

DECLARATION

This Thesis is my Original Work and has not been presented for a Degree in any Other University.

NAME OF AUTHOR

KAMAU J. G. NJENDU, B.A. (ARCHITECTURAL STUDIES)

SIGNATURE-----

K. J. G. Njendu.

This Thesis is submitted in part fulfilment of an examination for the award of a Master of Architecture Degree of the University of Nairobi.

CHAIRMAN, DEPARTMENT OF ARCHITECTURE,
UNIVERSITY OF NAIROBI.

SIGNATURE-----

JUNE 1978.

UNIVERSITY OF NAIROBI LIBRARY



0238975 7

CONTENTS

	<u>Page</u>
Acknowledgements-----	1
Abstract-----	3
Map of Major National Road Links-----	5
Introduction-----	6
Brief-----	10
Site Analysis-----	16
Environmental Analysis-----	23
General Approach to Planning-----	29
Schedule of Materials and Finishes-----	37
Schedule of Accommodation-----	39
Bibliography-----	45

Important Note

This Thesis is to be read in conjunction with the drawings related to this subject -

"CENTRAL COUNTRY BUSES' TERMINUS - MOMBASA".

ACKNOWLEDGEMENTS

The Author's thanks and gratitude are extended to the following people and organizations who have greatly contributed to the success of this project.

- My Tutors, Mr. Jim Archer, Dr. Denis Devaris, Dr. Erich Meffert and Mr. Ehsani whose devoted and kind guidance has been of great assistance.
- My fellow students particularly Mr. W. Kiarie, Mr. P. Nyanjui, Mr. R. Miano and Mr. R. Gathuku whose comments were of help to me.
- The Mombasa Municipal Council for all the material assistance received from them.
- Mr. Swaleh, Traffic Manager, Kenya Bus Services (Mombasa) for all his comments and kind assistance.
- Mr. Ian Situma, Traffic Engineer, Nairobi City Council for his assistance in traffic circulation considerations and for giving me access to his paper on Matatus in Nairobi.
- Mr. A. K. Soud, Chairman of the Mombasa Matatu Owners' Association for the helpful points he raised during the early stages of my research.
- Mr. Karugu, Station Manager, Kenya Airways and Mr. Wahome, District Traffic Manager, Kenya Railways for their enlightening discussion on the two main competitors of local travel.
- Mr. Tengia, Chief Architect, Kenya Railways for his advice on the proposed future extensions of the Railways whose site is next to my site.
- Mrs. Victoria Kamau for typing the manuscript.

- All others who have directly or indirectly contributed to the success of this project.

- Lastly but not least my parents, wife, son and daughter for their great moral support during my absence and period of study.

ABSTRACT

As well as being the second largest town in Kenya after Nairobi, Mombasa is the Capital town of the Coast Province. The Mombasa Island is the nucleus of Mombasa Municipality and centre of all types of business - Provincial, District and Civic administration; commercial activities; educational, health and recreational institutions; and shipping. The main link between Mombasa and other towns in the country is the Road Transportation.

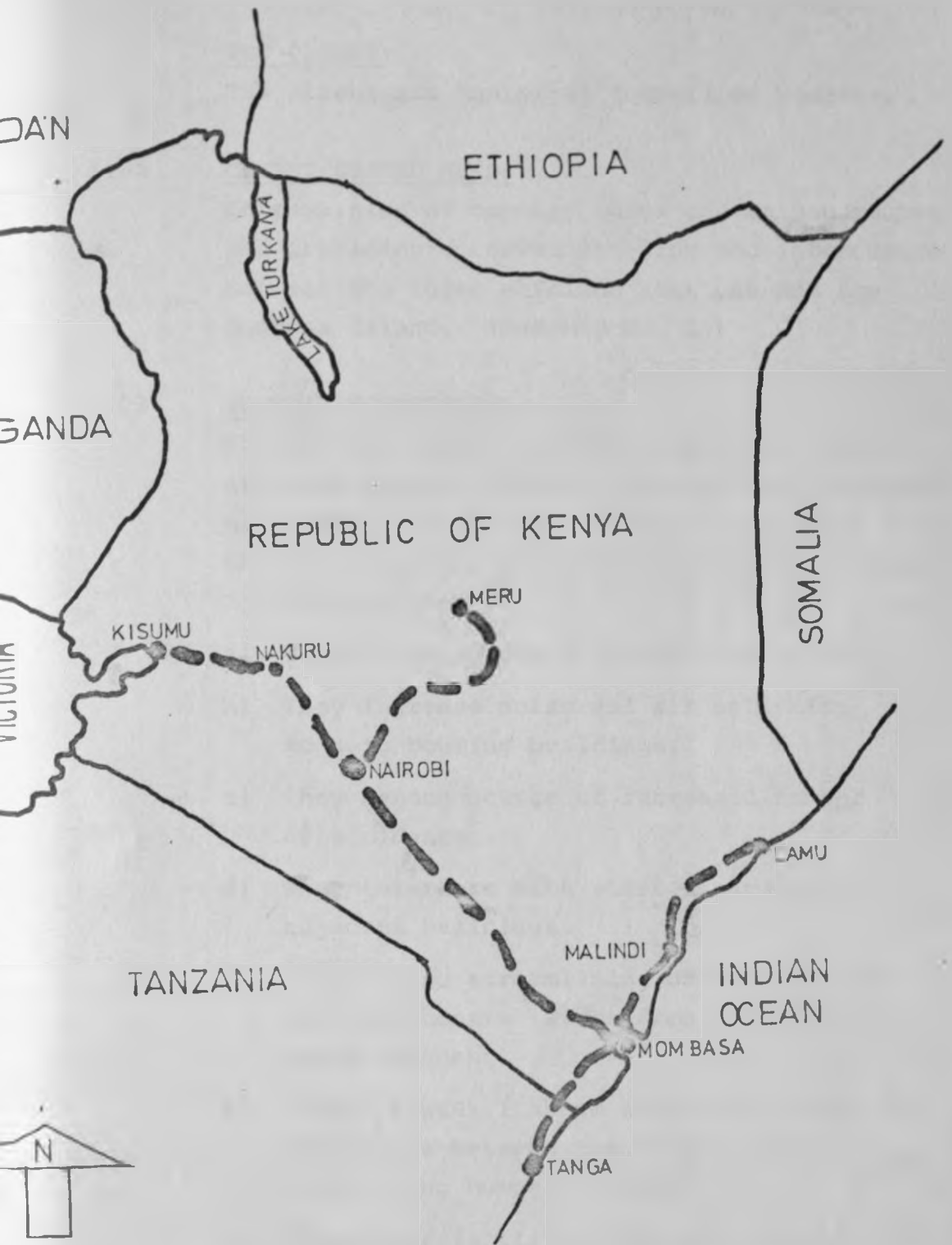
In Architectural terms, the road traveller into and out of Mombasa has not been afforded proper public road transportation facilities. An architectural solution to provide a passenger interchange and terminal is therefore called for. The Author has taken up the challenge and has aimed at providing an efficient road transit.

The Author in his solution has tried to provide a comfortable and aesthetically pleasing human transit environment. Open public spaces in the form of booking and waiting halls, restaurant and bar have been provided. Ample storage spaces for the travellers' luggage have been provided. Waiting facilities have been split up into two - a hall for longer waiting and short waiting along the main concourse.

The project being a public building project, the Author has provided an environmentally balanced solution with minimum support from mechanical devices. This is because cost considerations are important as the only possible financier is the Mombasa Municipal Council. This balance has been achieved by having most of the building "open", hence the structural system involved.

The project has been enriched by landscaping of the well vegetated area next to the building where it is hoped passengers could also be encouraged by the ground treatment offered to wait for their buses sitting in the open under trees.

Finally it gives the Author great pleasure to notice the very keen interest that the Mombasa Municipal Council has taken in this project, and it is his hope that the project will soon be realized in order to provide the road traveller with the facilities he has for so long been awaiting.



MAP OF MAJOR COUNTRY ROADS' LINKS

SCALE 1 6,000 000

1.00 INTRODUCTION

1.01 THE CLIENT:

The client are Municipal Council of Mombasa.

1.02 CLIENT STATED NEEDS:

Streamlining of country buses and matatu routes and providing a convenient link and interchange between the three mainland sections and the Mombasa Island. (See Map No. 1.)

1.03 IDENTIFIED PROBLEMS:

The present buses' and matatu termini arrangements are disordered. Termini for different companies are scattered and most of them arranged in a way that they narrow otherwise would-be-wide streets. The results are:-

- a) They cause nuisance to other motorists.
- b) They increase noise and air pollution to neighbouring buildings.
- c) They become source of increased number of accidents.
- d) They interfere with views of and from adjacent buildings.
- e) There is no streamlining of movement and the town centre is not free of country buses movement.
- f) There is weak linkage and interchange of passengers between the three mainlands surrounding Mombasa Island.
- g) Travellers facilities are poor and to some extent non-existent.

