, and the proper floor area of this laboratory with the abovementioned pieces of furniture in place and after arrangement of individual rooms in the new buildings will be 49.8m2. In addition, in the case a preparation room with the floor area of 9.45m2 will be located adjacent to the laboratory for simultaneous use, the total floor area will be 59.25m2, approximately equal to the existing laboratory's floor area of 57m2.

e. Teaching laboratory (Department of Geology) No. 2

Function : As a room where the teaching staff makes preparations for laboratory work and also seniors and graduate students perform laboratory work on geology. In addition, some teaching staff members use part of the laboratory as their office.

Seats : 2 seats for lecturers.
1 seat for principal technician.
1 seat for senior technician.
1 seat for technician.
24 laboratory tables.

Spaces for furniture, etc. :
3 laboratory tables (1,200mm × 3,000mm each), workbenches, sinks, and commodity storage.

Applicable standard :
According to a Collection of Building Design Data published in Japan, the typical floor area of a laboratory is 2.2m2 per student.

Calculation : Based on the student augmentation plan of the Faculty of Science, the number of seniors taking geological lectures in 1992 is 58. On the assumption that laboratory education is given to individual 20-student groups, the typical floor area required for one 20-student group will be 2.2m2 × 20 students = 44m2. In addition, as one teaching staff member uses a floor area of about 3m2 in this laboratory, 44m2 + (3m2 × 5 teaching staff members) = 59m2, and the proper floor area of this laboratory with the abovementioned pieces of furniture in place and after arrangement of individual rooms will be 64m2.

(4) Large and medium lecture rooms

Function : These lecture rooms will be used mainly by the Faculty of Science.

Seats : Large lecture room - 204 students.
Medium lecture room - 102 students.

Spaces for furniture, etc : Desks, chairs, and rostrums.

Applicable standard:

A Collection of Building Design Data published in Japan provides for the floor area required per student to be 1.0m2 ~ 1.3m2.

Calculation : The accommodation capacity of the large lecture room has earlier been determined to be 200 students and that of the medium lecture room, 100 students. With these figures in mind and on the assumption that the floor area of 1m2 is required per student, the following can be derived:

large lecture room : $1m^2 \times 200$ students = $200m^2$.
medium lecture room : $1m^2 \times 100$ students = $100m^2$.

The proper floor areas with the abovementioned pieces of furniture in place and after arrangement of individual rooms in

the new buildings will be 204m2 and 102m2, respectively, and the accommodation capacities of the two lecture rooms will be 204 and 102 students.

(5) Libraries

a. Library to Department of Biochemistry

Function : To garner 3,500 biochemistry related books for perusal by students and teaching staff.

Seats : 6 seats.

Furniture : Bookshelves, reading desks and chairs.

Applicable standard :

A Collection of Building Design Data provides for the capacity of library bookshelf to be 220 books per square meter.

Calculation : 3,500 books + 220 books/m^2 = 16m^2. The floor area of this library with the abovementioned pieces of furniture in place and after arrangement of individual rooms in the new buildings will be 16.24m^2.

b. Library to Department of Geology

Function : To garner 3,500 geology related books for perusal by students and teaching staff.

Seats : 6 seats.

Furniture : Bookshelves, perusal desks and chairs.

Applicable standard :

A Collection of Building Design Data provides for the capacity of library bookshelf to be 220 books per square meter.

Calculation : 3,500 books + 220 books/m^2 = 16m^2. The floor area of this library with the abovementioned pieces of furniture in place and after arrangement of individual rooms in the new buildings will be 15.6m^2.

(6) Faculty of Science's facilities for common use

a. Seminar room

Function : As a room where study, research, discussion or presentation will be conducted by small groups of students, graduate students or teaching staff.

Seats : 24 seats.

Furniture : Long desks, chairs, slides, O.H.P., and video monitors.

Applicable standard :

A Collection of Building Design Data published in Japan provides for the floor area required per student to be 1.3m2.

Calculation : The Request calls for a seminar room with the capacity of 24 students. This number will therefore use this seminar room. The number is a total of incumbent students of the Department of Geology plus lecturers, and is considered reasonable. The typical floor area of the seminar room will be 1.3m^2 × 24 students = 31.2m^2, and the floor area with the abovementioned pieces of furniture in place and after arrangement of individual rooms in the new buildings will be 31.28m^2.

b. Other Facilities for common use

For other rooms, each typical floor area of such rooms will be calculated based on the numbers of incumbent teaching staff and students and the sizes of the such existing rooms in accordance with a Collection of Building Design Data, followed by calculating the floor areas with pieces

of furniture in place and after arrangement of individual room. These facilities will be designed in the way to meet a diversity of conditions required for design establishment.

(7) Calculated floor areas of rooms

The following indicates the floor areas of rooms thus calculated and those of the existing rooms.

Table 4-5 Comparison of Floor Areas between Existing Rooms and New Rooms

(In m^2)

Affiliated with	Room name	Existing	New	Remarks
Faculty office of administrators	Dean's office	19.5	20.52	As per layout 8.
	Ditto secretary's office	14	13.68	As per layout 9.
	Administrative Staff office		22.8	
	Total floor area of Faculty office of administrators	33.5	57.0	
Geology Department	Head's office	18	12.6	As per layout 10.
	Ditto secretary's office	12	8.4	
	Library (graphics)	24	31.8	Department's library: 15.6m2 and map room: 16.2m2 (as per layout 12).
	Darkroom	3	6.75	
	Workshop	5		
	Staff office A	17.5	48.0	Lecturer's room (as per layout 11).
	Staff office B	17.5		
	Postgraduate laboratory	30.0	64.0	Teaching laboratory 2 (as per layout 11)
	Geology Department's laboratory	18	21.0	Mineral dressing room (as per layout 3).
	Geology Department's laboratory	6	21.0	Rock polishing room (as per layout 4).
	X-ray room	18	/	
	Teaching laboratory II	57	59.45	Teaching laboratory 1 : 50.0m^2 (as per layout 1).
	Specimen room	47	/	Preparation room : 9.45m2
	Subtotal	273.0	273.0	
Old building	Geology Department's seminar room	158.7		
	Office A	22.5		
	Office B	11		
	Office C	33.5		
	Store room A	27.5		
	Store room B	27.5		
	Subtotal	280.7		
	Total floor area of Geology Department	553.7		

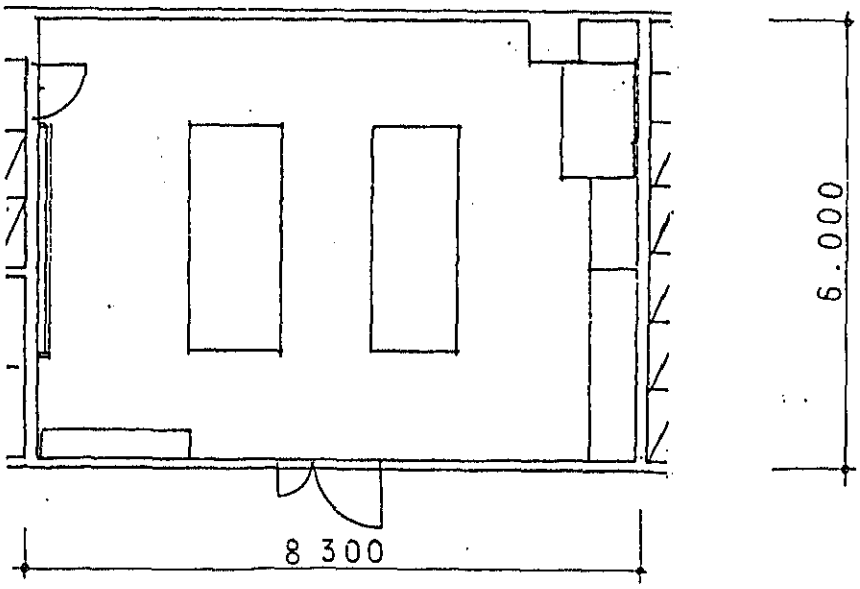
(To be continued)

Affiliated with	Room name	Existing	New	Remarks
Biochemistry Department	Head's office	10.5	11.9 8.4	Head's office secretary's office(as per layout 13).
	Teaching laboratory A	90		Teaching laboratory 1 (as per layout 5)
	Teaching laboratory B	44	108.0	Teaching laboratory 2 (as per layout 6)
	Research laboratory 1	15.75	57.0	
	Research laboratory 2	21		
	Radioisotope & gas laboratory	22.75		
		(59.5)	57.0	Teaching laboratory 3 (as per layout 7)
	Instrument room	10.5	14.5	
	Preparation room	10.5	14.5	
	Departmental library	/	16.24	
	Office A	10.5		
	Office B	12.25	48.0	
	Store room	15.25	35.0	
	Total floor area of Biochemistry Department	263.5	370.54	
Other	Large lecture room		204.0	As per layout 16.
	Medium lecture room 1		102.0	As per layout 17.
	Medium lecture room 2		102.0	As per layout 17.
	Seminar room		31.28	
	Toilet GF		27	
	Toilet 1F		30	
	Toilet 2F		21.62	
	Hot-water service room		6.4	
	Common room		27.84	As per layout 18.
	Store room		67.96	
	Total floor area of common area		620.1	
Total	floor area	850.7	1,320.64	

Geology

Layout Plan 1

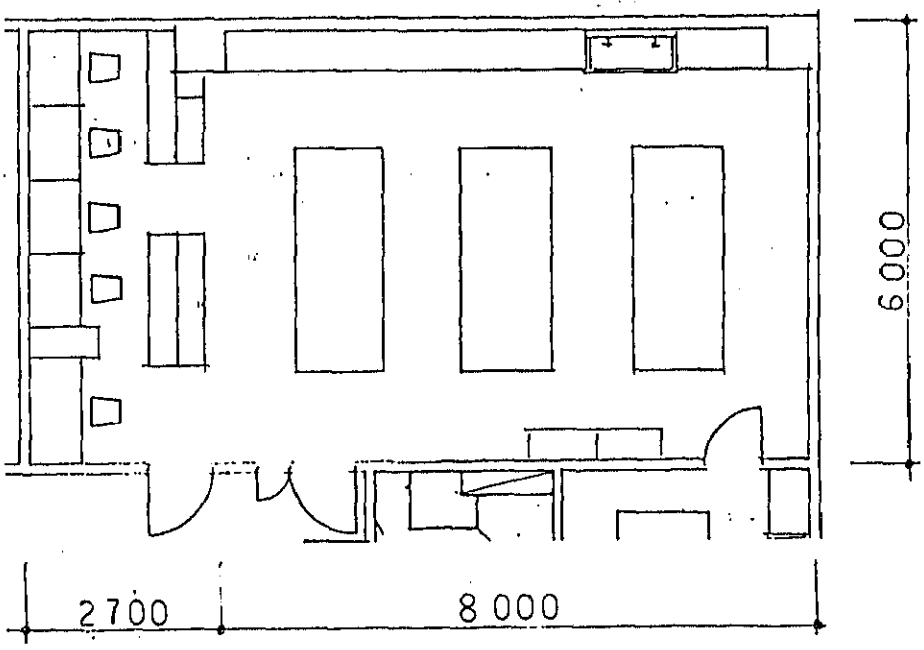
TEACHING LAB. 1 (49.8 M²)



Geology

Layout Plan 2

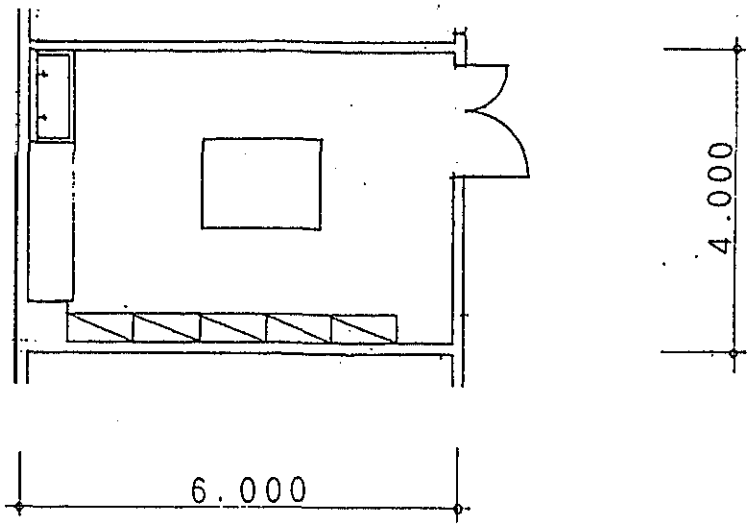
TEACHING LAB. 2 (64.0 M²)



Geology

Layout Plan 3

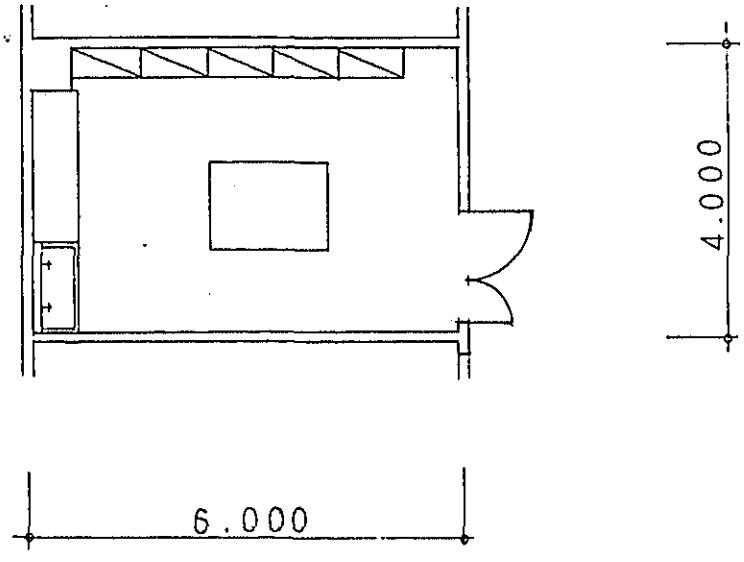
MINERAL DRESSING ROOM (24.0 M²)



Geology

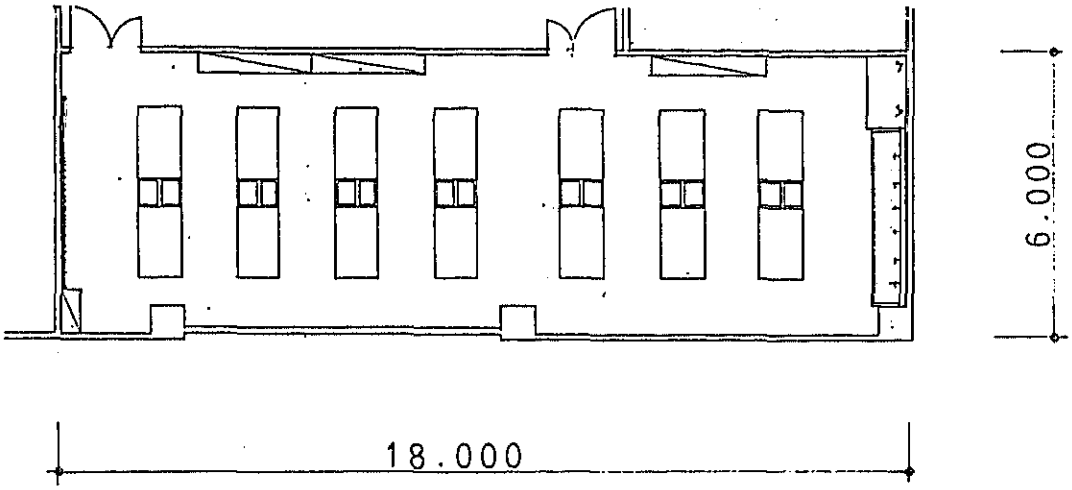
Layout Plan 4

ROCK POLISHING ROOM (24.0 M²)



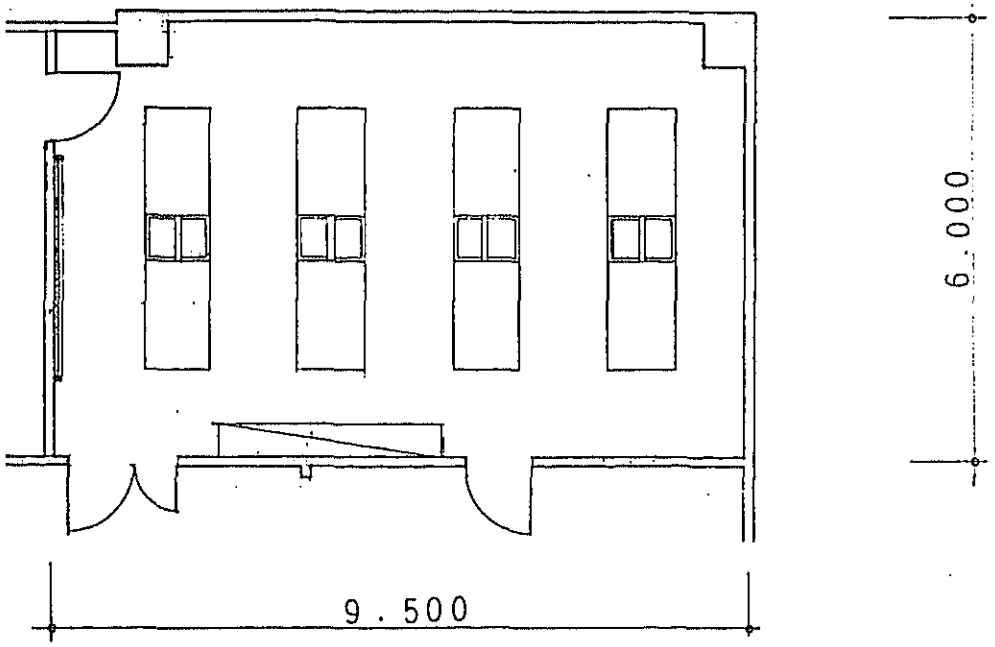
Biochemistry | Layout Plan 5

TEACHING LAB. 1 (108.0 M²)