1.04. STATEMENT OF INTENT

All public service vehicles coming into Mombasa from the country-side are to be afforded convenient passenger interchange, arrival and departure facilities. Such facilities are to be well connected with the Central Business District and other transportation facilities - i.e. rail, town bus service, air terminus (not necessarily airport) and taxis.

It is intended therefore to provide a central terminus to meet the above needs.

1.05 THE SITE

The client have already acquired the land indicated on the site plan. They have however given liberty to the Author to explore the best solution in town planning and architectural terms, site not limiting. Land can be acquired (compulsorily if necessary) if a good solution so necessitates. In site development it is intended to look at the bounded area in detail.

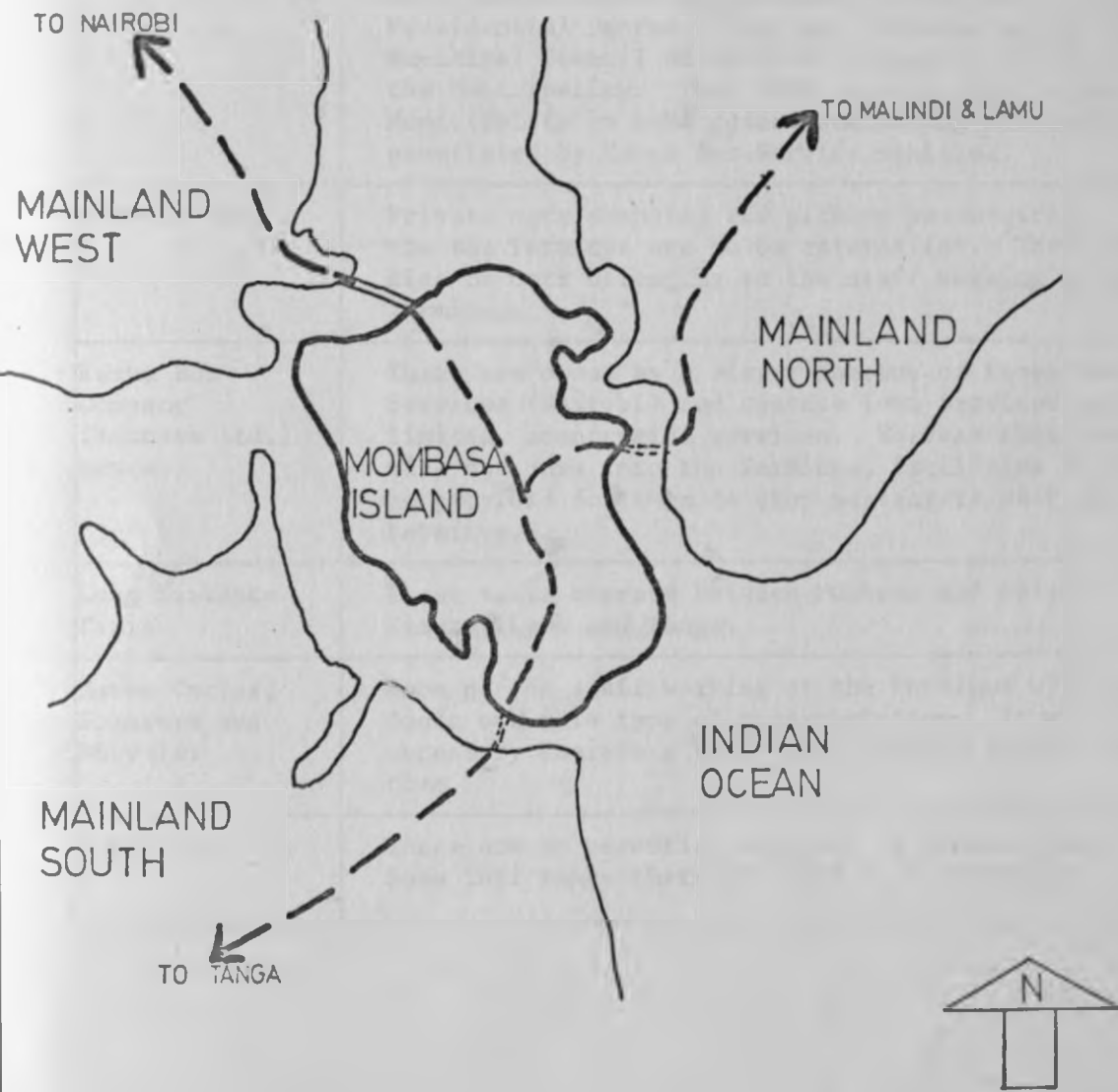
The site selected is satisfactory because:-

- a) It is well placed in a position where country buses and matatus can be easily re-routed to avoid cutting through residential areas, the town centre and CBD.
- b) It is in a mainly commercial area other than residential and institutional, hence acceptable as a non-nuisance noise zone.
- c) It is placed at a walking distance from the administration offices, shopping area, schools and even the Provincial General Hospital.

d) The site is in a position which has got a high landscaping potential, which is considered architecturally necessary for the intended focal environment.

e) The site is very well serviced with essential services - electricity, water, telephones, stormwater drainage, and there is proposed sewage line passing adjacent to the site.

f) The site is adjacent to the Railways terminal, about 600 metres from the Kenya Airways terminal Office and about 800 metres from the Town Bus services' terminus.



MAP NO 1: MOMBASA ISLAND & ITS SURROUND

2.01 DESCRIPTION OF VEHICLES TO BE ACCOMMODATED

Vehicle Type	Description
Long distance Country Buses	Licenced under the Trade Licencing Board, the buses operate express services to and from Nairobi, Kisumu, Meru and Lamu
Short Distance Country Buses	Also licenced under the Trade Licencing Board. Operate services within a radius of about 150 Kilometres.
Matatus	These are public service vehicles under 3 tons tare weight which operate under a May 1973 Presidential Decree. They are licenced by the Municipal Council of Mombasa to operate all over the Municipality. They also operate outside the Municipality in some cases penetrating areas not penetrated by Kenya Bus Service vehicles.
Private Cars	Private cars dropping and picking passengers at the Bus Terminus are to be catered for. There will also be cars belonging to the staff working at the terminus.
Kenya Bus Company (Mombasa Ltd.) buses.	These are owned by a sister company of Kenya Bus Services (Nairobi) and operate Town Services and limited countryside services. Whereas these buses will not come into the Terminus, facilities are to be provided for them to drop passengers near the terminus.
Long Distance Taxis	These taxis operate between Mombasa and Nairobi, Kisumu, Lamu and Tanga.
Motor Cycles, Scooters and Bicycles	Some of the staff working at the terminus will no doubt own this type of transportation. It will be necessary therefore to provide parking spaces for them
Hire Taxis	These are an essential services to the terminus. Some Taxi ranks therefore need to be provided

2.02 SUMMARY OF VEHICLE CENSUS
(CENSUS CARRIED OUT BETWEEN 6-9-77 AND 27/9/77
BY AUTHOR) - AVERAGE FIGURES LISTED FOR THE PEAK HOURS
6.00 A.M. TO 8.30 A.M.

DIRECTION FROM WHICH VEHICLES ARRIVED	COUNTRY BUSES	KENYA BUSES	MATATUS	PRIVATE CARS & VANS	OTHER HEAVY COMMERCIAL VEHICLES
MAINLAND WEST THROUGH MAKUPA CAUSEWAY	28	60	375	355	155
MAINLAND SOUTH THROUGH LIKONI FERRY	10	16	97	91	15
MAINLAND NORTH THROUGH NYALI BRIDGE	7	40	253	814	50
TOTAL	45	116	725	1260	220

2.03

SUMMARY OF ARRIVAL AND DEPARTURE TIMES

Source into or Destination from Mombasa		ARRIVAL TIMES INTO MOMBASA	DEPARTURE TIMES FROM MOMBASA
NAIROBI	BUSES	4.30 a.m. to 6.00 p.m. 7.30 p.m. to 9.00 p.m.	12.00 p.m. to 1.30 p.m. 7.30 p.m. to 9.30 p.m.
	TAXIS	1.00 p.m. to 12.00 midnight	7.30 a.m. to 6.30 p.m.
MERU & KISUMU	BUSES	Same times as for Nairobi buses	Same times as for Nairobi buses.
	TAXIS	Same times as for Nairobi Taxis	Same times as for Nairobi taxis.
LAMU	BUSES	Varying times between 8.00 a.m. and 8.00p.m.	Varying times between 6.00 a.m. and 4.00 p.m.
	TAXIS	Varying times between 8.00 a.m. and 6.00 p.m.	Varying times between 6.00 a.m. and 4.00 p.m.