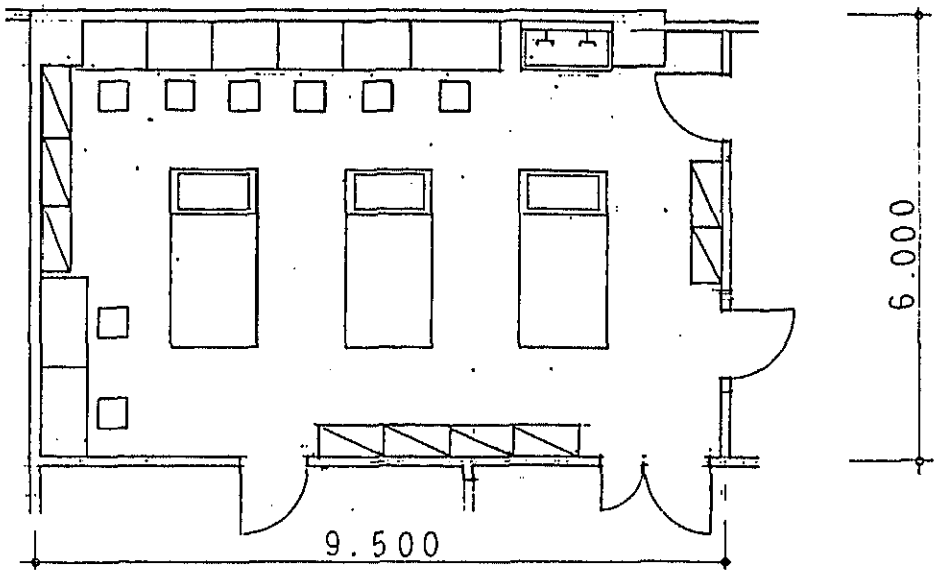
Biochemistry | Layout Plan 6

TEACHING LAB. 2 (57.0 M²)



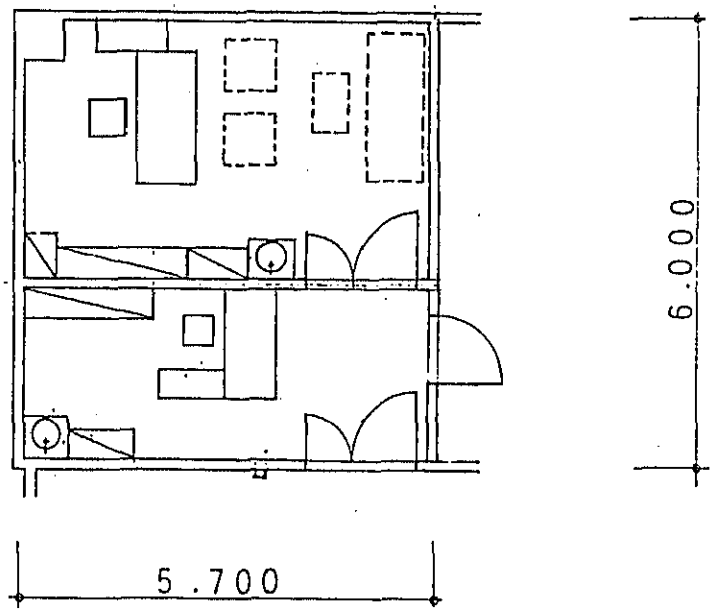
Biochemistry | Layout Plan 7

TEACHING LAB. 3 (57.0 M²)



Administration | Layout Plan 8

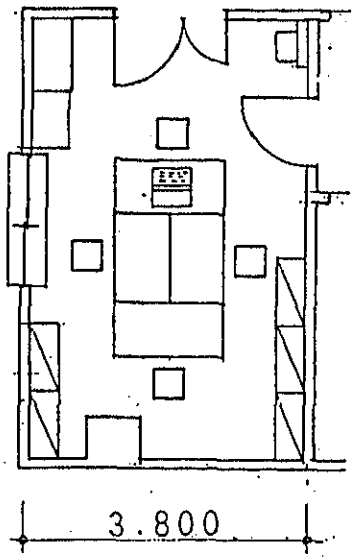
OFFICE OF THE DEAN AND SECRETARY (34.2 M²)



Administration

Layout Plan 9

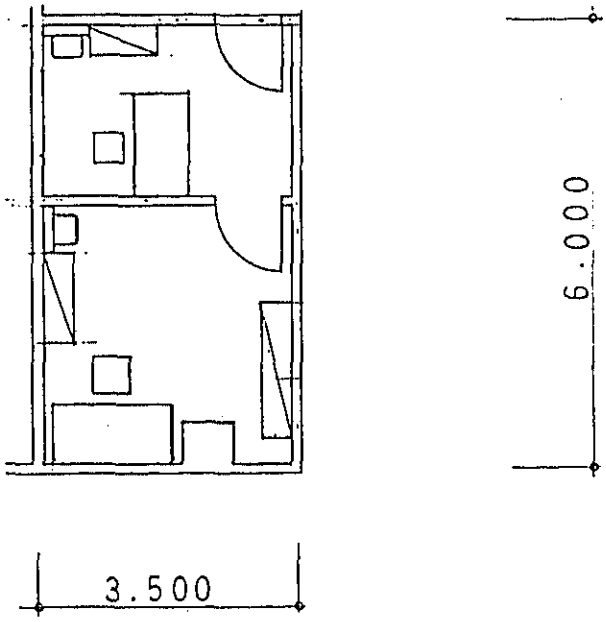
OFFICE OF THE FACULTY ADMINISTRATORS (22.8 M²)



Geology

Layout Plan 10

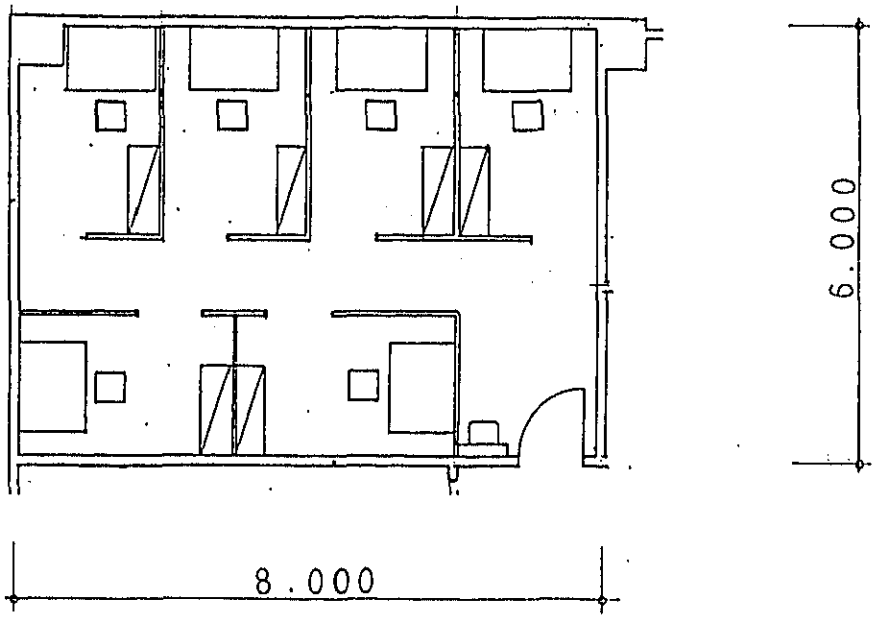
HEAD OF DEPARTMENT OFFICE AND SECRETARY (21.0 M²)



Geology

Layout Plan 11

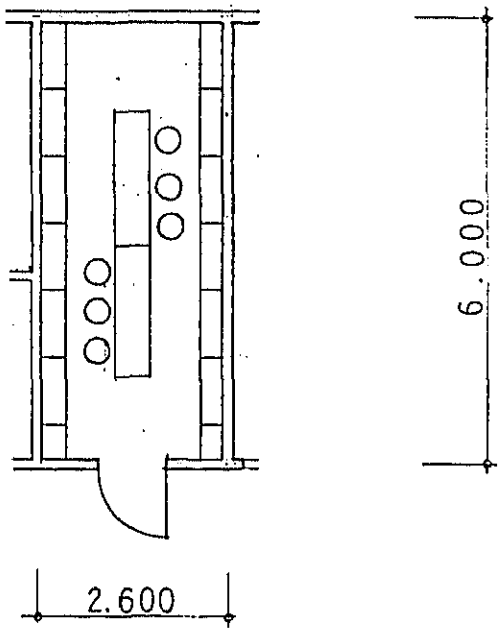
ACADEMIC STAFF OFFICE (48.0 M²)



Geology

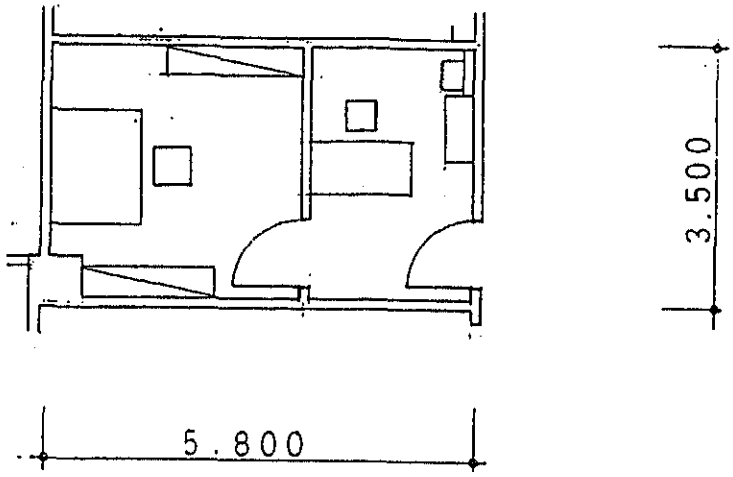
Layout Plan 12

DEPARTMENTAL LIBRARY (15.6 M²)



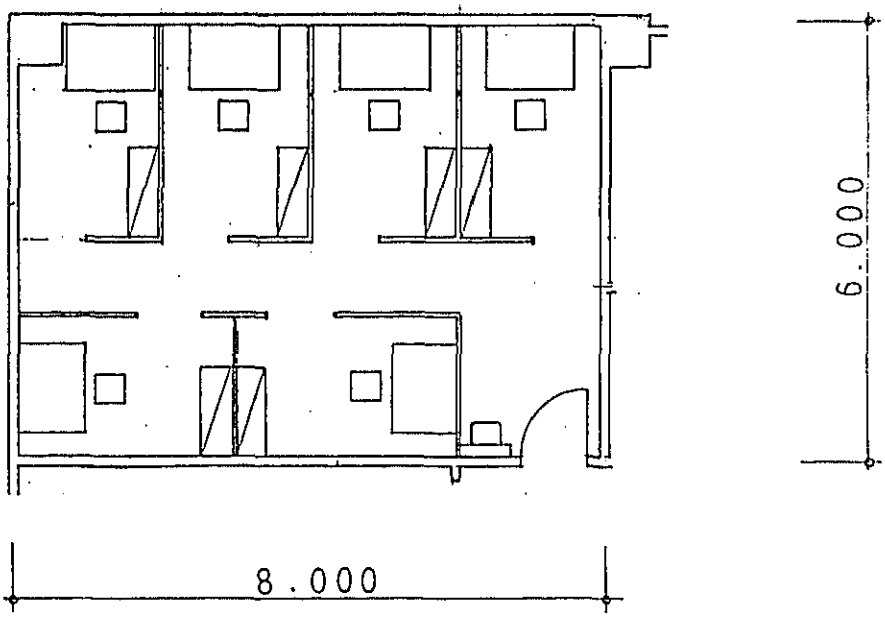
Biochemistry Layout Plan 13

HEAD OF DEPARTMENT OFFICE AND SECRETARY (20.3 M²)



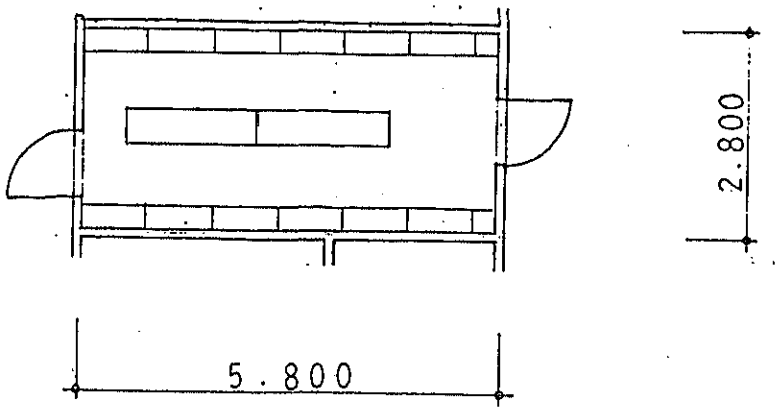
Biochemistry Layout Plan 14

ACADEMIC STAFF OFFICE (48.0 M²)



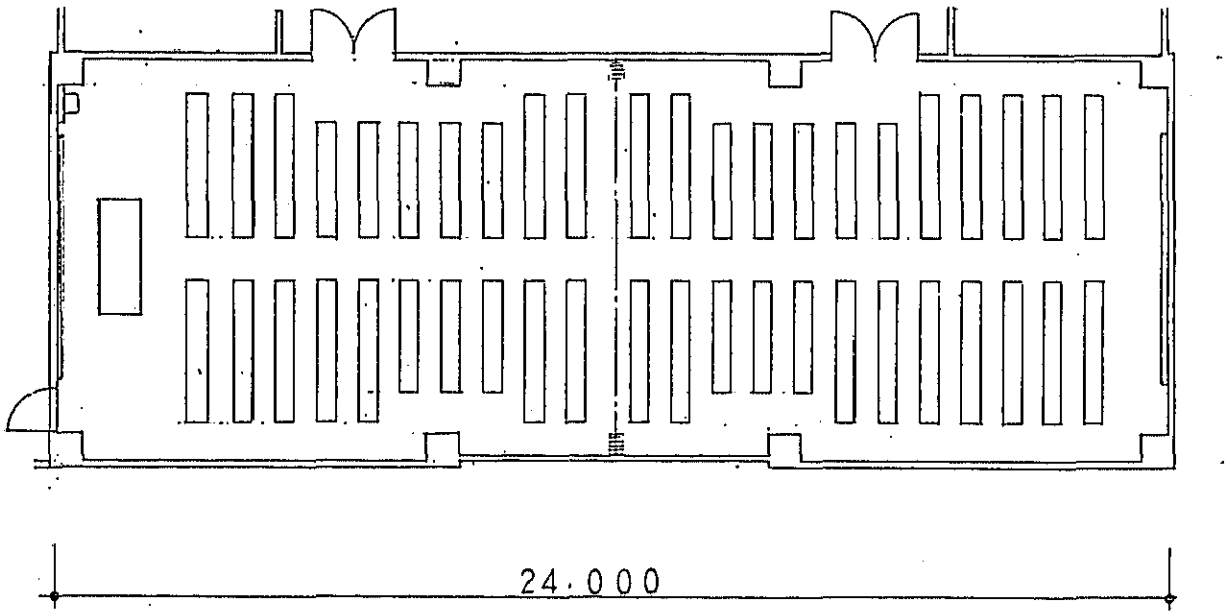
Biochemistry | Layout Plan 15

DEPARTMENTAL LIBRARY (16.24 M²)



Common Space | Layout Plan 16

LARGE LECTURE ROOM (204 M²)

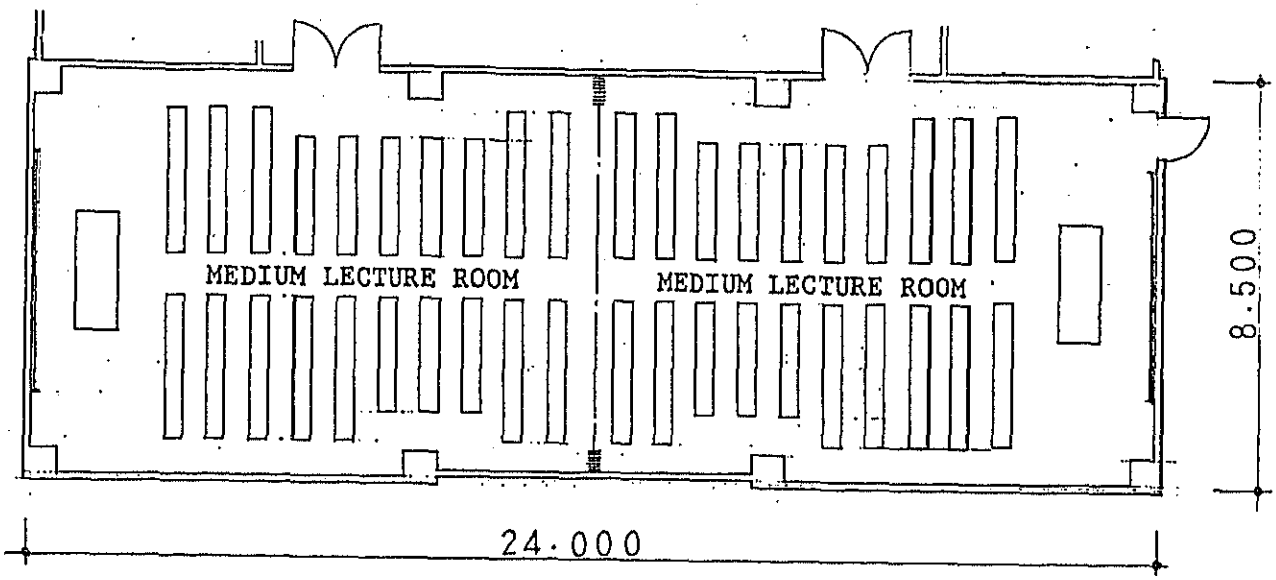


Common Space

Layout Plan 17

MEDIUM LECTURE ROOM

(102 M²)

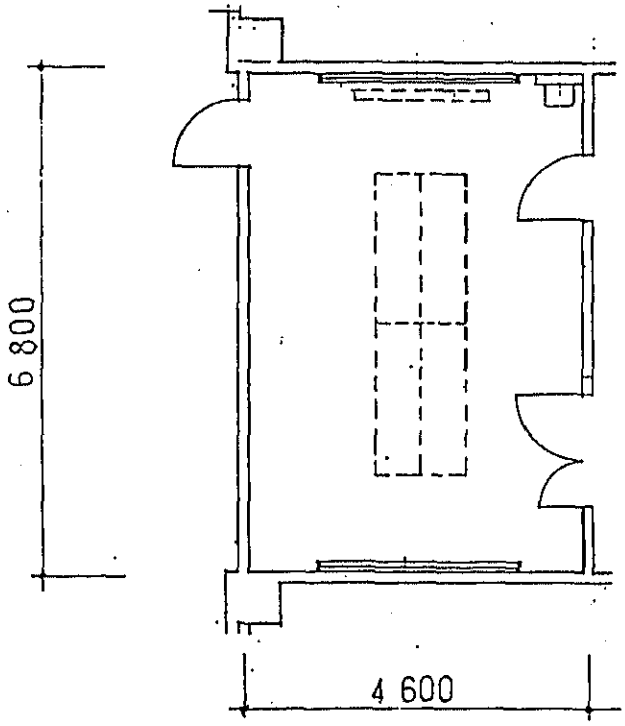


Common Space

Layout Plan 18

SEMINOR ROOM

(31.28 M²)



4-3 Basic Plan

4-3-1 Site and its Arrangement Plan

The site is located nearest the monument erected along the main road on the campus of Makerere University located in the City of Kampala.