Observation: There is need for the Proposed Terminus to run for 24 hours.

2.04 ANALYSIS OF NUMBER OF PUBLIC SERVICE VEHICLES
TO BE DESIGNED FOR:

1) BUSES

Buses recorded as entering Mombasa 6.00 a.m.
to 8.30 a.m. - 45 buses.

With 30 minutes allowance per bus, stalls
needed 10.

For every two of the ten long distance
buses allow one waiting stall - additional
stalls - 5.

Total number of stalls needed 15

- Projection growth for 10 years at
6% per annum after which buses could be
rescheduled or mini-termini introduced on
the 3 mainlands:

- Total stalls needed 27. (Source of
projection: Kenya Economic Survey -
1976 and 1977).

2) MATATUS

Allowing each Matatu 6 minutes waiting time
number of stalls needed - 30.

3) LONG DISTANCE TAXIS

For each of the 3 major long distance taxi
operators, allow 2 stalls.

Number needed 6.

2.05 DETERMINATION OF NUMBER OF PEOPLE TO BE HANDLED
BY THE TERMINUS

BUS-HANDLED PASSENGERS

Allow an average of 40 passengers per bus

Total Number of passengers - 1080

Assume 1/5 of them are escorted

Number of escorts 220

∴ Total No. Handled by	
Buses every 30 minutes	1300

2.05 MATATU AND TAXI-HANDLED PASSENGERS

(Cont.) Allow 10 passengers per matatu and 7 persons per
 long distance taxi - 342
 Allow 1 escort per 10 passengers
 (Most Matatu travellers are informal
 and may not need escorts) - 35
 Total 377 -
 say 380
 TOTAL NUMBER OF PASSENGERS & ESCORTS
 APPROX. = 1700

DETERMINATION OF CAR PARKING FACILITIES

PRIVATE CARS

For each of the escorts allow 1 car space for
 every 6 escorts.

Number of car parking spaces needed - 45

Allow 10 more parking spaces for staff

Total number of spaces needed - 55

TAXIS Allow for 10 taxis ranks.

SUMMARY DISCUSSION OF MOST ACCEPTABLE PARKING METHOD1) SUMMARY OF AREAS TAKEN UP BY VEHICLES (M²)

PARKING METHOD	BUSES (27)	MATATUS (30)	CARS (55)	TAXIS (10)	TOTAL
90°	2376	1764	1367	258	5765
45°	2700	2088	1595	286	6669
0°	5049	3168	2040	385	10642

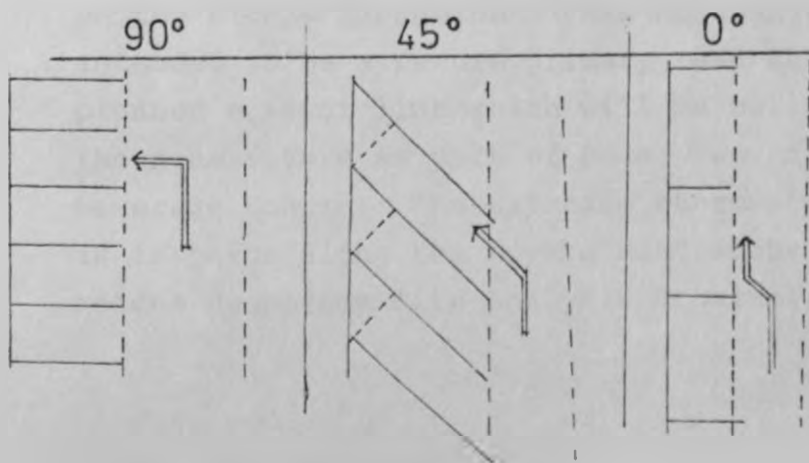
ii) b) DISCUSSION ON THE 3 PARKING METHODS

90° - This method takes the least area but vehicle manouvrebility into and out of the parking is not always easy.

45° - This method takes more area than 90° but a vehicle can be easily manouvred.

0° Though this would be the most efficient parking method for buses due to loading and off-loading, it is lavish area-wise and unacceptable where space considerations are concerned. It takes excessive areas.

It is clear therefore that the most acceptable parking method is the 45° method except perhaps in the case of taxis which are better arranged flush-wise to give fareness in operation.



3.00 SITE ANALYSIS

3.01 LOCATION

The site is sandwiched between a Centre of Business area and an Industrial area on the Mombasa Island of Mombasa Municipality (see Map 2 which also summarises the land use on Mombasa Island).

3.02 NATURAL FEATURES AND VIEWS FROM SITE

The Western and Southern side of the proposed site are very well vegetated with large trees (Mango, Mkilifi, etc.).

The best view from the site is to the South though the Eastern view captures the townscape. It is worth noting that the site itself has potential views which can be tapped in the design process. (See attached photographs).

3.03 TOPOGRAPHY AND GEOLOGY

The site is of a flat profile. It has a coral rock basement which gives good natural drainage by soakage. The top soil is dusty and coral-rich. The soil type and geology are suitable for strong foundations. For the Geology of Mombasa.

3.04 EXISTING SERVICES

All the necessary services, electricity, water, telephone and stormwater drainage are available either on the site or alongside the site. To make best use of the site it is necessary to re-route some of the services which are actually on the site. Alongside Muyaka Road which is intended to be a future primary road there is planned a sewer line which will be built in the near future as part of Phase Two of the Sewerage Scheme. The existing stormwater drain is in parts along the Muyaka Road about five metres deep. (See Site Analysis Drawing).







3.05 CLIMATIC CONDITIONS

The climatic conditions of the site are covered under Environmental Analysis. It is however worthy mentioning at this point that at the microclimatic level there are no major bodies in vicinity to affect the site greatly.

3.06 ACCESS INTO SITE

The site is bounded on all sides by tarmacked roads. The most important ones are Muyaka Road to the East and Baringo Road to the North. Muyaka Road is a proposed major Primary Road to connect the centre of Mombasa Town with the Mainland South. Baringo Road is marked for development as a secondary road. Access of vehicles into the site can be from these two major roads but the decisions opted for are discussed under the title Site Development.



-  Commercial
-  High Density Residential
-  Medium Density Residential
-  Low Density Residential
-  Industrial & Storage
-  Port
- Route Proposal for Lorries, Trailers & Country Buses.
- Site Proposal for country buses terminus



VIEW OF SITE FROM POINT "A" (SEE SITE PLAN)



SITE VIEW FROM POINT "B"



SITE VIEW FROM POINT "C"



SITE VIEW FROM POINT "D"



SITE VIEW FROM POINT "E"



VIEW FROM SITE POINT "F"



VIEW FROM SITE POINT "G" WITH TOWNSCAPE IN THE BACKGROUND

4.00

ENVIRONMENTAL ANALYSIS (Please read this Section in conjunction with attached graphs and charts).

Mombasa has a hot humid climate.

From the Bioclimatic chart (see Bioclimatic chart - illustration I), it can be seen that for both the hottest and coldest months of the year (March and July) temperature and relative humidity values are outside the comfort zone. Since on average the temperatures and relative humidity values are in either case higher than the acceptable comfort values the conclusions are:

- 1) Solar radiation is to be cut out from entering the building for almost all the hours of possible sunshine.
- 2) Cross ventilation should be utilized to the maximum so as to remove sweat and give comfort.
- 3) In public spaces fans may have to be introduced to increase the rate of cross ventilation.

Looking at the mean annual temperatures and mean daily temperatures (graphs in illustration 2 it can be seen that most of the times, particular in the month of March temperatures are outside the comfort zone. When temperatures fall within comfort zone, they correspond with relative humidity values which make conditions uncomfortable. (Evidence - Bioclimatic Chart included).

4.00 ENVIRONMENTAL ANALYSIS (Please read this Section in conjunction with attached graphs and charts).

Mombasa has a hot humid climate.

From the Bioclimatic chart (see Bioclimatic chart - illustration I), it can be seen that for both the hottest and coldest months of the year (March and July) temperature and relative humidity values are outside the comfort zone. Since on average the temperatures and relative humidity values are in either case higher than the acceptable comfort values the conclusions are:

- 1) Solar radiation is to be cut out from entering the building for almost all the hours of possible sunshine.
- 2) Cross ventilation should be utilized to the maximum so as to remove sweat and give comfort.
- 3) In public spaces fans may have to be introduced to increase the rate of cross ventilation.

Looking at the mean annual temperatures and mean daily temperatures (graphs in illustration 2) it can be seen that most of the times, particularly in the month of March temperatures are outside the comfort zone. When temperatures fall within comfort zone, they correspond with relative humidity values which make conditions uncomfortable. (Evidence - Bioclimatic Chart included).