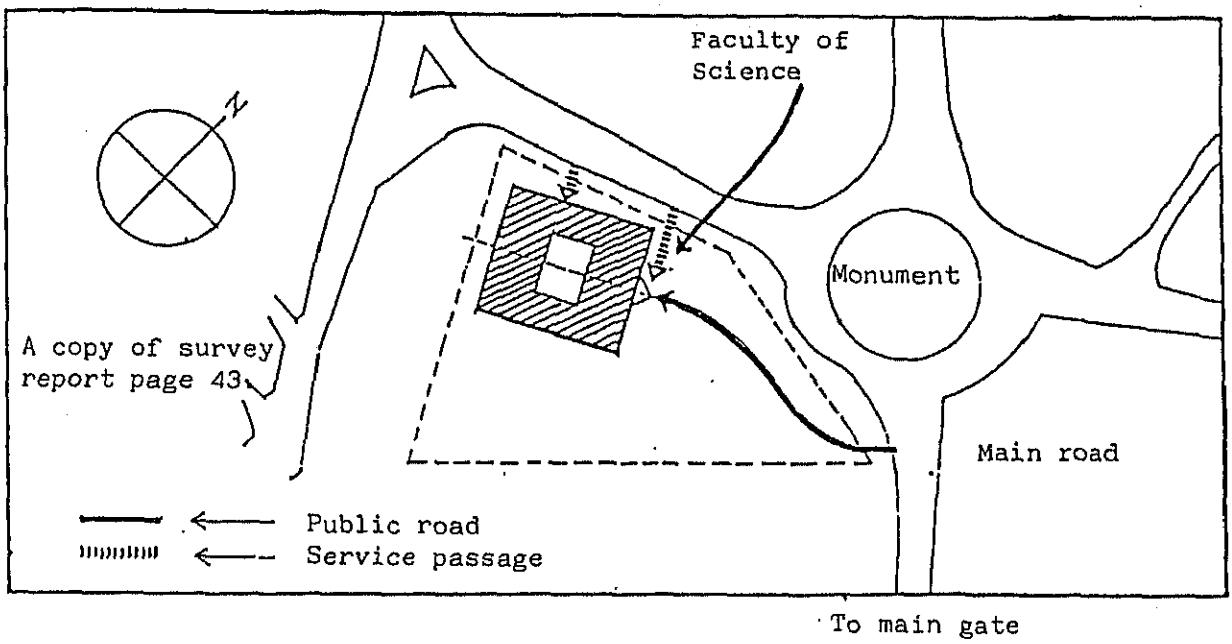
The site is located on the highest area of the university campus, and has a gentle slope of approx. 3,500m^2 towards the south. It is an unoccupied lot currently used as a parking area.

Power transmission line is laid under the road on the south of the site within the university campus and a new service line will be branched out from this existing main into the new facility. Water supply line is laid underground on the east of the site. Household drainage from the new facility will be discharged into the existing sewer pit on the south of the site. Similarly, rainwater will be discharged into the existing collection pit on the south corner of the site.

There is the Agriculture Department's building adjacent to the site on its south side. The university has a future plan to provide another building adjacent to the existing departmental building, and to link the two with a connecting corridor. This is apart from the project.

In such a situation, it would be reasonable to locate the project facility spreading from near the road facing the north and to the line where the slope begins on the west, and a future building of Agriculture Department on the south, with a front court on the east serving also as a parking area.

Fig. 4-1 Site and Its Arrangement Plan



The main entrance of the project facility will be located facing the main road on the east of the site, and a parking area provided near the front court. The project facility will be arranged with its facade facing the east.

By arranging the facility as mentioned above, it will be integrated into the entire university and the function of the whole Faculty of Science.

4-3-2 Building Plan

1) Plane Planning

Consideration of block plan

In considering the block plan, the following matters have been regarded as the basic points in order to compare and consider alternatives.

① The existing main road in front of the project facility will be used as an access road.

② Placing an emphasis on the functional linkage with other facilities, the project facility will be arranged facing the north of the site, under the

condition that the Agriculture Department's existing building adjacent to the site can be extended in the future.

③ Four functions (the Faculty of Science administrative zone, Geology Department, Biochemistry Department, and large and medium lecture rooms) will be clearly separated, but in a way to realize a maximally compact formation.

④ The facility will be a 3-storied building so that the site can be effectively utilized and the functions clearly separated.

⑤ In consideration of linkage between the functional areas, as short a traffic flow line as possible will be designed.

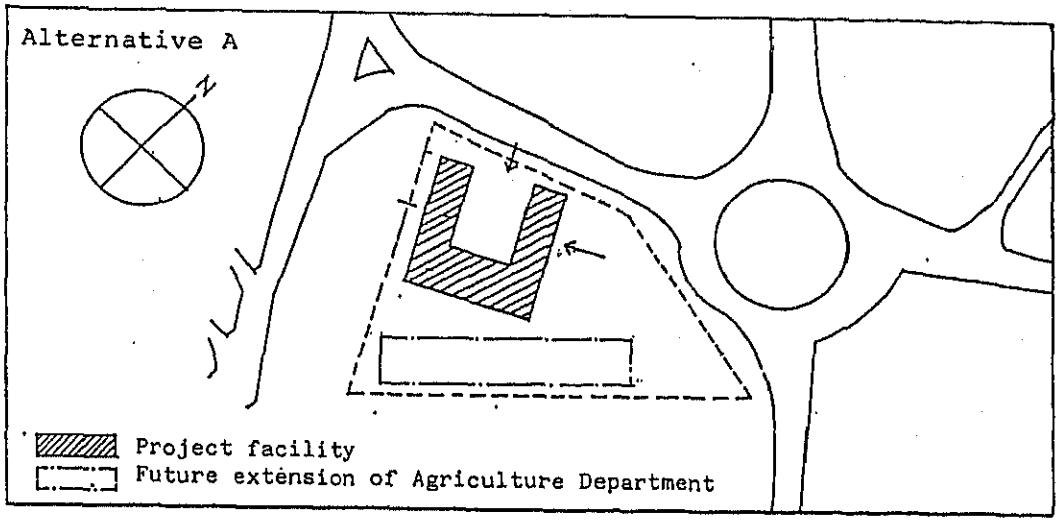
⑥ Provision will be made so that all interior spaces can maintain good draft and sunlight throughout the year.

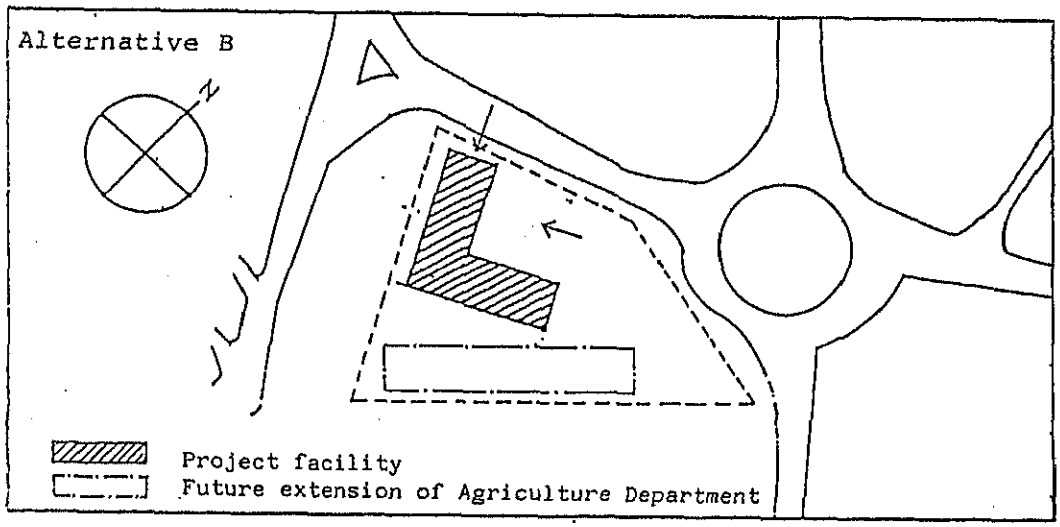
⑦ Administration of ingress and engress of outsiders (security) will be considered.

The possible block plan includes three alternative L type, ⊃ type and □ type (courtyard type).

As a result of judging from the comparison table of block plans in Table 4-1, Alternative C has been employed as the optimum plan with little defect on each check item.

Fig. 4-2 Consideration of Block Plan





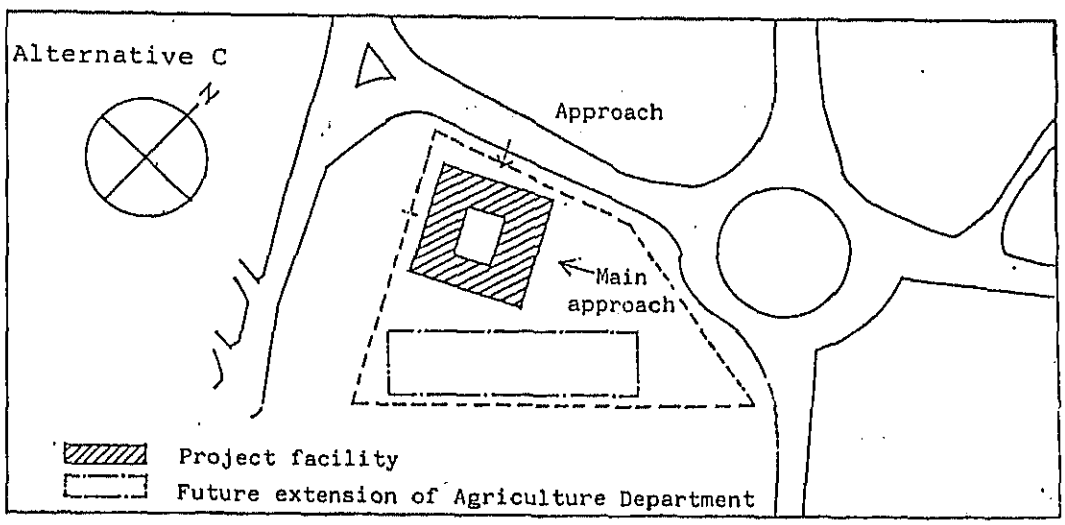


Table 4-1 Comparison between block plan alternatives

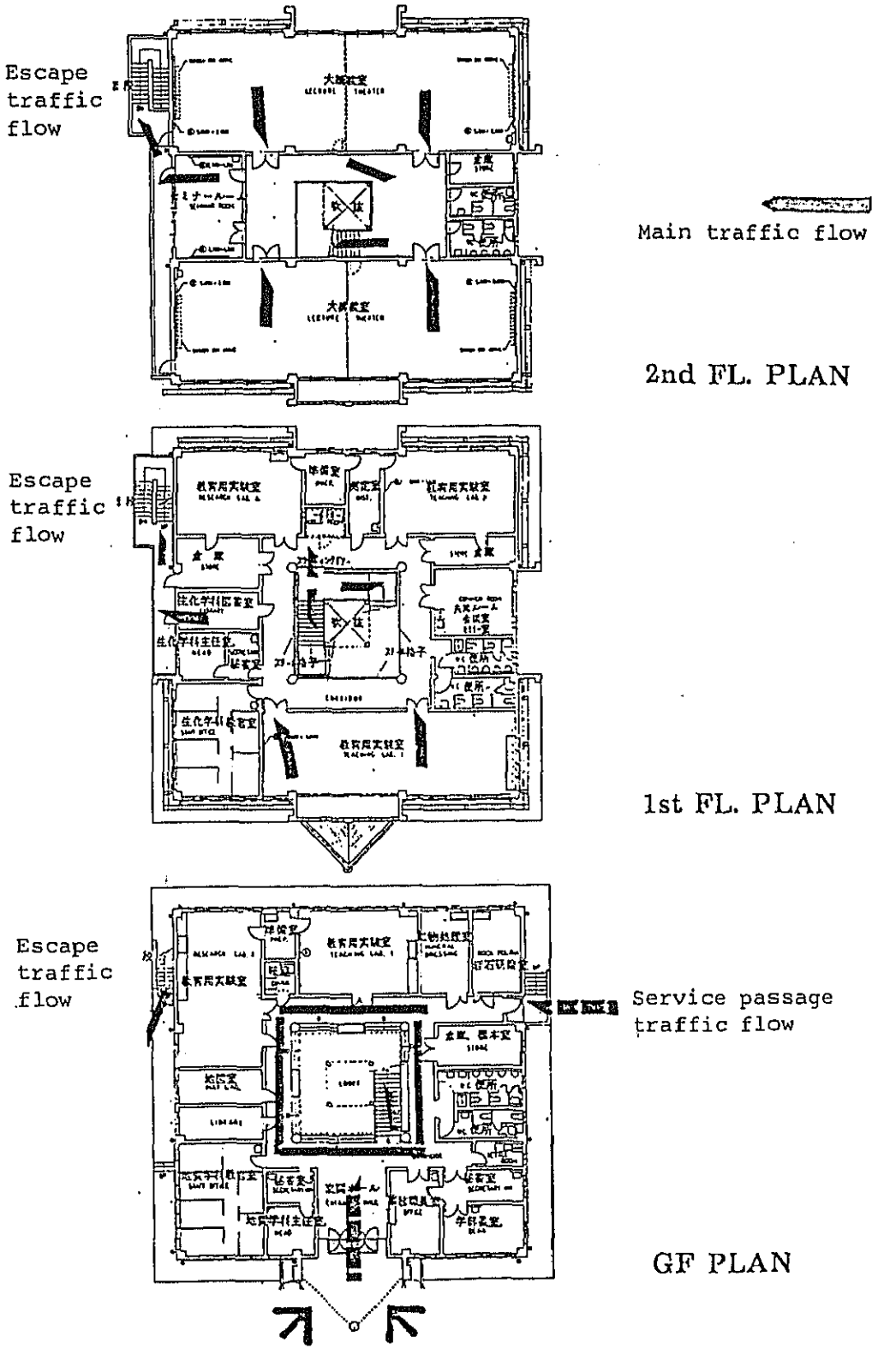
	Alternative A	Alternative B	Alternative C
1. Front of building	△	△	◎
2. Space for extension of Agriculture Department	△	△	◎
3. Administration of ingress and engress of outsiders (security)	△	△	◎
4. Traffic flow	○	○	◎
5. Livability	◎	◎	○
6. Linkage between administrative area and teaching & research area and large & medium lecture theaters	○	○	◎
7. Comprehensive administration of the university and the Faculty of Science	○	○	◎
Synthetic judgement	○	○	◎

2) Interior Traffic Flow Plan

(1) Plane traffic flow

The courtyard formation allows the traffic flow to be short and also creates circularity.

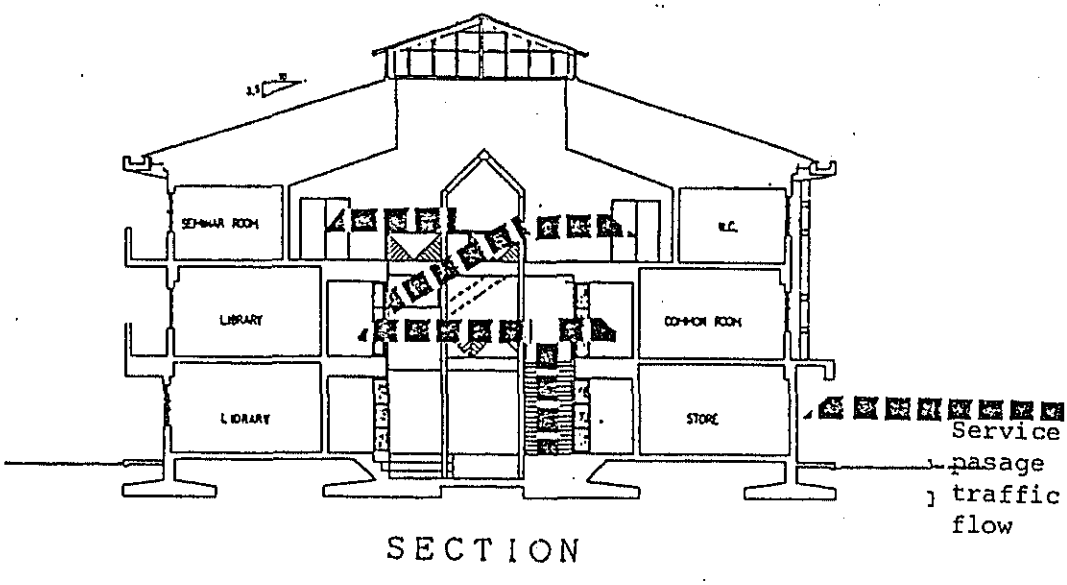
Fig. 4-3 Plane Traffic Flow



(2) Vertical traffic flows

As the courtyard is provided with stairs, the traffic flows are clear and short.

Fig. 4-4 Vertical Traffic Flows

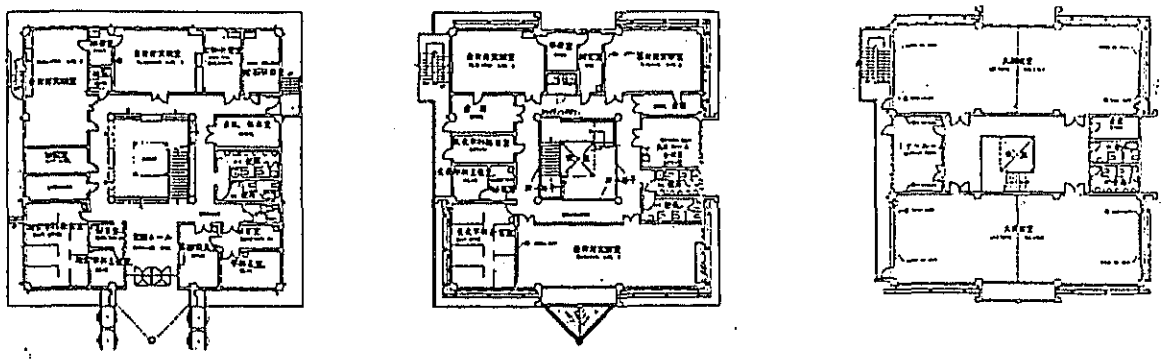


SECTION

3) Plane Planning of Individual Zones

(1) The facility is arranged so that the administrative zone of the Faculty of Science is located on the right facing the entrance of the ground floor with the Geology Department on the left, the Biochemistry Department on the first floor, and the large and medium lecture rooms on the second floor. This clearly separates the four functions.

Fig. 4-5 Plane Planning of Zones



GF PLAN

Geology Department

Office of Faculty Administrators

1st FL. PLAN

Biochemistry Department

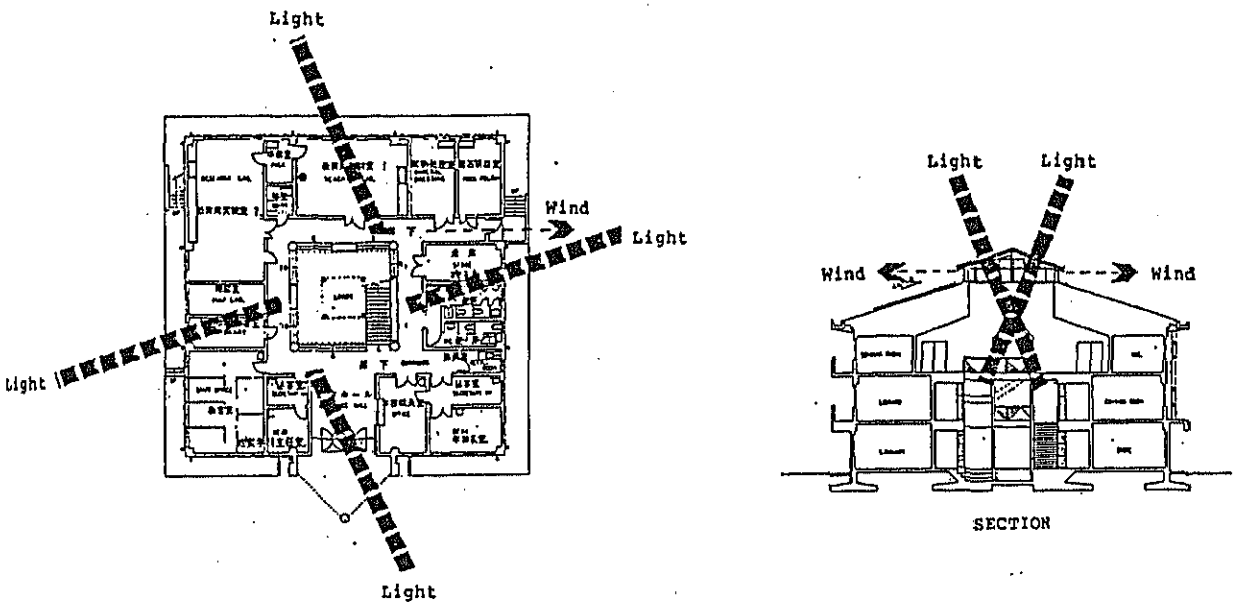
2nd FL. PLAN

Large Lecture theater

(2) Block plan for livability

In the case of the courtyard-type block plan, consideration is given to wind flow and natural light. Provision will be made so that natural light enters for the longest time possible, and a wind flows uninterruptedly.

Fig. 4-6 Block Plan for Livability



1) Elevation and Section Planning

As was described in "Basic Policy," in the Republic of Uganda, it is necessary to plan elevations and sections with consideration to rainwater planning, insect control measures, sunlight measures, security measures and ventilation measures.

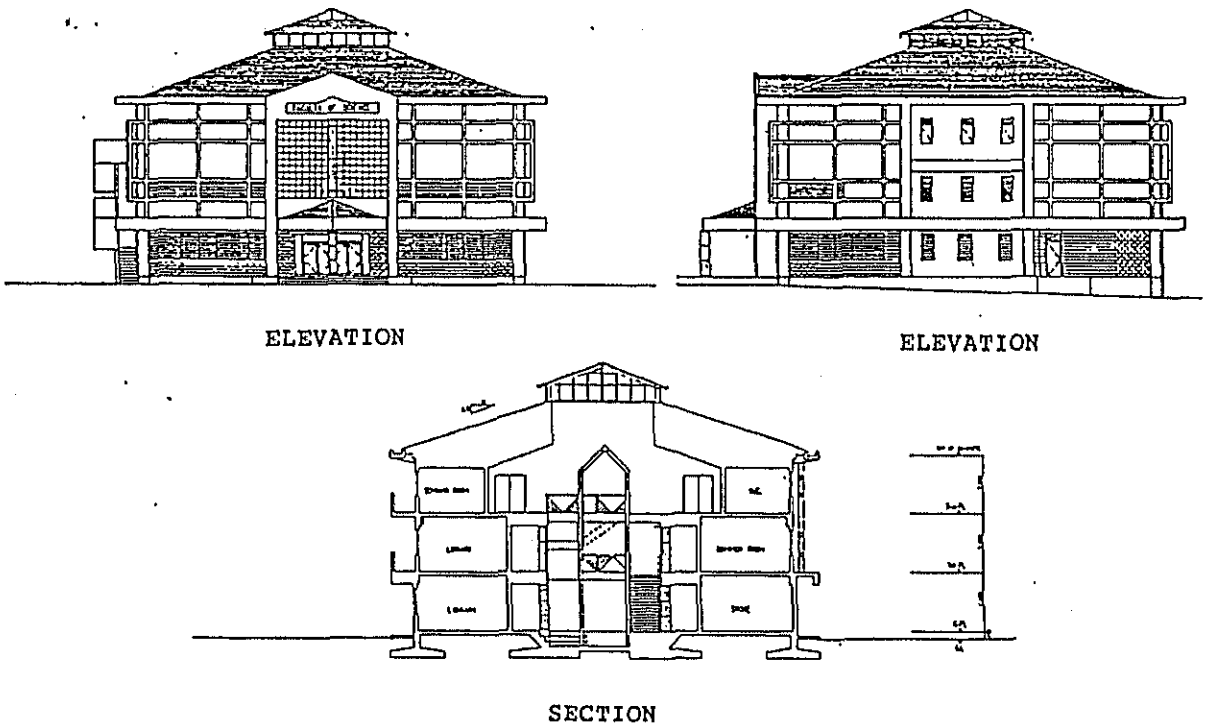
The project building will be composed of a 3-storied structure, all floors being 3.6 meters in ceiling height.

Since most of the ground floor is occupied by laboratories and research rooms (living rooms), the design ground level will be set near the main entrance with highest ground level, taking into consideration possible floods and solar radiation from the ground surface. Accordingly, the design ground floor level will be plus 30cm.

The roof will be provided with a slope of 3.5/10 in order to dispose of heavy rain quickly. The roof will be covered with shingle board to provide thermal insulation. Roof rainwater will be discharged through eaves gutters and downspouts in order to prevent it from penetrating the building. The roof eaves will be provided with large RC-made water pipes. To deal with the sunlight and rainwater, the roof eaves will have overhangs of approximately one meter in length, and louvers will be provided on the first and second floors.

For the purpose of security, openings on the ground and first floors will be provided with metal grilles. All exterior windows will have the top provided with a ventilating louver, and, similarly, the interior windows facing the courtyard will have the top provided with a louver, so that a wind flows through. In addition, a louver will be provided also to the skylights to be set overhead at the courtyard to permit good ventilation. As a whole, the windows will be the continuous type to improve natural lighting.

Fig. 4-7 Elevation and Section Plan



5) Structural Planning

(1) Structural design policy

Designing of the building will be based on the philosophy that it is structurally free from obstructions due to deflection, vibration, etc. in the long-term load, and that it is also thoroughly safe during an earthquake or severe wind pressure. The Republic of Uganda has no specific criteria or laws for structural design, and therefore the building structure will be designed in accordance with the requirements of the Architectural Institute of Japan, but sufficient consideration will be given also to the local characteristics.

(2) Framing

The building's frame will be of pure reinforced concrete, rigid construction without earthquake resisting walls, so that it will make it possible to perform free design in the aspect of plane planning and also deal with changes in the partition walls. The roof will be of structural steel members covered with roofing materials.

(3) Loads

① Live loads

Table 4-4 Live Loads

(In kg/m^2)

Use	For calculation of floor structure	For calculation of girders, columns and foundation	For calculation of earthquake load
Lecture rooms	230	210	110
Offices and research rooms	300	180	80
Halls, corridors and entrances	360	330	210
Libraries	550	450	400

Other live loads will be determined in accordance with actual conditions.

② Earthquake load

According to the earthquake records for the period between 1925 and 1966 in the Republic of Uganda, an earthquake of magnitude took place in Hortportal approximately 100 km. southwest of Campara City. However, no earthquakes have been recorded in which the vicinity of Campara City was seismic center. Nevertheless, in designing this building, the greatest emphasis is to be placed on the safety of human life. We have judged that some anti-earthquake measures should be taken. As an areal coefficient of earthquake load, a numerical value in Okinawa, a place where earthquakes least often take place in Japan, has been adopted.

$Ci = Z \cdot Rt \cdot Ai \cdot Co$

Ci ··· coefficient of earthquake layer shearing force

Z ···· coefficient of zone (the building's coefficient will be 0.7)

Rt ··· coefficient of subgrade characteristic (the building's this coefficient will be 1.0)

Ai ··· coefficient of distribution in height direction

Co ··· coefficient of typical shearing force (the building's coefficient will be 0.2)

③ Combination of loads

Table 4-5 Combination of Loads

Types of design load	Condition assumed	Combination of stresses
Long-term	Normally	G + P
Short-term	During earthquake	G + P + K

G : stress due to fixed load

P : stress due to live load

K : stress due to earthquake force

Wind load of the RC-made building is small. Wind load of this 3-storied building is of negligible value for the structural design. However, wind load for the roof will be taken into consideration and calculated.

④ Materials to be used

Concrete

Typical design strength

FC240kg/m^2 as per JIS

Main bars for columns and beams	: SD35 as per JIS
Other small-diameter bars	: SR24 as per JIS
Structural steel members	: SS41 as per JIS

⑤ Foundation

The building will be a 3-storied construction with the weight of the building per building area (m^2) being approximately 5 tons.

Although no geological survey report has been obtained yet for this project site, the nature of soil is viscous red soil and relatively hard. Judging from the conditions of peripheral existing buildings, a soil bearing capacity of at least 10 tons per square meter can be expected.

From the above, the subgrade would be sufficient to support the building with a spread foundation.

6) System Planning

(1) Electric Planning

① Power Supply System

- Power receiving system

Power will be received through RMU from the existing 11,000V high tension transmission line laid under the road on the west of the project site. For this purpose, an outdoor, floor-mounted type transformer will be provided at a power receiving point on the site, and a feeder pillar provided at the secondary side of the transformer.

Service line following the transformer F.P. will be provided at the cost of the Japanese party.

- As voltage fluctuations within the city of Kampala are plus or minus 15%, there is the possibility of induced failure of the instruments to be provided in the laboratories, producing inaccurate, measured data, so it is essential to provide a constant voltage system (AVR) to cover all the laboratories. Judging from the cost and the efficiency of utilization, each laboratory work bench should be provided with one AVR system.

② Lighting System

In principle, all lighting fixtures will be of fluorescent type. The average intensity of illumination in the following rooms will be as shown on the table below.

Table 4-6 Average Intensity of Illumination

Room name	Desired design intensity of illumination (LX)	Typical intensity of illumination per JIS (LX)
Research room	450	300 ~ 750
Laboratories	450	300 ~ 750
Offices	500	300 ~ 750
Store rooms	75	75 ~ 150
Halls	200	200 ~ 500
Corridors	100	100 ~ 200
Common rooms	300	200 ~ 500
Lecture rooms	400	200 ~ 500
Toilets	100	100 ~ 200

Lighting fixtures will be of ceiling-mounted type, flush-mounted type or pipe-suspended type.

③ Receptacle System

Together with ordinary receptacles, receptacles to research and laboratory equipment will be provided wherever required.

④ Telephone System

A telephone switchboard will be provided in the administrative zone and offices. Service lines following an MDF to be installed by the Ugandan party will be installed at the cost of the Japanese party.

The switchboards provided will be a digital, electronic type capable

of permitting the addition of up to 5 external circuits and up to 40 extension circuits. A telephone set will be provided in each room requiring it.

⑤ Broadcasting System

An independent, loud speaker system will be provided in the lecture rooms.

⑥ Lightning Arrester System

A lightning arrester system will be provided to protect the building and facilities from damage.

(2) Plumbing System Planning

① Water Supply System

Water will be supplied with a piping branched out from the existing 4-inch diameter water supply piping, and led to a water receiving tank with the effective capacity of 9,000ℓ. An elevated water tank (15m high and with the effective capacity of 2,250ℓ) will be provided near the new building, so that water is pumped up to the tank, and then supplied in gravity from the tank to inside the building.

② Drainage and Venting System

Household drainage (sewage and miscellaneous drainage) will be discharged through new piping into the sewage pit located between the south side of the site and the Agriculture Department's building. In the project building, miscellaneous drainage and sewage will be allowed to flow separately, but will join outside the building. In addition, special type of drainage (toxic) will be collected in polyvinyl containers, and disposed of independently. Rainwater will be discharged through new piping into the existing gutters and collection pits.

③ Sanitary Fixtures

All toilets will be Western type. Urinals, laboratories, slop sinks, etc. will be provided. The ratio of male students to female students at Makerere University is 4 to 1. On the assumption that the maximum number of persons using the facilities under the Grant Aid per day is

479 (lecture theaters: 408 + 71 staff), the ratio of male to female is 384 males to 95 females.

According to the Collection of Building Design Materials, one hundred males require two closets while one hundred females require four closets, and one hundred males require four urinals, thus the required quantities will be as follows:

Table 4-7

	Closet	Urinal
Male	6	12
Female	6	
Total	12	12

④ Hot-water service system

Hot-water will be made by an independent hot-water making unit. Hot-water service rooms, and parlors will be provided with a gas table.

(3) Gas supply System Planning

An LPG gas installation will be provided in hot-water service rooms and laboratories.

(4) Ventilating System

Living rooms will be subject to natural drought as a principle, but those rooms requiring forced ventilation in laboratory work and research will be provided with a forced ventilating system.

(5) Building Materials Planning

In consideration of factors such as the climate, building requirements, necessary functions, local construction circumstances, time of completion, reductions in construction costs, maintenance costs and running costs, the use of building materials will be planned as described in

the following paragraphs.

① Structural materials

Structural materials will be reinforced concrete and masonry walls. Local cement, aggregates and bricks are free of any significant problems both in quality and availability.

② Finishing materials

Finishing materials should be highly durable and easily maintained and controlled.

Principal finishing materials for the exterior walls, roofs, etc. that significantly affect durability will use the materials available in Japan which have long been proved to be economical, durable and functional. Other materials used will be locally procurable, easily repairable.

a. Exterior Finishing

① Roof

The roof will be a reinforced concrete, rigid construction. The roof will be of steel purlins covered with water resistant plywood sheathing board, which follows application of asphalt felt and asphalt roofing. The air space underneath the roof will act as a heat insulating layer to prevent the rise of the temperature on the uppermost story.

② Exterior wall

With consideration to waterproofing performance, the portions of exterior wall subject to rains will be constructed of reinforced concrete or brick masonry. The outside surface of exterior wall will be finished with spray tile, and the inside surface finished with concrete paint.

③ Doors and windows

All exterior doors and windows will be of aluminum sash. Compared to steel sash, aluminum sash does not need to be painted, can be easily maintained and controlled, and is also free from possible damage due to termites, unlike wood

sash. It is also easily provided with airtight performance to prevent dust.

b. Interior Finishing

① Floor

Both living rooms and corridors will be covered with vinyl tile, which is relatively often used for office etc., but will be partially finished with trowelled mortar or ceramic tile. Vinyl tile has a smooth surface, so it can be easily cleaned, and is thus sanitary.

② Interior wall

Reinforced concrete wall and brick masonry wall will be finished with mortar application, followed by concrete paint.

Partition walls will be a movable type.

The interior walls of toilets will be finished with semi-ceramic tile.

③ Ceiling

The ceiling of offices, Dean's office and rooms on the second floor will be finished with sound-absorbent asbestos boards. Ceilings of research and other rooms will be exposed ceilings finished with concrete paint.

4-3-3 Equipment Planning

With high regard paid to preferential order, types and quantities of equipment have been determined from among those requested from the Government of the Republic of Uganda, based on the following concepts:

a. As the request places emphasis on the upgrading of manpower, the equipment deemed necessary for laboratory education matching the teaching curricula of the country, should be selected.

b. The equipment to be used for limited purposes or for particular research purposes will be deleted from our program this time even if the equipment needs first priority in the order of request.

c. In order to facilitate maintenance and control, the equipment requiring expensive perishables or perishables difficult to be obtained in the country, should be deleted, but perishables with high necessity should be included, to a proper extent.

As a result, the following pieces of equipment have been concluded as the necessary items.

1) Laboratory equipment

(1) Laboratory fixtures

① Draft chamber for general use 2 units
(size: 12,008(W) × 750(D) × 2,300(H)mm)
These draft chambers are equipped with a device to perform the forced exhaustion of an organic solvent or a toxic gas generating an offensive odor.

② Cold room, prefabricated 1 set
(Temperature: 4°C, size: 1,800(W) × 2,700(D) × 2,100(H)mm)
The cold room will be used when laboratory work is conducted in a low or constant temperature, or for the storage of products that must be kept cold.

③ Laboratory tables 19 units
For use by students of Biochemistry Department:
(size: 3,600(W) × 900(D) × 1,800(H)mm
w/receptacle, sink, water tap, gas cock 11 units)
For research use by Biochemistry Department:
(size: 2,400(W) × 1,200(D) × 1,800(H)mm
w/receptacle, sink, water tap, gas cock 3 units)
For use by Geology Department:
(size: 3,000(W) × 1,200(D) × 1,800(H)mm
w/receptacle, sink water tap, gas cock 5 units)

Each of the laboratory tables above is to be used in laboratorys by 6 ~ 12 students.

④ Chairs for laboratories 1 set

(size: 315ø × 410 ~ 550(H)mm round-type upholstered with vinyl sheet. No casters.)

These chairs are associated to work benches, and 6 ~ 8 chairs will be provided to one work bench.

(2) Laboratory equipment

① Spectrophotometer (quasi type) 2 units

(Single beam type, range of wavelength: Minimum 325nm or less, maximum 1,000nm or more)

This is a testing apparatus to quantify the non-measurable substances contained in liquid specimens by utilizing the absorptive characteristic of light inherent to the corresponding substance, and is therefore extremely basic with a wide range of uses.