4.00 Results represented graphically in illustrations
(Cont.) 2 and 3 have been plotted and studied in the
Bioclimatic Chart - illustration I).

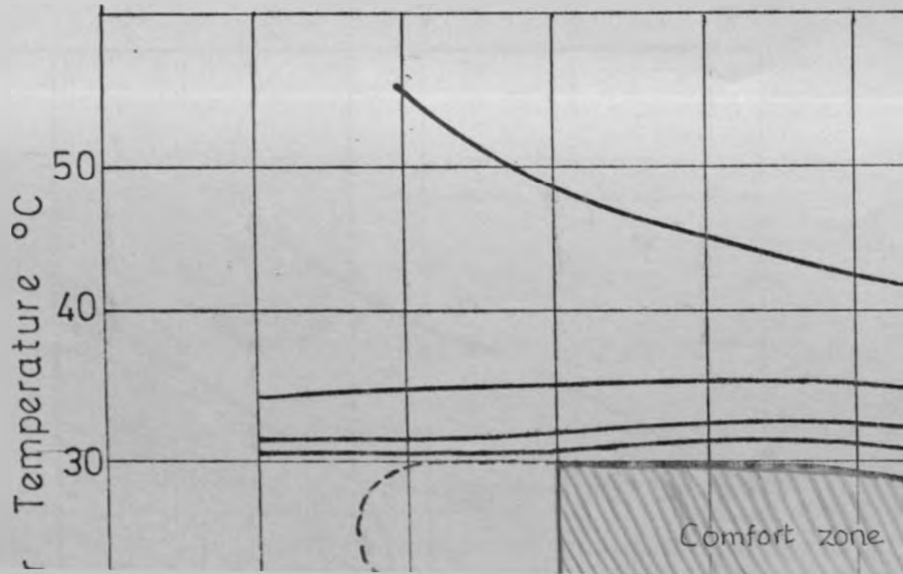
Illustration 4 containing rainfall and wind
movement charts indicates the following:

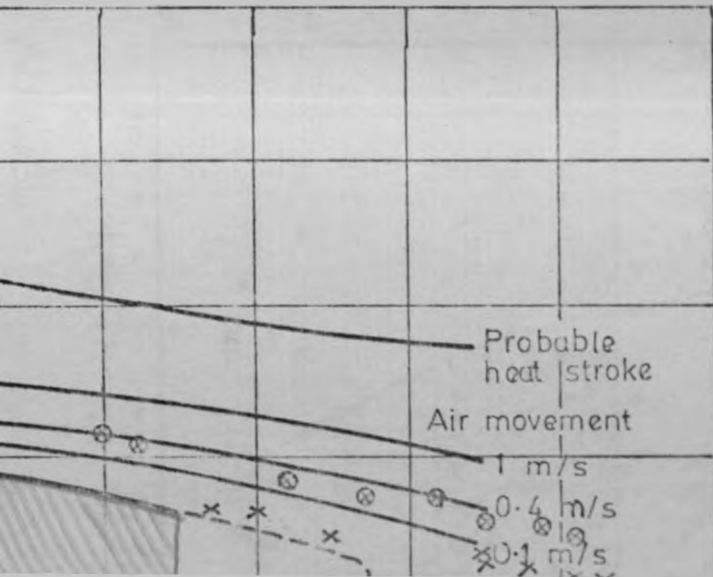
- 1) Mombasa has generous rainfall and amounts
falling in April and May imply that there are
occasional storms.
- 2) There is therefore need (from observation)
to design the roof in a way that the drainage
system could handle an occasional storm.
- 3) The wind chart indicating wind directions
show that wind directions change quite a lot
and there is need in design to make it possible
for the winds to be tapped the whole year round.
This can only be achieved by opting for an
"open" type of building.

4.00 Results represented graphically in illustrations
(Cont.) 2 and 3 have been plotted and studied in the
Bioclimatic Chart - illustration I).

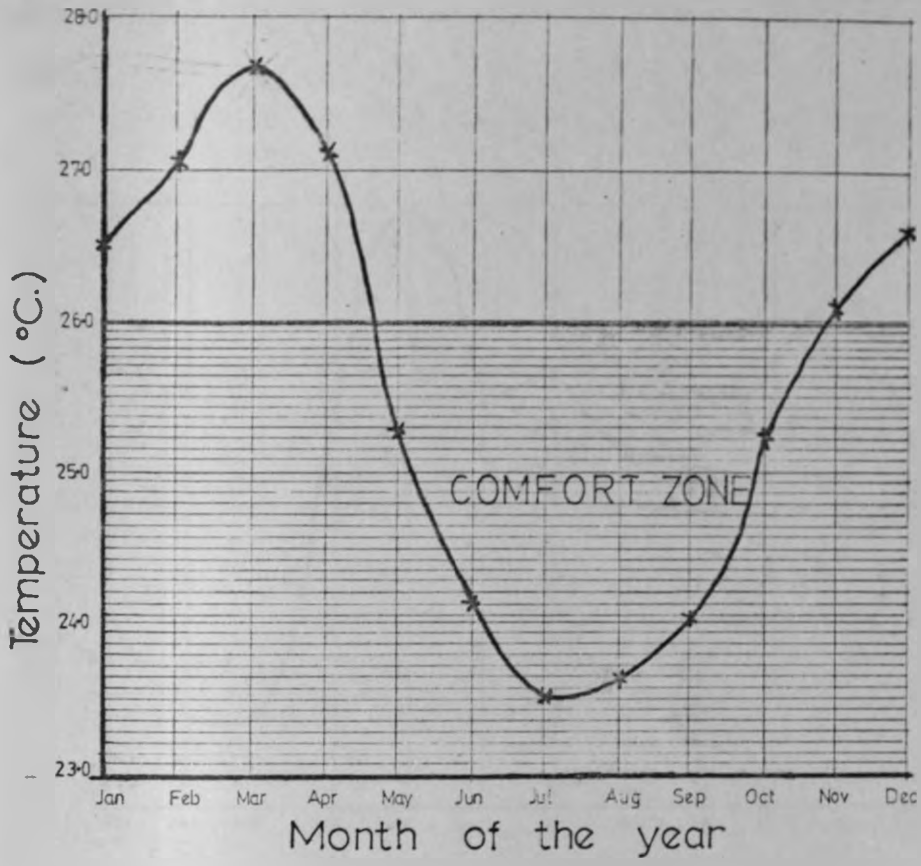
Illustration 4 containing rainfall and wind
movement charts indicates the following:

- 1) Mombasa has generous rainfall and amounts
falling in April and May imply that there are
occasional storms.
- 2) There is therefore need (from observation)
to design the roof in a way that the drainage
system could handle an occasional storm.
- 3) The wind chart indicating wind directions
show that wind directions change quite a lot
and there is need in design to make it possible
for the winds to be tapped the whole year round.
This can only be achieved by opting for an
"open" type of building.