This is similar to the apparatus described in item 1 above, but is highly accurate.

② Fluorescent spectrophotometer 1 unit

(Monochromatic light monitor type. Range of wavelength: Minimum 220nm or less, maximum 700nm or more)

This is a testing apparatus to quantify the substances contained in a specimen by measuring the amount of luminescence of the substance that emits fluorescence, and has wide usage.

③ High-speed centrifugal separator 1 unit

(Maximum revolutions: 20,000rpm and up. Maximum centrifugal force: 45,170kg and up. Digital indication. Three types of rotors: large, medium and small)

This is equipped with a cooling device to hold the rise of temperature while centrifugal separation at a high speed is taking place.

④ Inverted micrometer with a 35mm camera 1 unit

This is a testing apparatus to magnify and observe the micro specimen invisible to the eye, and is a binocular type usable also for tissue culture.

⑤ Automatic dispenser, digital 1 unit

(Spring capacity: 100μl and up. Minimum range for liquid adjustment: 1μl)

This is a testing apparatus to dispense a liquid specimen accurately and quickly, and necessary for the testing of a large amount of specimen efficiently.

⑥ High-speed liquid chromatography 1 set

(Configuration: Pump, gradient unit, detector, injector, fluorescent detector, automatic sampler, column opener, conductivity detector, data processor, and column)

This is a testing apparatus to separate and analyze the substances contained in liquid specimen by utilizing the differential between the drifting speeds of the substance caused by the difference in adsorptivity due to the fixed-phase substance filled in the channel, and has an extremely wide range of uses.

⑦ Electrophoretic equipment 1 unit

(Configuration: Stabilizing power, filter paper drifting bath, disk gel drifting bath, slab gel drifting bath, starch gel drifting bath, and thermometer)

This is an apparatus to separate and analyze the protein contained in specimen by utilizing the different speed of drifting depending on the type of protein molecule generating when impressing a DC electric field to a solution containing protein, and is basic and has wide usage.

⑧ Freeze drier 1 unit

(Maximum cooling temperature: -80°C and up, capacity: 2ℓ and up.)

This is an apparatus to freeze-dry the liquid specimen instable to heat in order to store it for a long time, and therefore necessary for the storage of specimens.

⑨ Micro pipette 10 sets

(Capacity variable type: 50μ ~ 100μl)

This is a knock type capable of apportioning a liquid specimen in equal quantities, and regarded as necessary for the conduct of efficient laboratory work. With special consideration to the use of it by students, 10 sets is envisaged for provision.

⑩ High-pressure steam sterilizer 1 set

(Range of working temperature: 100 ~ 300°C. Maximum working pressure: 1.7kg/m^2. Cubic content: 50ℓ and up.)

This is an apparatus to sterilize specimens such as laboratory equipment, culture medium, etc. by utilizing high-pressure steam. With consideration to ensuring the safety of a tester and accurate measurement, one unit of sterilizer, which is the minimum required quantity, is envisaged for provision.

11 Fluorescent microscope with reflecting illuminator 1 unit

This is a microscopic system capable of irradiating ultraviolet rays against the specimen with fluorescent action and observing the specimen selectively through the fluorescence being emitted from it. This is a type of apparatus often used by students in laboratory work and research.

12 Polarized microscope with a 35mm camera 1 unit

This is a microscopic system capable of irradiating polarized light against the specimen with double refractivity and observing the reflecting light in the direction of certain oscillation selectively by observing the reflecting light through the polarizer, and therefore indispensable for the observation of crystal, etc.

For this project, a binocular type capable of being used also for research is envisaged.

13 Vicker's hardness meter 1 unit

(Dial change-over type for loads of 1, 5, 10, 20, 30 and 50kgf)

This apparatus is capable of applying pressure to solid specimens such as minerals, and measuring the hardness. This is one of the extremely basic apparatuses used by the Geology Department.

14 Reflecting microscope with a reflecting illuminator for laboratory work by students 10 units

This apparatus is used for magnified observation of solid specimens such as minerals. For this project, 10 units of a simple ocellar-type microscope for use by students is envisaged.

15 Rock slice forming machine with dial gauge 1 unit
(Spindle descent scale: Min. 0.01mm)
This machine is capable of finishing a piece of rock to an extremely thin specimen observable by a penetrating type microscope, and is one of the apparatuses highly required by the Geology Department.

16 Other laboratory apparatuses 1 set
Shakers, ice makers, supersonic wave washers, etc. which are the basic apparatuses highly required in laboratories are envisaged.

2) Field work equipment

① Portable apparatuses for field work 1 set
Magnetic needles, magnifying lens, hammers, etc. which are all indispensable for the conduct of field work are envisaged.

② Camping supplies for field work 1 set
Tents, camping beds, cooking utensils, etc. which are used during field work are envisaged.

3) Audiovisual equipment

① Video system 1 set
(Configuration: 2 video recorders, 1 monitor, 1 video camera, 1 simple editing unit. VHS mode multisystem)
Of the audiovisual teaching aids to improve educational effects, one set of a system to produce and replay video tapes which are currently generally used is envisaged.

② Other audiovisual equipment 1 set
One set of audiovisual equipment to assist lectures, such as slide projectors, 16mm projectors, etc. is envisaged.

4) Vehicular equipment

① Motorcar for field work (4-wheel driven wagon) 2 units
Motorcars are indispensable for the transportation of teachers and students and equipment when and while field work is conducted.

5) Office Equipment

(1) Office Furniture

① Cabinet 1 set

(Size: Cabinet with 2 shelves.

Large type : 1,760(W) × 515(D) × 1,848(H)mm

Small type : 880(W) × 515(D) × 1,848(H)mm

Shelf : 1,800(W) × 600(D) × 2,100(H)mm

These are for storage of documents and equipment. They will be classified into three types; large type with two shelves and sliding doors, small type with two shelves and sliding door, and large shelf type.

② Bookshelf with 6 shelves 20 units

(Size: 1,690(W) × 290(D) × 2,120(H)mm)

These are for book storage in the library of each department.

③ Other fixtures

Fixtures of lecture rooms are planned in minimum requirement.

(2) Office Equipment

① Data processor 3 units

(Configuration: 16-bit laptop-type personal computer, 135-digit dot matrix-type pin printer, software for English word processor, software for table calculation, and software for data processor.)

These are for efficient document preparation to totalize numerals and administer data on the results of laboratory work. These pieces of equipment are highly reliable and have become general tools in the educational field and office work.

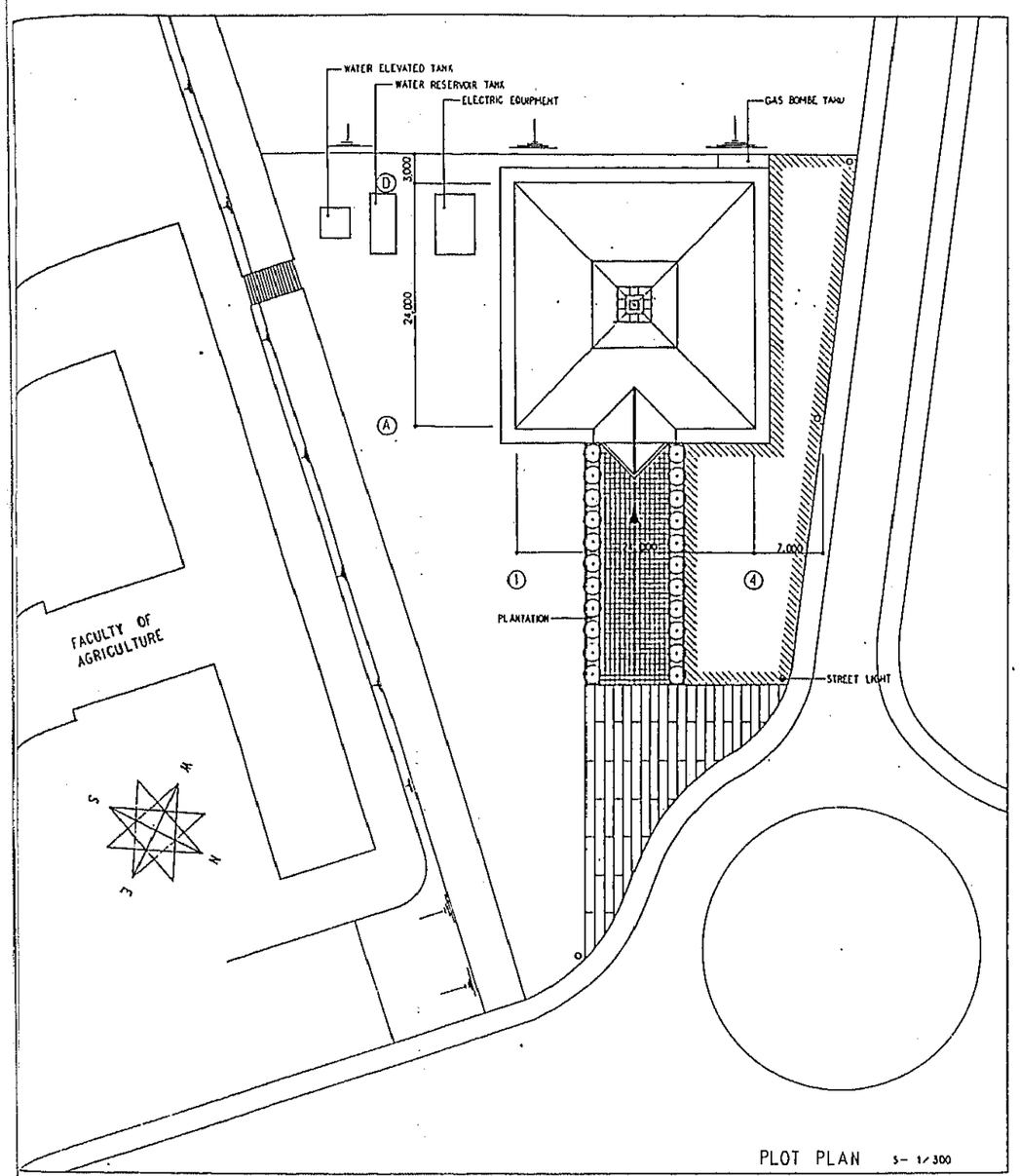
② Copier, desk type (copy size: max. A3) 1 unit

This copier permits the use of common paper, is of the dry type capable of reproducing a small quantity of teaching materials or documents and currently indispensable in office work.

③ Other office equipment 1 set

Typewriters, function calculators, etc. which should be used in offices and research rooms are envisaged, in various, small quantities.

4-3-4 Basic Drawing Design



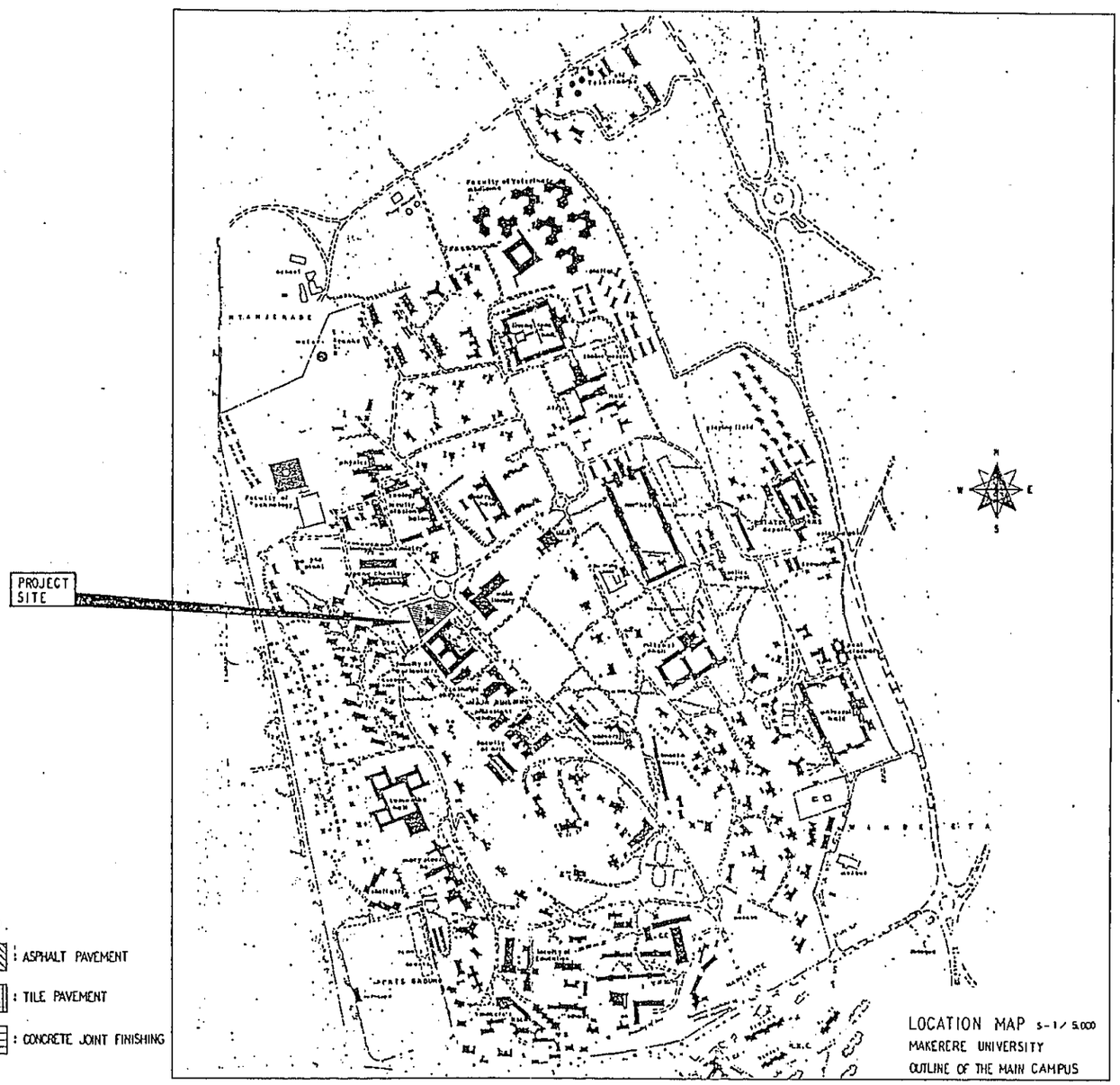
PLOT PLAN S- 1/300

LEGEND .

: ASPHALT PAVEMENT

: TILE PAVEMENT

: CONCRETE JOINT FINISHING



LOCATION MAP S-1/5,000
MAKERERE UNIVERSITY
OUTLINE OF THE MAIN CAMPUS

EXTERIOR FINISH SCHEDULE

ROOF	SHINGLE IN COLONIAL STYLE
WALL	ACRYLIC PAINT ON CEMENT MORTAR CAST STONE BLOCK (GROUND FLOOR ONLY)
WAINSCOT	CEMENT MORTAR
WINDOW	ALUMINIUM WINDOW (OP ON STEEL GRILLE.)
DOOR	ALUMINIUM FLUSH DOOR (ENTRANCE:OP ON STEEL DOOR)
TERRACE	CONCRETE TROWEL FINISH
ROOF GUTTER (EAVES)	SHEET METAL
DOWN PIPE	POLYVINYL CHLORIDE PIPE
SCARCEMENT	CONCRETE TROWEL FINISH

INTERIOR FINISH SCHEDULE

BUILDING	FLOOR	ROOM NAME	FLOOR: VINYL TILE	FLOOR: CERAMIC TILE	FLOOR: CEMENT MORTAR	BASEBORD: CLEAR LACQUERE ON WOODEN BOARD	BASEBORD: CERAMIC TILE	HEIGHT	WALL: A.E.P. ON CEMENT MORTAR	WALL: CERAMIC TILE	CEILING: ACOUSTICAL ROCK WOOL BOARD A.E.P. ON LIME MORTAL	GENERAL NOTES
	GROUND FLOOR	ENTRANCE	○			○		100	○		○	WAINSCOT: CLEAR LAQUER ON WOODEN BOARD
		DEAN	○			○		100	○			
		SECRETARY (1)	○			○		100	○		○	NOTICE BOARD
		OFFICE	○			○		100	○		○	COUNTER
		MINERALDRESSING	○			○		100	○			SINK WORK TABLE
		ROCK POLISH	○			○		100	○			DITTO
		RESEARCH LAB.	○			○		100	○			DITTO
		PREP.	○			○		100	○			SINK BLACKOUT CURTAIN
		DARK ROOM	○			○		100	○			SINK WORK TABLE "
		LIBRARY	○			○		100	○			
		MAP LAB.	○			○		100	○			
		TEACHING LAB.	○			○		100	○			SINK WORK TABLE
		STORE		○		○		100	○			
		LOBBY		○		○		100	○			
		HEAD	○			○		100	○			
		SECRETARY (2)	○			○		100	○			NOTICE BOARD
		STAFF OFFICE	○			○		100	○			PARTITION (H=1,800)

BUILDING	FLOOR	ROOM NAME	FLOOR: VINYL TILE	FLOOR: CERAMIC TILE	FLOOR: CEMENT MORTAR	BASEBORD: CLEAR LACQUER ON WOODEN BOARD	BASEBORD: CERAMIC TILE	HEIGHT	WALL: A.E.P. ON CEMENT MORTAR	WALL: CERAMIC TILE	CEILING: ACOUSTICAL ROCK WOOL BOARD A.E.P. ON LIME MORTAL	GENERAL NOTES
	FIRST FLOOR	TEACHING LAB.	○			○		100	○		○	SINK
		STAFF OFFICE	○			○		100	○		○	PARTITION (H=1,800)
		SECRETARY	○			○		100	○		○	NOTICE BOARD
		HEAD	○			○		100	○		○	
		LIBRARY	○			○		100	○		○	
		STORE			○	○		100	○		○	
		RESEARCH LAB.	○			○		100	○		○	SINK
		COLD ROOM	○			○		100	○		○	
		PREP.	○			○		100	○		○	
		INST.	○			○		100	○		○	
		COMMON ROOM	○			○		100	○		○	SINK GAS TABLE

BUILDING	FLOOR	ROOM NAME	FLOOR: VINYL TILE	FLOOR: CEMENT MORTAR	BASEBORD: CLEAR LACQUERE ON WOODEN BORD.	BASEBORD: CERAMIC TILE	HEIGHT	WALL: A.E.P. ON CEMENT MORTAR	WALL: CERAMIC TILE	CEILING: ACOUSTICAL ROCK WOOL BOARD A.E.P. ON ASBESTOS BOARD	GENERAL NOTES
	SECOND FLOOR	LECTURE THEATER	○		○		100	○		○	ACCORDION DOOR
		SEMINAR ROOM	○		○		100	○		○	
		HALL	○		○		100	○		○	
	COMMON	LAVATORY		○		○	(H=1800)	○		○	
		CORRIDOR	○		○		100	○		○	
		STAIR	○		○		100	○		○	
		KETTLE ROOM	○		○		100	○		○	

TREAD: VARNISH ON WOODEN BOARD
RISER: OP ON STEEL PLATE
HANDRAIL: OP ON STEEL PIPE

SINK GAS TABLE

NOTE

WORK NO.

DATE

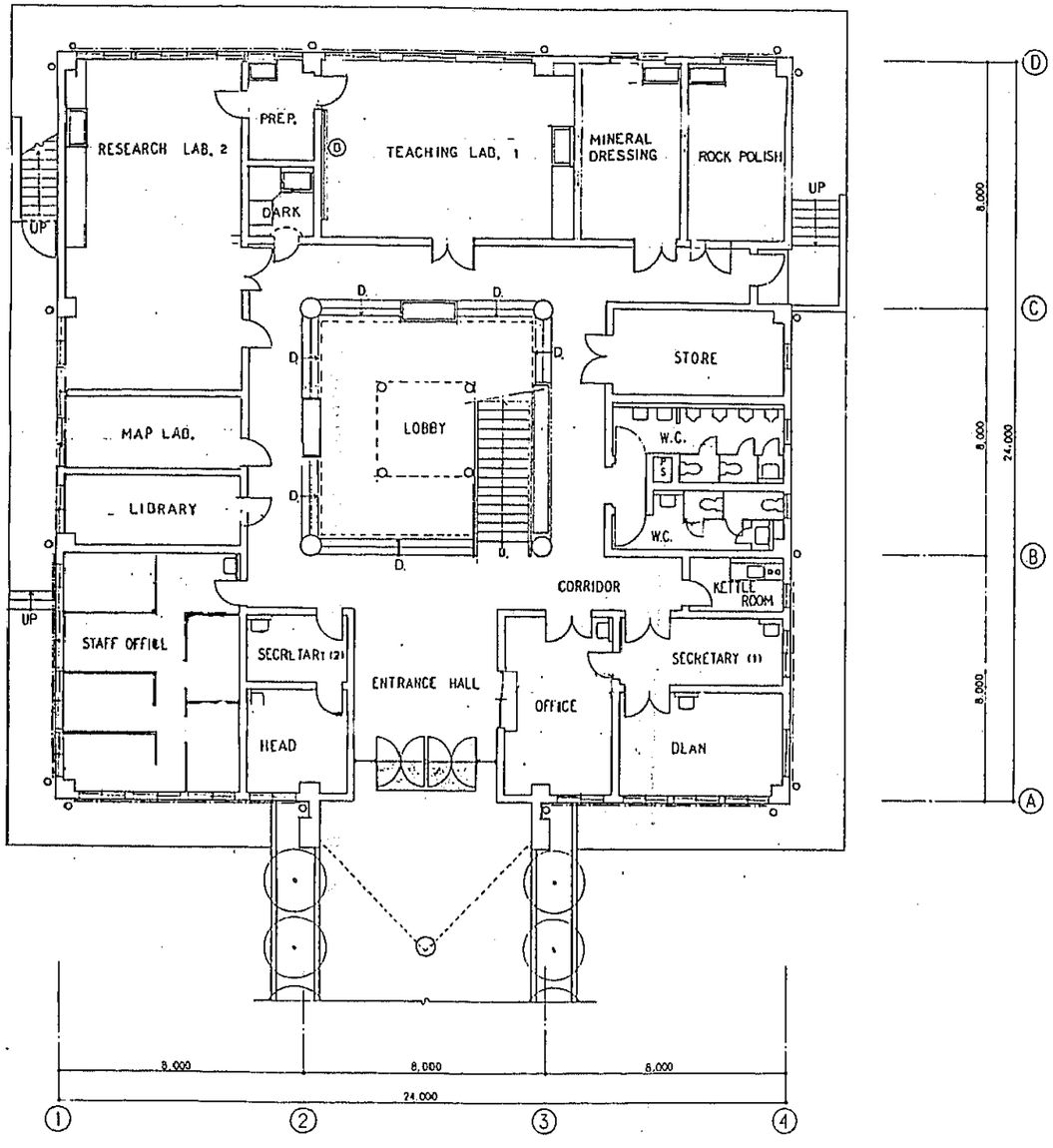
TITLE

APPROVAL

DRAWN

SCALE 1:5000 1:300

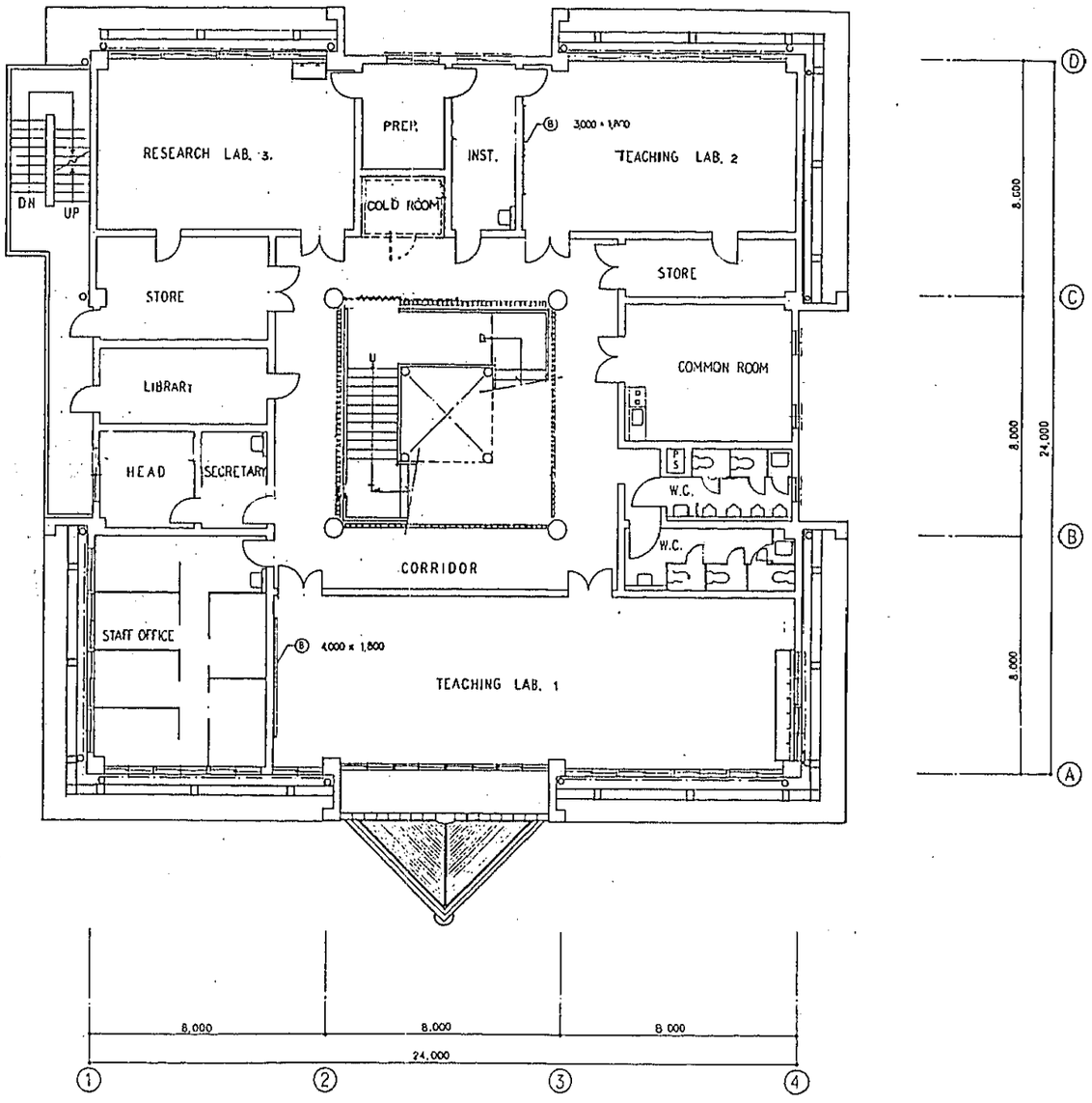
the Department of Geology



LEGEND: —— STEEL GRILLE

GROUND FLOOR PLAN S=1/100

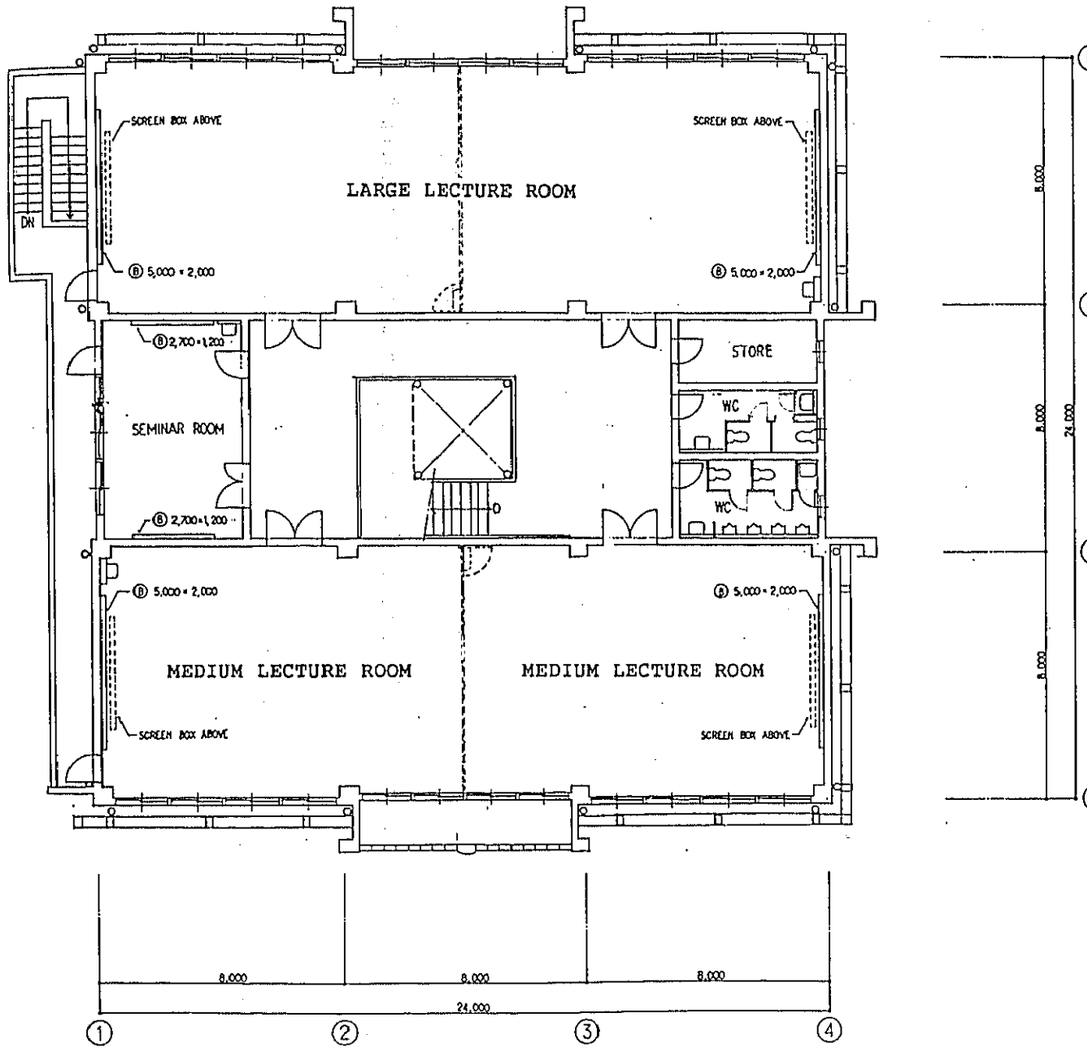
the Department of Biochemistry



LEGEND: Ⓑ BLACK BOARD

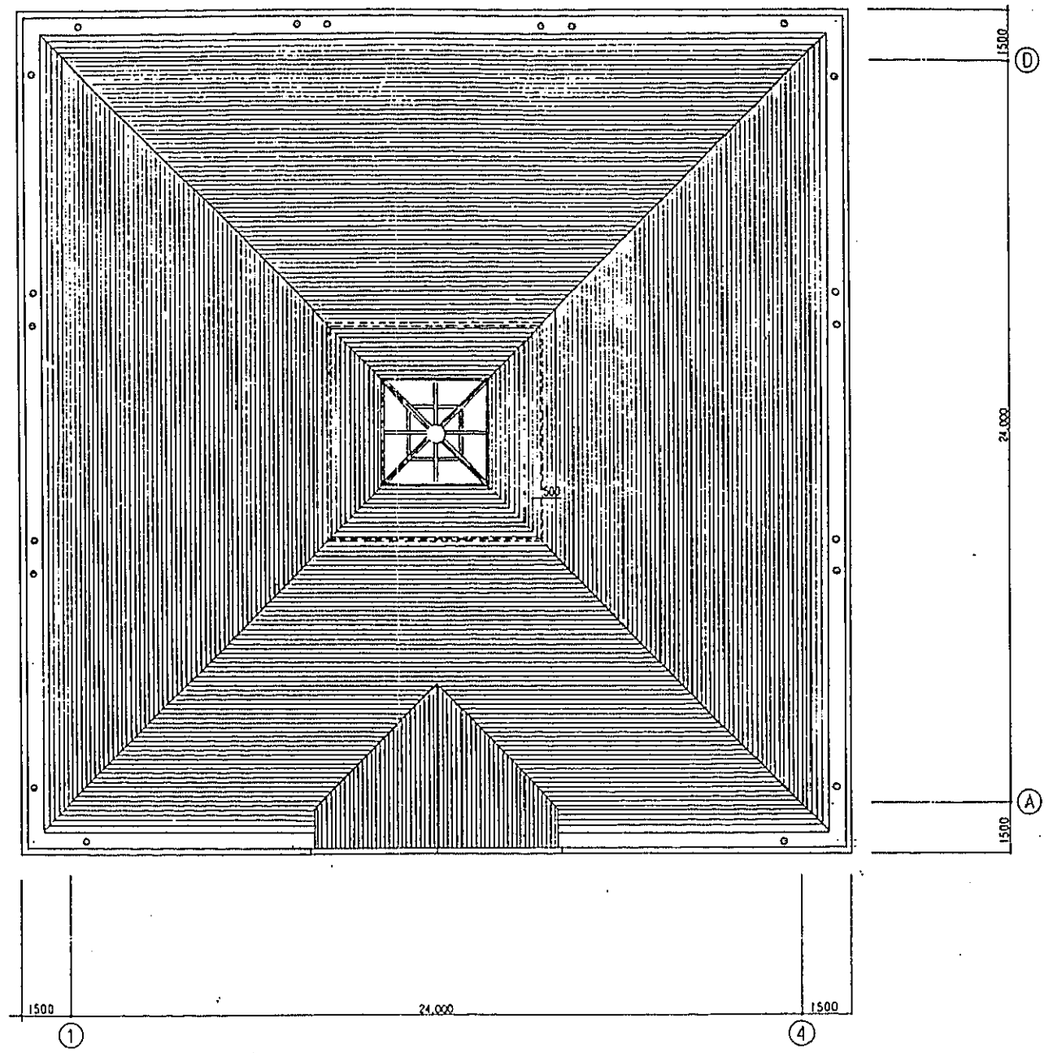
FIRST FLOOR PLAN S=1/100

NOTE		WORK NO.	DATE	TITLE
		APPROVAL / DRAWN	SCALE S=1:100	



LEGEND : Ⓑ BLACK BOARD

SECOND FLOOR PLAN S-1/100



ROOF PLAN S-1/100

NOTE		WORK NO.	DATE	TITLE
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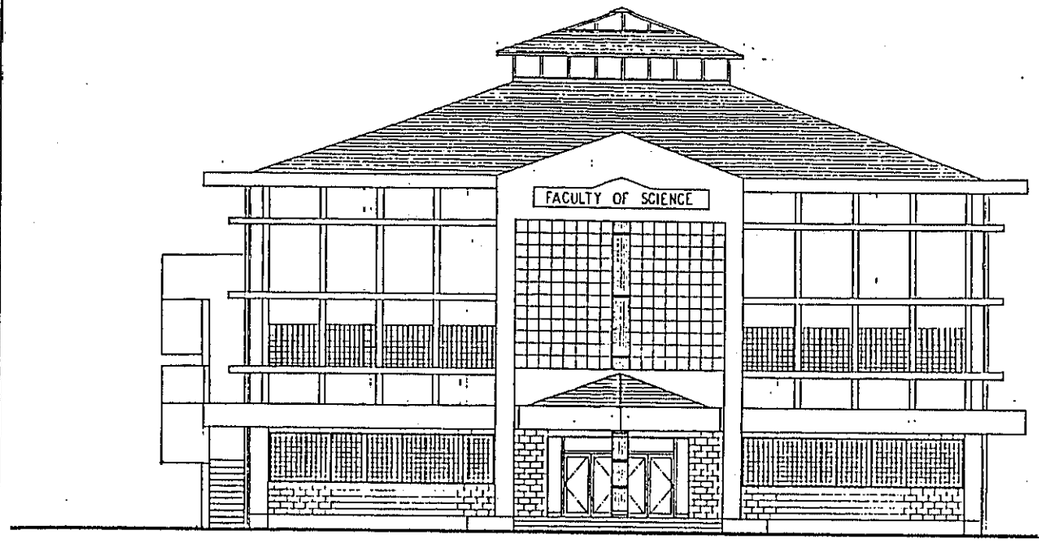
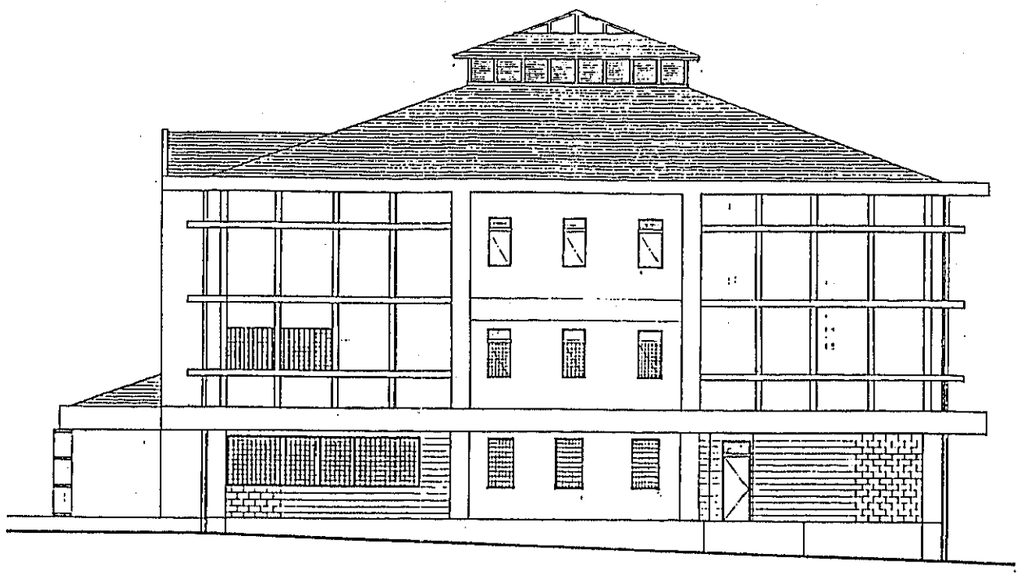