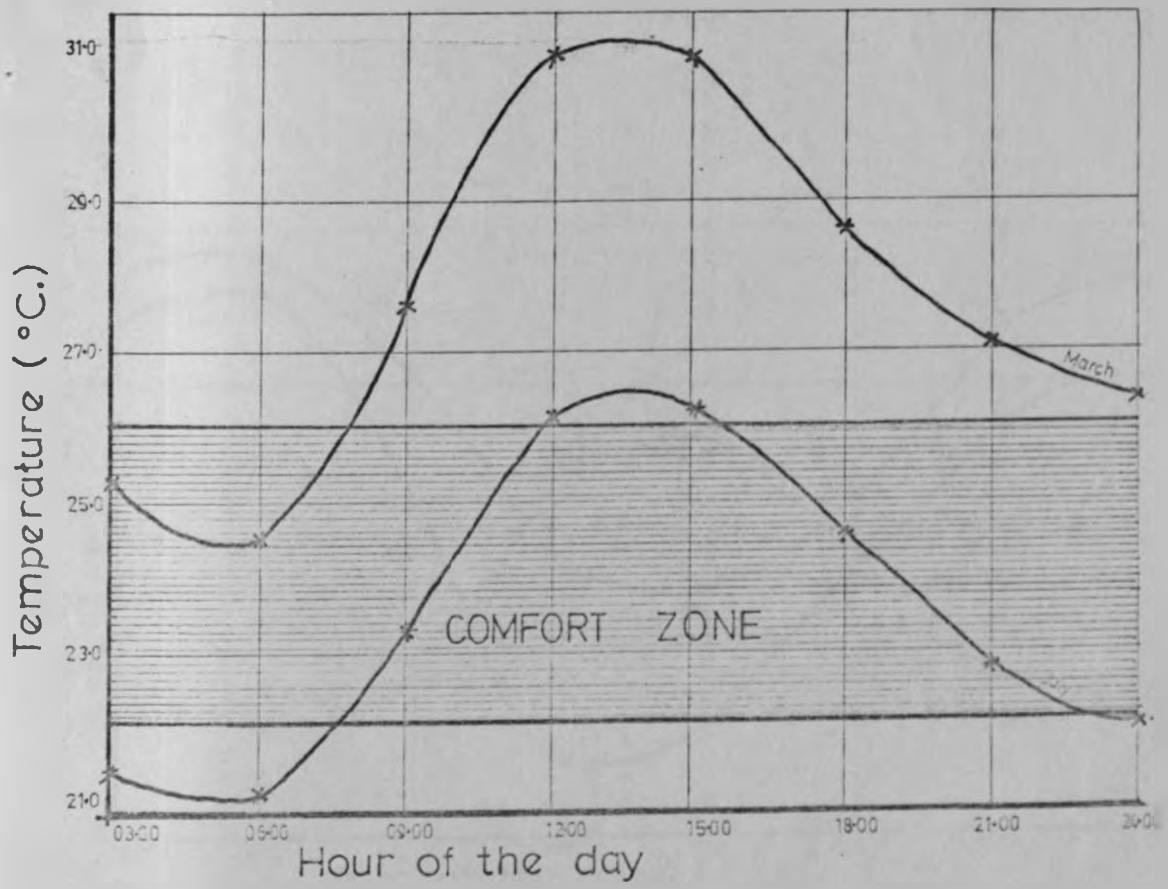




MEAN ANNUAL & DAILY TEMPERATURES (1964-1973)