ELEVATION S-1/100



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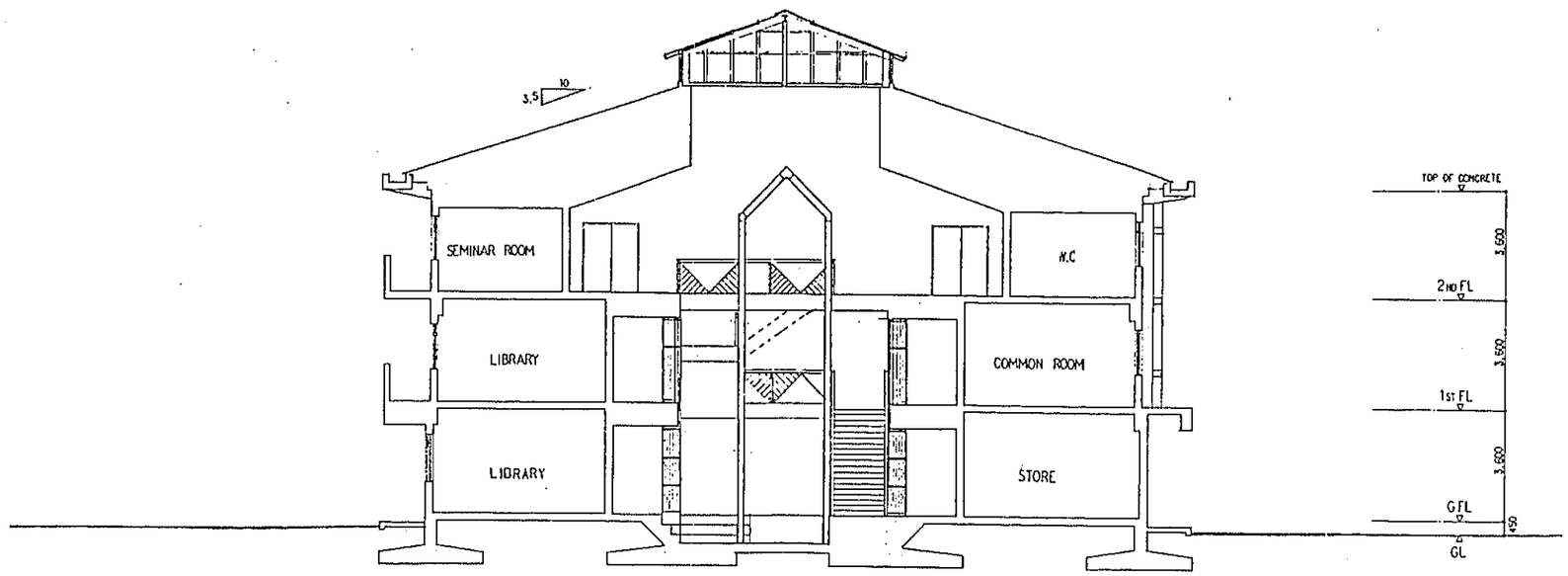

SECTION S-1/100

NOTE

WORK NO.	DATE	TITLE	
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4-4 Construction Plan

4-4-1 Construction Policy

1) *Execution system*

The Uganda execution body for the construction is Makerere University and is the contractor with Japanese consultant and construction company. Ugandan Finance Ministry takes charge of the procedures for exchange of notes to be exchanged between the both governments, arrangements with banks and tax exemption arrangements. Also, Kampala City Council is responsible for permission and approval of design and construction of the facility and for various inspections.

2) Project Execution Basic Items by Japan's Grant Aid Programme

This project is to be executed as follows in accordance with the Japanese grant aid programme.

(1) Exchanges of notes (E/N) will be concluded between Japanese and Ugandan Governments.

(2) A Japanese consultant recommended by the Japan International cooperation Agency (or JICA) will conclude the contract for detailed design and construction management with Makerere University, and after the contract is approved by Japanese government, the consultant will promptly start the detailed design.

It is necessary for Japanese consultant and Makerere University to discuss detailed design, tender, construction contract arrangement and construction in details and to fully adjust opinions.

(3) The consultant shall prepare all of detailed design and construction specifications, necessary for the construction, specifications for equipments and materials, tender documents necessary for tender and for contract with constructor and then get approval for them from Makerere University.

(4) The consultant shall advise the tender in news papers in accordance with the instructions of Makerere University, and select prospective bidders following the screening of the prequalification (P/Q) documents submitted by Japanese applicant for construction contractors and equipment and material supplier, and invite them to bidding on the project.

(5) Makerere University inspect the breakdown of the contract prices of successful bidders to check if prices are appropriate and then concludes the contract. The successful bidder shall start the contract job after the contract is approved by Japanese government.

(6) ugandan Government shall demolish existing buildings, fell threes, dig up roots and level the ground before the contractor starts construction so that the construction will not be influenced by them.

(7) The consultant shall start supervision of the construction.

3) Supervision by Consultant

(1) The consultant shall keep close contacts with Makerere University, authorities concerned, local consultant and constructor and do managements such as necessary confirmation, adjustment and recording so that the construction can proceed smoothly in accordance with detail design and specifications as scheduled, and also shall report the construction situations to both Ugandan and Japanese parties. The consultant shall also dispatch specialist of facility management to the site for confirmation and adjustment of the facility construction, if necessary. Also, the consultant shall issue certificate of completion at the end of each stage and get the approval from Makerere University.

(2) The consultant shall send specialist of equipment and material to the site when equipments and materials are delivered to the site. When equipments and materials are delivered to Makerere University, items and quantities are confirmed at the presence of parties concerned by collating them with written evidence, and the consultant shall issue the certificate of delivery completion and get approval from Makerere University.

4) Field where Local Consultant is Utilized

(1) Local consultant shall enter into a contact with the Consultant and check and approve detail design and specifications so that they can be approved the Republic of Uganda.

(2) Makerere University shall apply construction approval to Kampala City Council, and when the Consultant is asked by divisions concerned examining the application for Kampala City Council and fire department for explanation on the application drawings, the local consult shall assist the Consultant.

(3) When the Consultant is in management and thinks it necessary to discuss with Kampala City Council or fire department and necessitates the local consultant, the local consultant shall assist the Consultant.

5) Roles of Japanese Constructor

(1) The Japanese constructor shall be the general contractor and execute the construction works.

(2) The constructor shall send his representative to the field, and the field representative shall always report the progress of the construction to the Consultant. When some problem occurs, the field representative shall solve the problem in accordance with the Consultant's instructions and proceed with the construction.

(3) The field representative shall keep close contacts with parties concerned and pay sufficient attention to plan control, safety control, quality control and material control. Since some materials and equipments have been procured from Japan, local engineers may hardly manage to handle them by themselves and, if necessary, Japanese engineers shall be dispatched to the site.

6) Utilization of Local Constructor

(1) Local constructor shall execute the construction work under the contract concluded with the Japanese constructor.

(2) Local constructor shall display their power sufficiently and construct quality building in accordance with instructions of field representative of the Japanese constructor.

7) Equipment and material Supplier

Japanese equipment and material supplier shall procure equipments and materials satisfying the specifications and delivery them to Makerere University within the specified period. At that time, the suppliers shall provide Makerere University with explanatory lecture on operation, maintenance and repair and, in return, receive receipt and certificate of attendance to the explanatory lecture from Makerere University.

4-4-2 Construction Situation and Precautions on Construction

1) General Construction Situation

(1) Building

① High Rise Building

In Kampala city, there are Kampala Sheraton Hotel (14 stories), Uganda National Bank (16 stories), Uganda Commercial Bank (14 stories) and a building not completed and suspended. Other buildings are mostly of 2 or 3 stories.

② Building Design

Since constructors of advanced countries such as Switzerland and UK have designed and constructed such buildings in this country, buildings of various designs can be seen. There stand buildings of various designs in the campus of Makerere University, some of British traditional design and some of modern design.

③ Roof

Large buildings have flat roofs, and the roofs of new buildings are of water-proof sheet exposed type. Some old buildings face leak of rain water. Even if water leaks, it is difficult to get waterproof materials in Uganda, and buildings can hardly be repaired.

General houses and small buildings have gable roofs and are covered with corrugated asbestos-cement sheet, corrugated galvanized iron sheet or roof tile and roof slope is usually more than 45°.

④ Most houses are covered with roof tile and seem to have inherited the tradition of UK ruling days. Outer walls are white plaster, and the roofs are roof tile of brick color. It rains a lot in this country, and houses have long eaves which are also effective to shade fierce sunlight. Some houses have eaves troughs but others do not.

(2) Building Code

In the Republic of Uganda, none of the building codes currently used has been instituted on its own account. For this reason, both local building consultants and Kampala City resort to the British Standards and also the Public Health enforced at the times the country was a colony of England. However, for any building which will be constructed on a foreign aid, Kampala City will grant a building permit to the building designed in conformity to the building code of the country which will provide a grant aid. Therefore, this Project will be subject to Japan's related building codes. For information, the construction permission affairs for buildings to be erected within Kampala City are steered through discussions by the Deliberative Council of Kampala City as the core body plus the City's official responsible for Chief Planner, the City's engineers, fire stations, and the Land Office.

(3) Construction Method

There are scarcely wooden buildings, and small buildings are made of brick and concrete. Large buildings are mostly of rigid-frame structure and have partitions and outer walls of brick. Gable roofs are mode of wood. Kampala has the temperatures from 22 to 24°C throughout a year, and the appropriate wind blows. So, no forced cooling is required. General houses have a ventilating opening in the ceiling, perforated bricks in the wall or openings covered with metal nets to make houses airy.

(4) Consultant

In Uganda, consultants are specialized separately in design, structure, equipments and estimation to separate companies. Generally, design consultants take the lead in forming teams for effective consulting.

(5) Construction Work-related Traders

There are about 170 traders in relation with construction works including large and small and also foreign businesses from Europe.

(6) Equipments and Materials for Construction

This matter is explained in Paragraph 4-4-5 and be omitted here.

2) Precautions on Construction

In Chapter 4-3, we have explained the basic plan in view of the general construction situations in Uganda, and in this paragraph, we point out some precautions on construction taking into account the singularity that the facility is constructed in the campus of existing university.

(1) It is necessary to draw up construction plan including temporary installation plans so that the daily activities in the campus are not influenced, and also to take safety measures for third parties.

(2) When materials for construction are carried in and out, traffic controllers should be posted at the entrance gate and at the site entrance in relation with the above, and also necessary measures should be taken to protect third parties from inconvenience and to protect asphalt pavement in the campus from traffic of heavy vehicles.

(3) Distribution method and connecting method of water-supply and draining pipes shall match the existing ones, and the construction should be executed not to cause troubles to operation of the existing facilities after sufficient discussions are made among parties concerned.

(4) Since the construction period is rather long judging from the local construction situations (shortage of advanced construction machinery), the construction necessitates appropriate guidance by officials dispatched

from Japan and construction plan including careful temporary work schedule to shorten processes and to rationalize the construction.

(5) Since provisions of local construction-related authorities such as the Construction Ministry, Kampala City Council and fire department require inspection by local officials in charge at the end of each construction stage, close communications with these authorities are necessary.

(6) In relation with the Paragraph (2) and (3), careful surveys are necessary before commencement of the construction to prevent damage to existing pipes buried under ground.

(7) Uganda has rainy seasons in March to May and in September to November, and in relation with the Paragraph (4), no earthwork and fundamental work should be conducted during the rainy seasons.

4-4-3 Undertakings of Both Governments

In the execution of the project by the grant aid of Japanese government, the whole project is undertaken by Japan and Uganda Government as shown in Table 4-8.

Table 4-8

The portion undertaken by Japan	Portion undertaken by the Republic of Uganda
1. Building works Structure and finish. 2. Electric equipment-related works Power receiving transformer, Power and trunk lines, Electric lamp, plug socket, Private telephone, Broadcasting equipment and lightning conductors 3. Water-supply, draining, sanitary and ventilating equipment Water-supply equipment, draining and ventilating equipment, sanitary equipment 4. Outdoor construction works Walkway in the campus, outdoor lamps 5. Education and office equipments Laboratory equipment, field survey equipment, audio-visual equipment, vehicular equipment, office equipment 6. Furniture for teaching use Educational furniture	1. Building works *Demolishment of existing building in the site* 2. Ground leveling Felling of existing trees, Digging up roots and leveling ground 3. Outdoor works Gardening, planting 4. Infrastructure lead-in wire connection Telephone 5. Fixtures Curtain, blind, general furniture, portable fire extinguishers. 6. Others Fee for confirmation application, Boring survey, Surveying, Customs clearance of unloaded cargo and tax exemption arrangements 7. Expenses for maintenance, management and operation

4-4-4 Supervision Plan

The Consultant shall understand the meaning of the basic design, and, in accordance with the policy of grant aid project of Japanese Government, shall for a consistent project team for preparation of detial design and specification and for management, adjust opinions of parties concerned and make efforts to smoothly complete the facility.

The Consultant shall dispatch competent resident engineer to the construction site at the stage of construction management to let them provide guidance for the construction and keep close communications and also dispatch special engineers to the site for short periods at the times of its necessity in the progress of the construction for inspection, witnessing and guidance of construction.

1) Major Policy of Supervision Plan

(1) The Consultant shall keep close contacts with and report to authorities concerned of the both countries and officials in charge so as to complete the construction without delay in accordance with the construction plan.

(2) Since the facility should be constructed faithfully to design drawings, the Consultant shall provide parties related to the construction with appropriate and prompt guidance and advice.

(3) The Consultant shall examine to adopt local materials and equipments as many as possible keeping it in mind that construction and production industries should be brought up in this country.

(4) The Consultant shall try to transfer technologies such as construction methods and construction technology to this country by raising effects of the grant aid project.

(5) After completion of construction and turnover of the facility, the Consultant shall provide with appropriate advice and guidance for maintenance so that the facility can be smoothly operated.

2) Details of Supervision Works

(1) Cooperation for Construction Contract

Selection of constructor, decision of the concluding method of construction contract, preparation of construction contract draft, investigation of construction contract detail and witnessing conclusion of construction contract.

(2) Inspection and Approval of Construction Drawings

Inspection of construction drawings submitted by the contractor, material, finish sample and equipment.

(3) Guidance of Construction

Examination of construction plan and process, guidance to the constructor, and report of construction progress to the owner.

(4) Cooperation of Payment Approval Procedures

Cooperation in examining details of debit note of construction cost to be paid during the construction and after completion of the construction and for the procedures.

(5) Witnessing at Inspection

The Consultant shall inspect piecework at each stage of the construction and provide the constructor with guidance. After completion of the construction, the Consultant shall confirm that the contract conditions have been satisfied, witness the turnover of the contract object, get receipt and approval from the owner and then finish the whole work. In addition, the Consultant shall report necessary items concerning construction progress, payment procedures and turnover after completion to officials concerned of Japanese government during the life of this project.

3) Management of Construction Site

The constructor shall dispatch the following Japanese engineers to the site as a rule:

(1) Field residents

① One field representative (construction Manager)

② One building engineer

③ One office worker

(2) Short-term field attendants

① Two equipment engineers

② One building steel frame engineer

③ One sash engineer

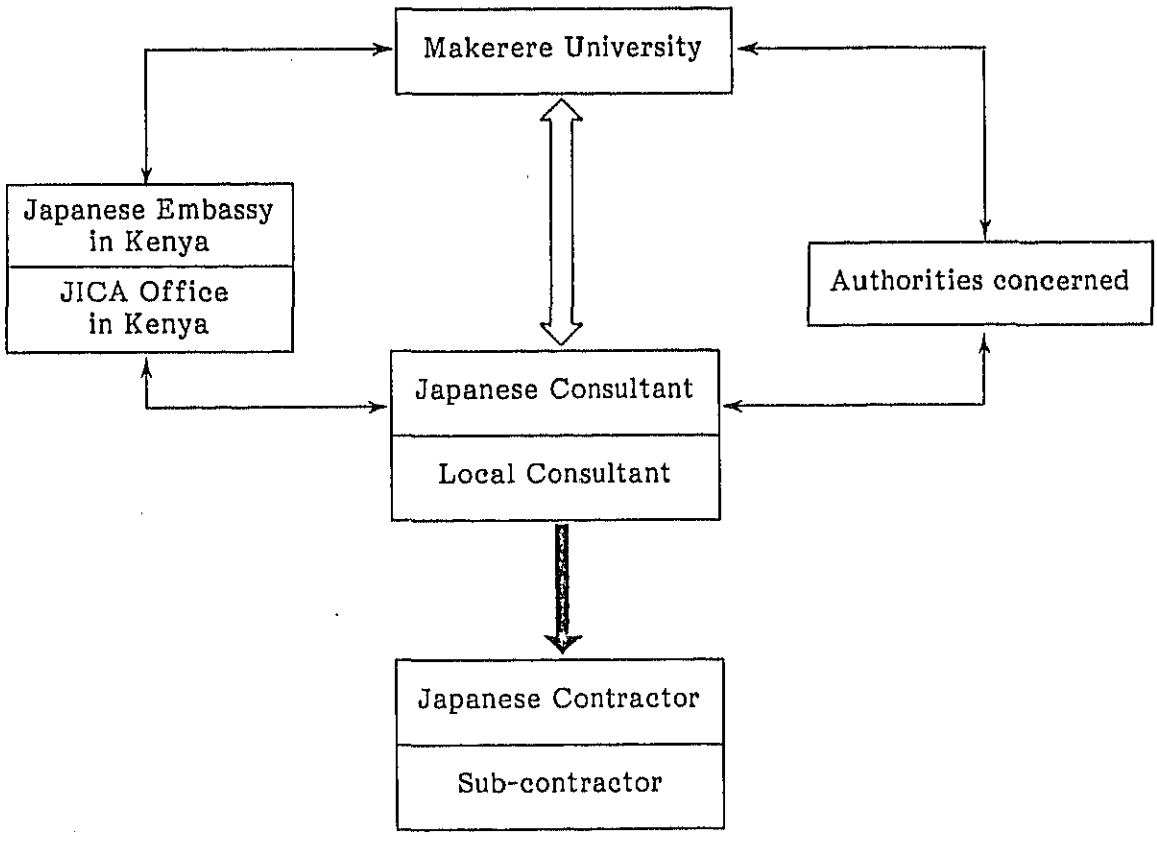


Fig. 4-8 Construction Management System

4-4-5 Procurement Schedule of Equipment and Material

The following explanation is based on procurement of materials in Kampala, the Republic of Uganda.

1) Equipment and Material for Building Purpose

(1) Building Materials

It is possible to procure sand, gravel, cement, etc. for structure constantly in Kampala City. Steel materials such as reinforcing bar and steel frame are locally produced by certain steel mills, but most of them are imported from Kenya. But they are poorly supplied in general and are more expensive than in Japan. Finishing materials produced in Uganda are block, brick and timber, and others are imported from Kenya and Europe. However, their quality is inferior, the supply is not sufficient, and delivery is delayed almost all the time. Metal fittings, glass, water-proof material, backing plywood, roof single are hard to get and are very expensive. Since such are the situations in Kampala City, materials necessary for the construction shall be procured in Japan and brought to Uganda.

(2) Construction Machinery

Advanced construction machinery cannot be procured locally. Concrete mixer to produce ready-mixed concrete, vibrator, truck cranes for concrete placing and for steel work, welder and construction wagon are available by lease. But electric reinforcing bar cutter and electric reinforcing machining unit can not be procured locally and man-power machining takes considerable delivery time. so, they shall be procured in Japan.

2) Electric Equipment

Distribution board, luminaire, electric wire, cable glant, etc. are partially imported from Kenya and produced locally. Welder and rust preventive treatment are inferior in quality. Also, telephone and light electric appliance

are difficult to get there. Therefore, electric equipment shall be procured in Japan.

3) Machinery and Equipment

PVC pipe, sanitary arrangements, elevated tank are imported from Kenya, but model and quality are not satisfactory. They are poorly supplied and cannot be delivered constantly. Therefore, machinery and equipment shall be procured in Japan.

Supply situation per material is as follows:

Table 4-9 Supply Situation per Material

Material	Locally procured	Procured in Japan	Procured in third country	Remarks
1. Sand, gravel	○			
2. Cement	○			Mostly from Kenya
3. Timber	○			Mostly cedar and mahogany
4. Reinforcing bar		○		Available in Kenya but expensive and poorly supplied.
5. Steel frame		○		ditto
6. Block, brick	○			
7. Tile		○		Poorly supplied.
8. Wooden fittings	○			
9. Metal fittings		○		Available in Kenya, but of poor quality.
10. Glass		○		Available in Kenya, but expensive.
11. Water-proof material		○		Hard to procure.
12. Backing plywood		○		Production is suspended in Uganda and available in Kenya but of poor quality.
13. Roof single		○		Hard to procure.
14. P tile		○		Poorly supplied and expensive.
15. Ceiling board		○		ditto
16. Paint		○		Of poor quality and poorly supplied.
17. Other hardwares		○		Inferior in quality
18. Distribution board		○		Available in Kenya, but of poor quality and poorly supplied.
19. Luminaire		○		ditto
20. Telephone		○		Hard to procure.
21. Electric wire, cable glant		○		Of poor quality and poorly supplied.
22. Wiring accessories		○		ditto
23. Transformer		○		Hard to procure,
24. Light electric appliance		○		ditto
25. PVC pipe		○		Available in Kenya but of poor quality and poorly supplied.
26. Sanitary arrangements		○		ditto
27. Elevated tank		○		ditto
28. Pump		○		Hard to procure

4-4-6 Inland Transportation Plan

1) Transportation Route

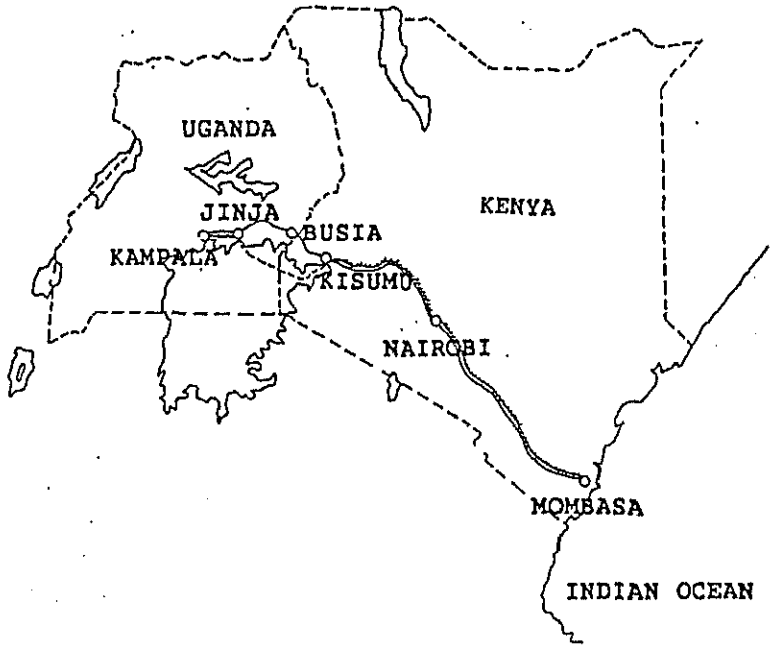


Fig. 4-9 Inland Transportation Route

The following two inland transportation routes are considered from the transportation of materials procured in Japan.

A. Transportation by truck (Mombasa - Narirobi, - Kisumu - Busia - Jinja - Kampala)

B. Transportation by rail (Mombasa ⫲ Narirobi, ⫲ Kisumu ~ Jinja ⫲ Kampala) (~ denote ferry)

Transportation by rial (B) is not reliable because the service availability is not sure, and they do not use rail for transportation of material excluding any special case, and they usually transport them by truck. The transportation period is calculated as bout 70 days from the delivery to packing yard to the delivery at site (as shown in Fig. 4-10).

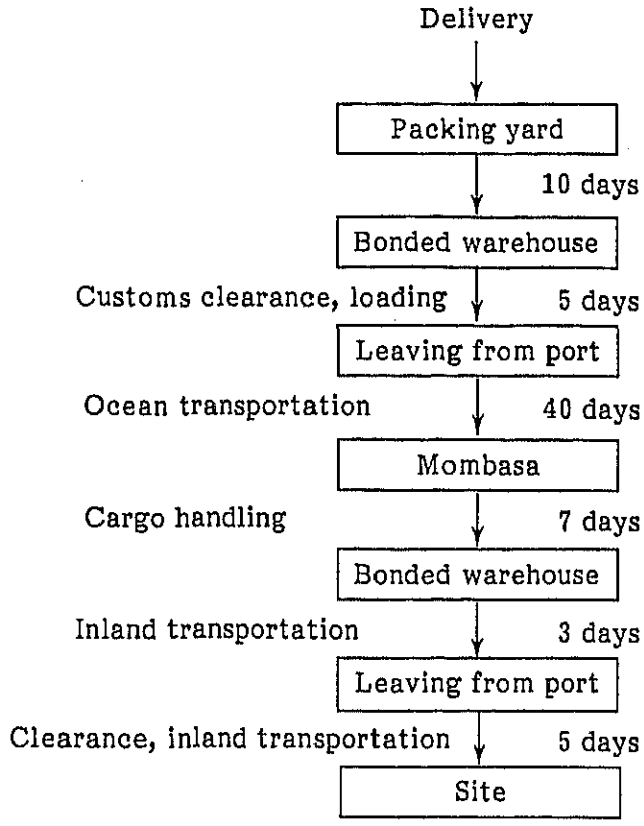


Fig. 4-10 Number of Days Necessary for Inland Transportation

2) Study of Packing Style

Cargoes occasionally encounter pilferage during the inland transportation to Kampala, the capital of the Republic of Uganda through the Republic of Kenya, and building materials other than reinforcing bar and steel frame are containerized in general. Therefore, it is now planned to containerize all materials procured for this project in Japan other than reinforcing bar and steel frame.

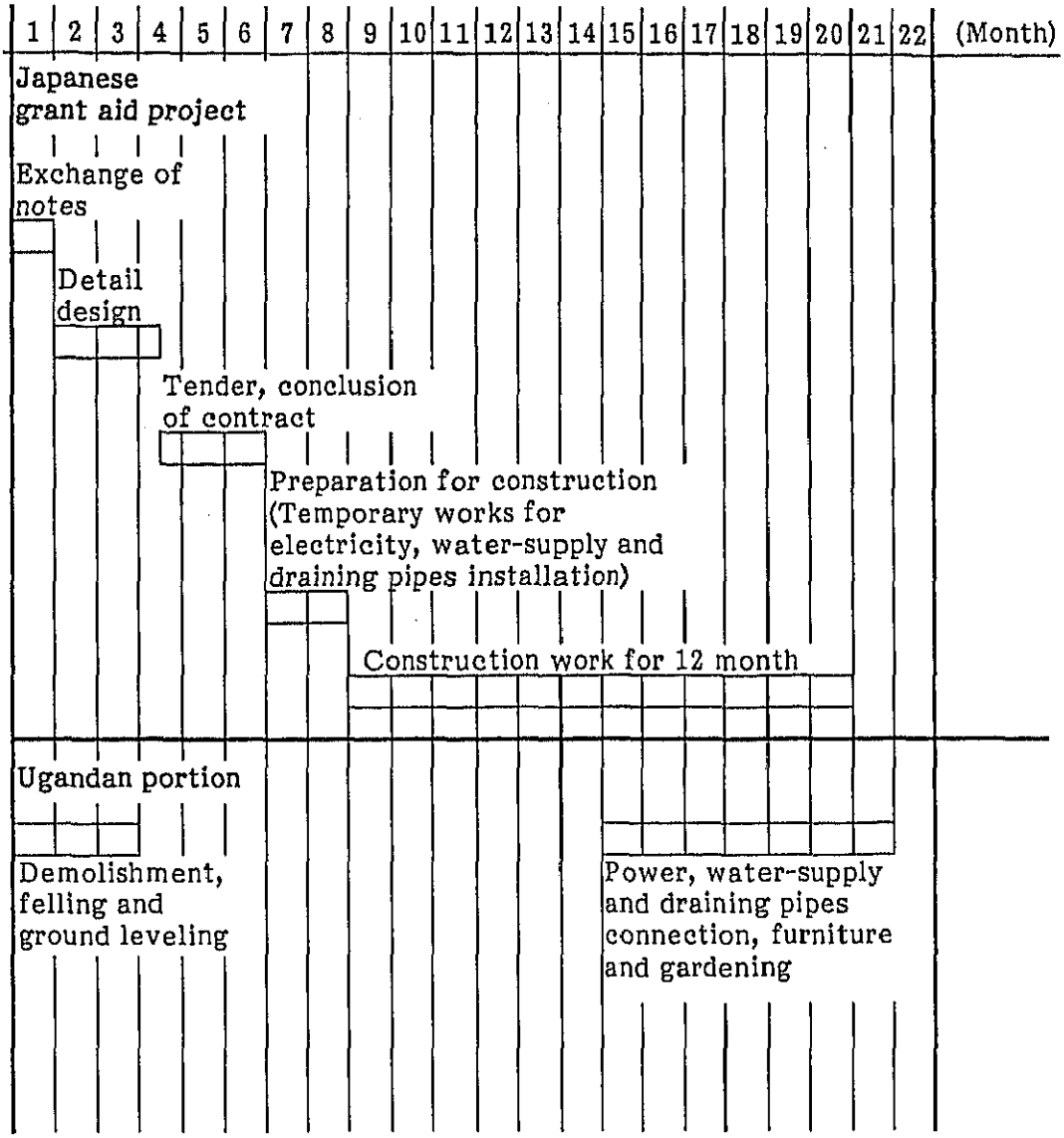
4-4-7 Execution Schedule

When this project is executed in accordance with the procedures for grant aid of Japanese Government, the following schedule shown in Table 4-10 can be considered.

1) The construction period is considered to be 12 months.

2) Detailed discussions will be necessary to match the schedule with the one of Ugandan portion as the project proceeds. It is recommended that the Ugandan portion will proceed in parallel with this schedule.

Table 4-11 Whole Flowchart



4-4-8 Approximate Estimate of the Project Costs

1) Calculating Conditions of Approximate Estimate of the Project Costs

The followings are the preconditions for calculating the approximate estimate of the project costs.

①	Time of calculation	:	September, 1989
②	Foreign exchange rate	:	US$1 = ¥140.44 (USH1 = ¥0.702)
③	Construction period	:	12 months
④	Material procurement	:	As per 4-4-5 Procurement Schedule
⑤	Constructor	:	Construction company of Japanese nationality
⑥	Others	:	Exemption of import duty on equipments and materials used for the construction at the size, business tax and value-added tax levied on the Japanese construction company within the range of grant aid project of Japanese government.

2) Approximate Estimate of the Project Costs Borne by Uganda

The burden to be borne by Uganda amounts to about US$35,600 (infrastructure lead-in wire connection and ground leveling, etc.).

SECTION 5 EFFECT OF THIS PROJECT AND CONCLUSION

5-1 Effects from Execution of this Project

5-2 Conclusion

SECTION 5 EFFECT OF THIS PROJECT AND CONCLUSION

5-1 *Effects from Execution of this Project*

Social and economic benefits expected for the extension of the department of science can be divided into direct effects and indirect effects as follows:

1) Direct Effects

(1) Increase of Educational Opportunities

At present, the departments of biochemistry and of geology and the dean's office of faculty of science are housed in the building of the departments of mathematics and of botany. So, this project is intended to shift the former two departments to a new separate building and, at the same time, to install a large and a medium lecture rooms with larger seating capacity than the existing ones' so that the university can increase the number of students of the departments of biochemistry, geology, mathematics, botany, and other departments. The department of biochemistry can increase the current number of new students (15) to 50, the planned number for 1992. The department of geology can also increase the current number of new students (20) to 30, the planned number for 1992. However, though the department of mathematics has the plan to increase the current number of new students (120) to 360 in 1991, to 400 in 1992, to 450 in 1993 and to 500 in 1994, the maximum number of new students is 365 due to the space available for the department. So, they should revise the planned numbers downward or manage to secure additional space.

(2) Improvement of quality of Education of Biochemistry and Geology

At the same time of expansion of building, this project is planned to supplement insufficient science education materials by grant aid. This enables the departments of biochemistry and of geology to provide education and conduct experiments which are not available now, and they can expect to realize wider and higher education than those they can get at preset.

(3) Improvement of Quality of Education of Other Departments Related with Biochemistry and Geology

Biochemistry is also taught to students of the medical faculty, the faculties of veterinary medicine, agriculture, and science (the departments of zoology, botany, and chemistry). Geology is also taught to students of the department of civil engineering of the faculty of technology and of the department of geography of the department of Arts. Therefore, the improvement of the quality of biochemistry and geology can be expected to automatically improve the quality of education of other related faculties and departments.

(4) Improvement of Quality of Research

It is now planned to install educational materials for students of biochemistry and geology, and this means to reinforce the current insufficient research installations as well. Therefore, this plan is expected to improve the quality of researches conducted at the both departments.

2) Indirect Effects

(1) Recovery of Education Level of Makerere University

Civil war destroyed facilities, educational materials and research installations of Makerere University. This lowered the education level at the age of former East Africa University. This project is intended to expand and improve the function of the faculty of science attracting many students. If the education quality of the faculty of science recovers, the education level of the whole Makerere University will be led to recover as it serves as the motive power.

(2) Development of Industries Based on Biochemistry and Geology

Biochemistry is the basis of such industries as medical industry, pharmaceutical industry, agriculture, animal industry, food industry, brewing industry and drinking water industry, and geology is the basis of such industries as government's geological survey and mineral resources

development division, water resources development division, mining industry, cement industry and brick manufacturing industry. Since these industries try to produce materials in the country, improve quality of products and discover crude oil resources, they need many talents studies biochemistry or geology. This project will make it possible for the university to produce much more students, and this will lead to further development of these industries.

5-2 Conclusion

The purposes to expand the faculty of science and of the science education materials improvement plan are to bring up many talents acquired science and engineering technology necessary to restore and promote the economy of the country destroyed by civil wars, to increase the student accommodation of the faculty of science of Makerere University which plays important role of national science and engineering education by expanding the building and to improve the education level by reinforcing educational materials for science.

After the facilities are established, the departments of biochemistry and geology will return the currently occupying space to the departments of botany and mathematics, and these four (4) departments can increase respective student accommodation by far.

For the departments of biochemistry and geology necessary to promote the growth of the national economy, educational materials for science are reinforced, and they will be able to provide more replenished education than ever.

This new facilities are used not only by students of the departments of biochemistry and geology to take lectures but also by students of other faculties and departments to study the same subjects. So, students not only of the faculty of science but also of other faculty are beneficiaries of the facilities and educational materials, and the facilities will bring about great effects.

Since this free financial cooperation serve to bring up many talents necessary for restoration of the Ugandan economy destroyed by civil wars by constructing the facilities and supplying them with science equipments, the adequacy of this grant aid project will be fully acknowledged. And the execution is very meaningful and will bring about great effects to this country.

The Republic of Uganda has the system to operate and manage the project and has sufficient fund, having no problem in the operation. If the following points are improved, this project will be executed more smoothly and more effectively.

1) It is recommended that, in response to the student increase plan, the university shall promote a teacher training plan to further extent so that the number of teacher will reach the number limit as soon as possible.

2) it is recommended to secure repair engineers of equipment and materials so as to utilize the equipment and materials supplied effectively.

3) Since many theft cases occur in Uganda, it will be necessary to take proper measure (to set Grille on windows of the ground and 1st floors, set keys at necessary locations and post guards) for this project facilities.

4) Since the Republic of Uganda wishes to have technical tie-up in relation with this project, the both countries are expected to study the matter together in the future.