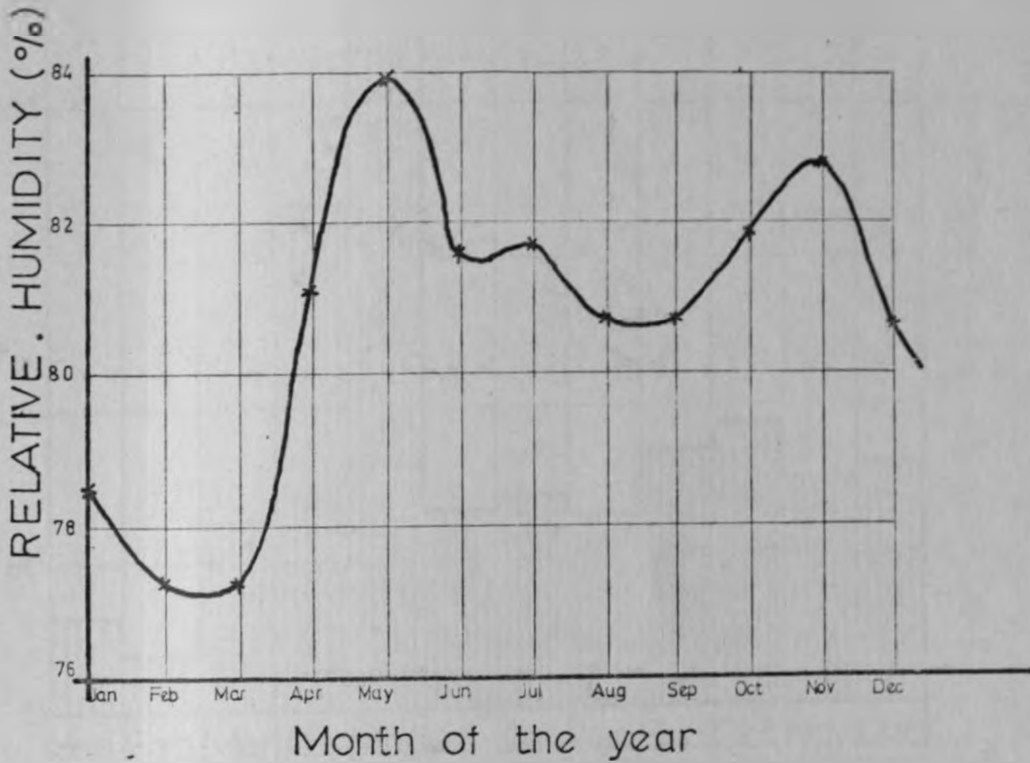
ANNUAL



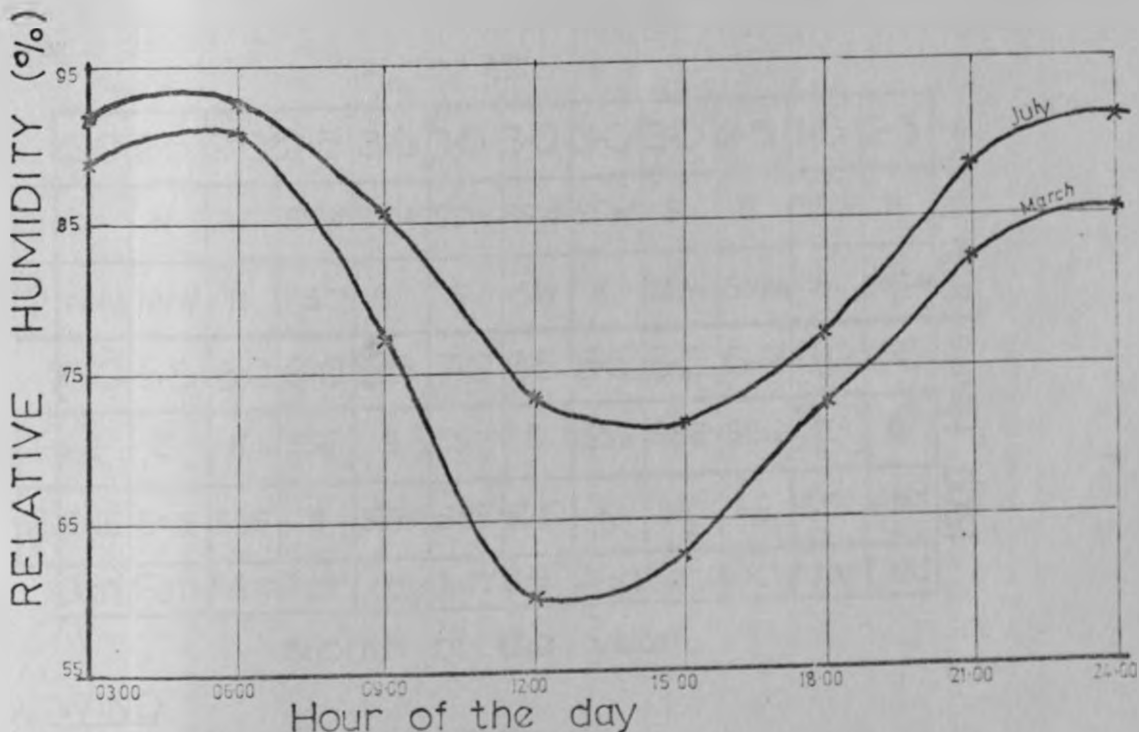
DAILY

ILLUSTRATION 2

MEAN ANNUAL & DAILY RELATIVE HUMIDITY RANGES



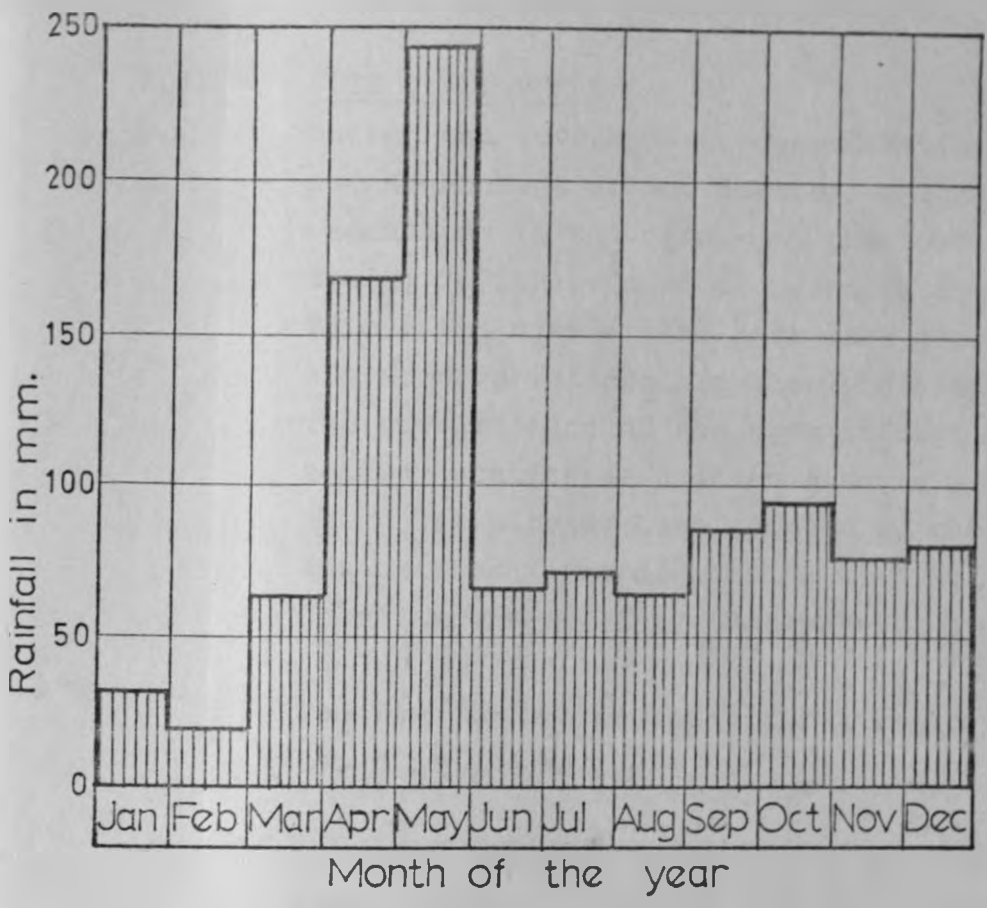
ANNUAL RANGES



DAILY RANGES

ILLUSTRATION 3

ANNUAL RAINFALL & WIND MOVEMENT



RAINFALL

Wind direction & Speed in m/s

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
9:00 Hours	3.0	2.5	2.0	2.5	3.5	3.5	3.0	3.0	3.0	2.5	1.5	2.5	
1	N	N	W	SSW	SSW	SSW	SSW	SSW	S	S	SSW	N	
2	NNW	NNW	N	S	S	S	SW	S	SSW	SWM	W	NNW	
15:00 Hours	6.0	6.5	6.0	6.0	6.5	7.0	6.5	6.5	6.5	6.0	6.0	5.5	
1	E	E	E	SSE	S	S	S	SSE	SSE	SSE	E	E	
2	ENE	ENE	ESE	S	SSW	SSE	SSE	S	SE	SE	SE	ENE	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	Month of the year												

WIND

- 1 Prevailing wind
- 2 Secondary Component

ILLUSTRATION 4

5.00

GENERAL APPROACH TO PLANNING

5.01

SITE DEVELOPMENT

During the development, consideration was given to the concept of not destroying the rich green vegetation in the site. At the Town Planning Scale, it is intended to preserve a town square. This is in view of the fact that green areas on the Mombasa islands are slowly disappearing. The preservation of the area in front of the railway station as a green area is a concept which has already been adopted by the Railways authorities (from discussion with Mr. Tengia - Chief Architect, Kenya Railways).

The Town Square proposal for this project is shown on Map No.3.

The area to be built up has as much as possible been defined by the boundary of the heavy vegetation.

The two main buildings existing along Muyaka Road are to be demolished in the project as they will anyway have to be demolished when Muyaka Road is developed into a primary road. The existing mosque on sentimentality and religious grounds is recommended to be moved to the extreme North West or South West corner of the site.

5.02

FACTORS AFFECTING BUILDING ORIENTATION

1) The shape and natural features of the site dictate that the dominating facade runs approximately North South, facing approximately East and running along Muyaka Road. The shape of the portion of site to be built up also dictates that the main passenger concourse runs East West. This orientation of the concourse is convenient as the concourse can conveniently be under shade most of the day - and after all for Mombasa's climate passengers would be expected to be seated under a covered open area than under a covered and a closed area.

5.02 2) VEHICLES ACCESSES

(Cont.) Best access into the site is from Baringo Road. This is mainly so for buses as they would not be allowed to turn off a primary road into the site (Discussion on this aspect was held with Mr. Ian Situma, Traffic Engineer, Nairobi City Council). Other vehicles (cars and matatus) can be got off Muyaka Road by creating a car lane so that other drivers do not necessarily have to be disturbed.

3) PREVAILING WINDS

These are mainly East South East, North and South and need to be tapped if maximum air flow into the building is to be achieved. The facing of a mainly open facade to the East and giving the North and South facades large openings ensure that this air flow is achieved.

4) The retention of the green area which has to be landscaped to harmonize with the building has to a large extent dictated the positioning of the building.

5.03 BUILDING DEVELOPMENT

Two main forces have dictated the design of the terminus building - passengers and vehicles. The most important of these two is the traveller, whose circulation and safety must be met and who must be provided with a pleasing human environment though in transit.

Passenger circulation has been taken care of by providing large public spaces flowing into each other as related to function. Corridors are wide and their design has taken passengers with luggage as a design force. The intention is that passengers are able to find their way with minimum enquiries.

5.03 Passenger safety is critical at the site connection
(Cont.) with the main source of passenger flow (from town centre), which is Muyaka Road. This road is seen as a potential threat to the lives of passengers crossing it to the Bus terminus. A solution has been the introduction of a tunnel across the road connected with a ramp to the main building foyer of the terminus. The other vital crossing is from the railway station but this cuts across a relatively less busy road and a zebra-crossing will suffice. At the site scale the passenger can get to his bus without crossing its way. The boarding arrangements for matatus have also been well studied as any crossings occur where speed limits can be of easy control administratively.

Considerations for vehicles ensure that matatus do not at all mix with buses except when leaving the site. This is important as any mixing of the two facilities which are so diverse in operation would not only introduce administrative problems but would be a source of nuisance to the traveller. The arrangement provided gives the traveller the opportunity to choose his means of travel without being harassed.

The private car, motor cycle and bicycle find their way into basement parking. The main reason for introducing this facility in the basement was to reduce the amount of tarmacking at the ground level. As pointed out earlier, the concept was to maintain as much green area as possible.

Discussed in the following sub-sections are factors which have been considered in the process of building development:-

5.03 1) GENERAL CIRCULATION

(Cont.) The relationship between passengers and vehicles has been carefully studied. The bulk of passengers arrive into the building from the Town Centre side. A walking passenger comes through a sub-way connected to a passenger ramp which terminates at the entrance foyer. The passenger being dropped by a hurrying driver or a taxi is dropped at the "porte cochere" from where he can immediately locate the foyer. A driver who wishes to hang on after dropping a passenger parks in the basement from where they can walk up the ramp or the stairs.

From the entrance foyer, the booking offices are obvious. The restaurant above is also obvious and the stairs leading to it are conspicuous immediately one gets into the entrance foyer. The long interval waiting hall is also obvious from the entrance foyer. The booking hall connects directly with the long distance waiting hall, with luggage storage and with the main concourse alongside which buses park.

The general administration offices connect the ground floor by a second staircase while the kitchen and its storage are connected to the service yard by a third staircase and a service lift. To enable disabled people to use the restaurant and bar, a small lift for use by disabled people has been provided and strategically placed.

The matatus concourse is conveniently linked to the main building and bus-matatu interchange is thus simplified.

5.03 2) ENVIRONMENTAL CONSIDERATIONS

(Cont.) Balancing the building with Mombasa's thermal environment has been a major factor affecting the design. Generous openings on all sides of the building supplemented by roof lights in some cases have been made. For the Eastern and Western facade, solar radiation getting into the building has been successfully cut off by means of fascias extending about two metres from the building, and designed using vertical and horizontal sun angles for Mombasa.

The building has deliberately been made independent of use of mechanical devices as much as possible. The basement however will be mechanically ventilated and artificially lighted. Some public toilets will be ventilated through a duct by convection.

3) STRUCTURAL CONSIDERATIONS

The structure of the building has largely been controlled by:

- i) The need for large open spaces as this is a public building handling a big number of travellers having luggage.
- ii) Environmental considerations where large open sides are called for.

The solution arrived at therefore is a framed structure. This gives the freedom in design to have large open spaces and also to have openings where needed.

Reinforced concrete columns and beams have been used. The planning grid was 1 metre while the structural grid has varied as follows:

5.03 For the main terminal building, 6 m x 8 m.

(Cont.) For the matatu terminal and basement parking
14 m x 4 m and 14 m x 8 m

(This is based on a basement bay holding 4 cars
corresponding with a ground floor bay holding
3 matatus).

The main bus passenger concourse having 6 m x 12 m
grid which carries a cantilevered cover system.

Structural member sizes are as follows:

For main terminal building,

Columns	600 mm x 300 mm
Beams - main beams	600 mm x 300 mm
Secondary Beams	400 mm x 200 mm
Slab -	200 mm.

Though the secondary beams may be said to be redundant
vertically, for the openness required for this
building, they serve an important purpose in
giving the building rigidity and strength against
lateral forces.

For the matatu bays:

Columns	600 mm x 300 mm
Beams - main beams	700 mm x 300 mm
Secondary beams	400 mm x 200 mm
Slab -	250 mm.

For the main bus passenger concourse

Columns:	300 mm x 300 mm
at base widening to	900 mm x 300 mm
at the top.	
Cantilever Beams -	900 mm x 300 mm
at thickest point,	
narrowing down to	400 mm x 300 mm
at the end.	
Secondary beams	400 mm x 200 mm
Slab -	200 mm maxispan hollow clay tiles.

5.03 Lateral forces where they would otherwise be critical (Cont.) are counteracted as follows:

For main concourse, introduction of a tying toilet block along the concourse and a kiosk at the end of the concourse plus tying with the main building at junction.

For matatu area, walls surrounding ramps.

4) AESTHETIC CONSIDERATIONS

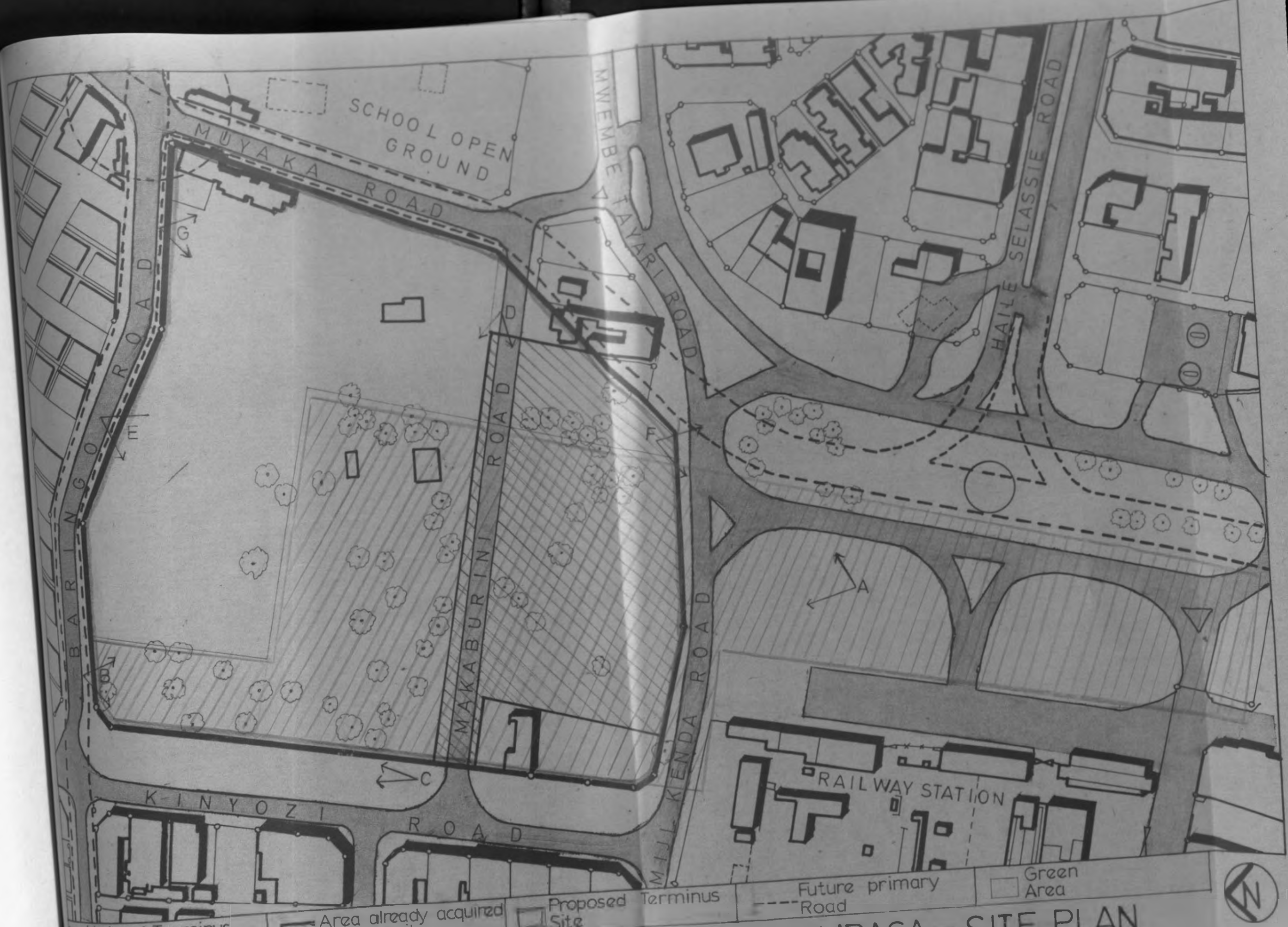
There has been an effort in the development of the building not to let functional requirements totally deny the building its aesthetic qualities. The building will provide a buzzing environment for passengers and its external treatment in particular needs to be taken care of. The building form has not entirely been dictated by the building functions. Form has rather been intermarried with function to give an aesthetically balanced building. Environmentally functional fascias have been shaped and treated to give the building a character unique of public buildings. The basic idea is to save the building from having a factory-like form. The intended off-white colour to be applied externally to the building (mainly for solar radiation reflective function) will form a pleasing foreground to the thickly vegetated site.

5) MATERIALS AND FINISHES

The choice of materials and finishes has largely been dictated by:

- 1) Local availability
- 2) Ease of construction without necessarily involving highly skilled labour.
- 3) Performance (structural, thermal aesthetic tear and wear).
- 4) Ease of maintenance.

The author feels that the materials chosen as discussed under schedule of materials and finishes are a good balance of all the above requirements.



CENTRAL COUNTRY BUSES' TERMINUS, MOMBASA - SITE PLAN
 SCALE : 1250
 K.J.G. NJENDU M-ARCH THESIS

6.00 SCHEDULE OF MATERIALS AND FINISHES

ACCOMMODATION	WALLS			FLOOR		ROOF		CEILING		DOORS & WINDOWS
	MATERIALS	EXTERNAL FINISHES	INTERNAL FINISHES	MATERIALS	FINISHES	MATERIALS	FINISHES	MATERIAL BASE	FINISH	
1) All public spaces (e.g. Foyer, Booking Hall, Waiting Hall etc)	R.C. and Hollow concrete Blocks. 100 mm precast concrete fascias	Columns fair faced with off- white colour and fascias having Tyrolean finish also off- white.	Steel trowelled plaster	R.C. Slab	20 mm Granoli- thic	R.C.	Asphal- to laid on screed to fall. Chippings	R.C. Concrete Slab	Wood Float Plaster	Timber (200 x 100 mullions frames with aluminium/ glass sliding units.
2) Restaurant and Bar.	As above	As above	As above	As above	PVC tiles	As above	As above	As above	As above	As above
3) Offices	As above	As above	As above	As above	As for 2 above	As above	As above	As above	Suspended accoustic ceiling (perforated soft board panels).	As above
4) Kitchen	As above	As above	Steel trowelled plaster & ceramic tiles	R.C. Slab	Grano	As above	As above	As above	As above	As above

ACCOMMODATION	WALLS		FLOOR		ROOF		CEILING			DOOR & WINDOWS
	MATERIAL	EXTERNAL FINISHES	INTERNAL FINISHES	MATERIAL	FINISHES	MATERIAL	FINISHES	MATERIAL BASE	FINISHES	
5) Shops & Kiosks	As above	As above	Steel trowelled plaster	Concrete	Grano (20 mm)	R.C.	As above	R.C.	Wood float plaster	As above
6) Storage spaces	As above	As above	Wood float plaster. In situ concrete shelves to detail	R.C.	Grano (20 mm)	R.C.	As above	R.C.	Fair faced finish	As above but for luggage storage burglar proofing steel bars at high level.
7) Toilets	As above	As above	Steel trowelled plaster with high gloss paint. Ceramic tiles at wash hand basins.	Concrete in places reinforced	Grano (20 mm)	R.C.	As above	R.C.	Wood float plaster	As for 1 above
8) Bus Passenger Concourse	-	-	-	Concrete	Cement sand screed	R.C.	As above	R.C.	Fair faced	-
9) Basement car park and Matatu parking	R.C. columns R.C. walls & Concrete block work	As above	Wood float plaster	R.C.	Raked cement screed	R.C.	As above	R.C.	Fair faced	-

7.00 SCHEDULE OF ACCOMMODATION7.01 MANAGEMENT AND GENERAL ADMINISTRATION

SPACE	NO.OF USERS	AREA PER UNIT (M ²)	NO.OF UNITS	TOTAL AREA	REMARKS
GENERAL MANAGER	1	25	1	25	Source of data AJ Metric Handbook
SECRETARY	1	12	1	12	do
TRAFFIC MANAGER	1	25	1	25	do
SECRETARY	1	12	1	12	do
ASST. TRAFFIC MANAGER	1	15	1	15	do
PERSONNEL MANAGER	1	15	1	15	do
SECRETARY	1	15	1	15	Space also used as Waiting Room
ADMINISTRATIVE OFFICER	1	12	1	12	AJ and Neufert
TYPING POOL	4	25	1	25	Neufert Architects' data
TOTAL				156	-

7.02 FINANCE ADMINISTRATION

SPACE	NO.OF USERS	AREA PER UNIT (M ²)	NO.OF UNITS	TOTAL AREA	REMARKS
SENIOR ACCOUNTANT	1	25	1	25	Source of data AJ, Handbook & Neufert
ACCOUNTANTS	2	15	1	15	do
INTERNAL AUDITOR	1	12	1	12	do
ACCOUNTS CLERKS	3	15	1	15	do
TOTAL				67	-

7.03

CATERING DEPARTMENT

SPACE	NO. OF USERS	AREA OF ONE UNIT (M ²)	NO. OF UNITS	TOTAL AREA (M ²)	REMARKS
CATERING MANAGER	1	25	1	25	Overall in charge of restaurant & bar
SECRETARY	1	9	1	9	Source of Data AJ Handbook
BEVERAGE MANAGER	1	9	1	9	Source of Data 4th Year Hotel Study
RESTAURANT MANAGER	1	9	1	9	do
CHIEF CASHIER	1	9	1	9	To handle all cash
DRY FOODS STORAGE	-	40	1	40	
COLD ROOM (VEGETABLES, MEAT FISH)	-	60	1	60	Spacious as even vegetables will be stored there.
BEVERAGES STORAGE	-	30	1	30	Includes spirits storage
RESTAURANT	200	500	1	500	1/8 of people assumed to visit restaurant at a time - 25m ² per 1.
BAR	100	200	1	200	2.0 m ² per person.
KITCHEN	-	290	1	290	Kitchen area given 60% area of restaurant
CHANGING ROOMS AND STAFF TOILETS	20	20	1	20	1 Worker attached to 10 visitors.
MALE WCS (PASSENGERS) & URINALS	150	20	1	20	Males assumed to be 1/2 of users
FEMALE WCS (PASSENGERS)	150	10	1	10	Male and female population taken as half/half
TOTAL	-	-	-	1241	-

PASSENGER AND LUGGAGE HANDLING

SPACE	NO. OF USERS	AREA PER UNIT (m ²)	NO. OF UNITS	TOTAL AREA	REMARKS
ENTRANCE LOBBY	100	100	1	100	To handle about 100 per minute @ 1 m ² per person
WAITING HALL	250	350	1	350	1/3 of population assumed to be using it at 1.4 m ²
BOOKING HALL WITH BOOKING OFFICES To handle about 1700 persons per 30 minutes	200 every 3 minutes	400	1	400	Allowance for 12 bus companies allow 2 m ² per person due to luggage
PARCELS' OFFICES	do	20	6	120	Light parcels handled by 6 companies
BULKY LUGGAGE (AGRICULTURAL ETC.)	Unlimited	150	1	150	About 5 m ² per bus berth
LIGHT LUGGAGE (BOXES, CASES ETC.)	do	60	1	60	About 2 m ² per bus berth
LUGGAGE CLERKS	2	20	1	20	Space includes weighing area
TIME KEEPER/ ANNOUNCER	2	20	1	20	Main co-ordinator strategic positioning
LOST ARTICLES	Unlimited	50	1	50	Ample space to handle all lost articles
MALE WCS	900	1.5	6	9	Kenya Building Code (1970)
MALE URINALS	900	1.0	22	22	do
MALE WASHHAND BASINS	900	0.5	22	11	do
FEMALE WCS	900	1.5	14	21	do
FEMALE WASHHAND BASINS	900	0.5	14	7	do
TOTAL				1340	-

7.05 TECHNICAL AND SECURITY SECTION

SPACE	NO. OF USERS	AREA PER UNIT M ²	NO. OF UNITS	TOTAL AREA M ²	REMARKS
MACHINE ROOM (AIR-CONDITIONING PLANT)	-	80	1	80	Ample space for air handling unit + generator
TELEPHONE SWITCH BOARD	-	30	1	30	-
TELEPHONE OPERATOR	1	20	1	20	-
CHIEF SECURITY OFFICER	1	9	1	9	Overall incharge of security
LIFT MACHINES & GENERAL STORAGE	-	100	1	100	-
TOTAL				242	-

7.06 SHOPPING FACILITIES

SPACE	NO. OF USERS	AREA PER UNIT M ²	NO. OF UNITS	TOTAL AREA M ²	REMARKS
SHOPS	Unlimited	100	2	200	General provision shops for travellers
KIOSKS	Unlimited	10	6	60	To provide differing facilities
TOTAL				260	-

7.07 DELIVERY AND GARBAGE COLLECTION

SPACE	NO. OF USERS	AREA PER UNIT M ²	NO.OF UNITS	TOTAL AREA M ²	REMARKS
SERVICE YARD	-	300	1	300	Enough space an average truck would turn even if restricted
KITCHEN & GENERAL LITTER DUSTBINS	-	30	1	30	Lockable but mechanically ventilated
TOTAL				330	-

7.08 VEHICLES

VEHICLE SPACE	NO.OF VEHICLES	AREA PER UNIT M ²	NO. OF UNITS	TOTAL AREA	REMARKS
BUSES	27	100	27	2700	45° parking considered
MATATUS (INCLUDING LONG DISTANCE TAXIS)	36	58	36	2088	45° parking
CARS (PUBLIC CAR PARK & STAFF CARS)	55	29	55	1595	45° parking
TAXIS	10	38.5	10	385	0° parking
TOTAL				6770	-

7.09	<u>GRAND TOTAL AREA TAKEN BY BUILDING (M²)</u>	
	Management and General Administration	156
	Finance Administration	67
	Catering Department	1241
	Passenger and Luggage Handling	1340
	Technical and Security	242
	Shopping Facilities	260
	Delivery and garbage collection	330
		<hr/>
	Total Area	3618
	+ 10% Circulation Area	362
		<hr/>
	Total Area	3998
		<hr/>

7.10	<u>GRAND TOTAL AREA TAKEN BY VEHICLES M²</u>	
	Buses	2700
	Matatus	2088
	Cars	1595
	Taxis	385
		<hr/>
	Sub-Total Area	6768
	+ 15% Road Circulation	1015
		<hr/>
	Total Area	7783
		<hr/>

7.11	<u>OVERALL AREA TAKEN BY BUILDING AND VEHICLE</u>	
		= 11,781
	Approx.	11,800
		<hr/>
		<hr/>

8.00 BIBLIOGRAPHY

1. Motorways in the Urban Environment
- Llewelyne Davies (British Road Federation).
2. Environmental Management Planning for Traffic -
J. Antonion (McGraw Hill).
3. Belfast Transportation Plan - Travers Morgan
and Partners (McCaw, Stevenson and Orr Ltd.)
4. The Management of Urban Public Transport
(a Marketing Perspective) - P.J. Hovell
(Sexton House/Lexiton Books).
5. Mombasa Transportation Study - Draft for
long Range Plans (Ministry of Works - Kenya).
6. Mombasa Transportation Study - Short Term
improvement (Ministry of Works - Kenya).
7. Mombasa Draft Physical Development Plan -
(Ministry of Lands and Settlement - Kenya -
July 1971).
8. Manual of Tropical Housing and Building -
Part One: Climate Design - O.H. Koenigsberger,
T.G. Ingersoll, Allan Mayhew and S.V. Szokolay
(Longman Group Limited - London).
9. Design for Climate - 1975 (Housing Research
and Development Unit - University of Nairobi -
Kenya.)
10. The "Matatus" Public Transport of Nairobi
- Ian Situma (Nairobi City Council).
11. Building Code (Kenya) - Ministry of Local
Government (Government Press, Nairobi).
12. Central Bus Terminal, Kampala - S. Kikuba
(M. Arch. Thesis (1975) University of Nairobi).
13. Kisumu Bus Terminal - A.J. Odera (B. Arch.
Thesis (1977) - University of Nairobi).
14. Central Bus Terminal Kampala - Y. Kamulegeya
(B. Arch. Thesis (1977) University of Nairobi).
15. Mombasa Railway Terminal - D. M. Rimber
(B. Arch. Thesis University of Nairobi).
16. Architects Data - Ernst Neufert (Crosby
Lockwood and Son Ltd. London).
17. A.J. Metric Handbook (Leslie Fairweather
and John A. Sliwa (The Architectural Press
London).