SECOND WORLD BANK/GOVERNMENT OF KENYA URBAN PROJECT

KENYA LOW-COST HOUSING BY-LAW STUDY

INCEPTION REPORT
&
DETAILED BRIEF

1st SEPTEMBER 1979

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FOREWORD

The Kenya Low-Cost Housing Bye-Laws Study forms an element in the World Bank/Government of Kenya Second Urban Project. The purpose of the study is to review legislation concerned with low-cost housing and to make recommendations for the development of relevant model housing bye-laws and building codes.

The study is being undertaken by three firms of consultants, Saad Yahya and Associates, Kitololo and Partners and Halcrow Fox and Associates for the Ministry of Housing and Social Services, Government of Kenya.

The Study Team is therefore drawn from these three firms and consists of a core team and resident specialists with the possibility of inputs from non-resident specialists if and when required.

The core team will be:

- J.A. Hurrell : Architecture and Planning/Project Manager
- A.S. Kitololo : Services Engineering
- R. England : Public Health

Resident Specialists:

- J.D. Murimi : Legal adviser
- S.S. Yahya : Urban economist
- G.M. Mutiso : Housing administration
- S.M. Kaburu : Structural engineering

In addition there are sources of advice in relvant fields from experts in the UK (including the Building Research Establishment) and in Kenya which will be available as and when required.

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1
INTRODUCTION

1.1 The objectives of this Study of housing legislation are twofold:

a. to analyse and evaluate the performance of the existing building control system in Kenya as embodied in the legislation and current practice.

and b. to develop and present for the consideration of the Government, specific measures that would enhance its efficiency, equity and contribution to community planning objectives and in particular the delivery of housing and associated community facilities./1

1.2 The scope of the Study will be to focus mainly on the low-cost housing sector with a view to reviewing, developing and consolidating all relevant legislation (including planning and environmental standards) into model housing by-laws and building codes appropriate to site and service schemes and other low-cost housing. That is, legally enforceable residential standards will be proposed within the general context of building control. In doing this, consideration shall be given to safety, community health, environmental factors, social and cultural aspects; to costs, household incomes and constraints as reflected in the national housing policy; to administrative organisation; and to changes in building technology./2

1.3 This Study forms an integral part of the Government's policy for the development of housing, and particularly low-cost housing in Kenya, for as the Development Plan 1970-1983 states:

_/1 Source: Terms of Reference for the Study.

_/2 ibid

"2.113. Within the urban areas effective development has been impeded in the past by a conflict between standards and needs. Standards protect some groups against the means used to provide needs for others. Realistic minimum standards are essential but if they are set too high they impose needless sacrifices on those in greatest need. Low-cost housing in municipalities is a case in point. Over the last plan period only 8 per cent (ranging, however, from 5 per cent in Nairobi to 96 per cent in Western Province) of the low-cost units planned were in fact completed and these cost on the average five times the expected cost.

Excessively high and unrealistic standards for building design, occupancy, and municipal services were clearly a major contributing factor. During the planning period, all municipalities will review their housing standards in order to make them appropriate for the settings to which they will be applied and to reduce them to the minimum consistent with the provision of low-cost housing needs at reasonable cost. These standards will be raised as development creates higher and more widespread incomes." /3

1.4 The application of the minmum standards refered to in the above quotation are normally exercised by the local authorities (Municipal Councils, Town Councils, County Councils and Urban Councils) under the powers given them by the following legislation:-

- Public Health Act. 1972
- Building Codes Grade I & Grade II 1968
- Town Planning Act.

_/3 Source: Development Plan 1979-1983 Part I. Chapter 2: Government of Kenya 1979 (emphasis added)

- Local bye-laws and policies approved by the Councils which expand or modify the Building Codes or Planning Legislation.

In addition, where the land to be developed is Government (or State) Land then the Commissioner of Lands can, as a condition of granting a lease, impose his own standards and requirements.

2 BRIEF BACKGROUND

2.1 In order to consider the objectives of such legislation it is important to bear in mind its historical background.

2.2 The control of housing development was created originally in Europe at the end of the nineteenth century in order to combat the unpleasant odours and sights and, later, public health dangers created by the insanitary living conditions of the overcrowded urban poor as a result of the Industrial Revolution. The manpower needs of the new factories created at the expense of the earlier small-scale rural industries, produced an urgent demand for vast numbers of cheap accommodation close to the factories. As a result large numbers of dwellings were quickly constructed at minimum cost and with the minimum of facilities. However the inhabitants of these substandard dwellings were lucky in comparison to those crowded into the decaying mediaeval dwellings which still remain in the centres of cities or which were the remains of villages overwhelmed in the outward spread of the urban area.

2.3 The lack of proper sewerage and refuse disposal aggravated by the overcrowded conditions of both buildings and whole areas of the urban centres, created ideal breeding grounds for major outbreaks of diseases. The spread of these diseases to the better accommodated and more educated (and therefore more vociferous) members of the community, together with the emergence of philanthopically-minded organisations and individuals created an impetus to find means of providing more sanitary conditions. The simultaneous initial development of local authorities with powers to order and manage the life and development of the urban area, provided the means and the vehicle for the application of these improvements.

2.4 Thus the early Public Health Acts were born. Their objectives were to prohibit conditions to arise whereby

the health of the public at large would be threatened. Thus water supplies either from wells, standpipes or individual piped supplies had to be uncontaminated; human wastes and refuse had to be collected and disposed of in a clean sanitary manner. Subsequently the controls were extended to cover the construction of buildings to ensure structural stability, weather resistance, minimum levels of lighting and ventilation.

2.5 Following the heavy influx of settlers into Kenya after the First World War the British colonial authorities introduced public health legislation and building controls for the rapidly growing towns of Nairobi, Mombasa and Kisumu during the period from 1929-1931. This legislation was naturally based upon the British system both with regard to the regulations themselves and their means of application.

2.6 The public control of the building process was extended further by the introduction of the Town Planning Act of 1931, and the Nairobi City Council introduced its own Building By-Laws (Planning) in 1948.

2.7 However the most strictly applied regulations were and are those embodied in the Public Health Act and its by-product the Building Codes. Historically the pre-eminence of the Public Health Acts and their creation to protect the public from contagious diseases gave them legal precedence over all other legislation.

3
CURRENT HOUSING NEEDS OF KENYA

3.1 The total national housing requirement of Kenya is estimated at some 290,000 housing units in urban areas which includes a current shortfall of 140,000 units together with a requirement of 30,000 per annum to cater for the expected increases in households between 1978 and 1983. In addition an estimated 125,000 units are needed each year to replace existing houses which are beyond repair./4

3.2 Whilst this need is staggering it is complicated by the lack of adequate purchasing power among a large section of the urban population. "Of the existing 440,000 urban households only about 30% have incomes to afford minimum-cost conventional housing"./5

3.3 Among the Government's aims for housing are:-

i) increasing the stock of housing in the urban areas so as to keep pace with the demand caused by urban population growth;

ii) meeting the housing shortfall that already exists in major urban areas;

iii) ensuring that the houses produced benefit in particular those families in the lowest income groups where need for shelter is greater;

iv) maintaining a healthy and safe urban environment, free from dangers of epidemics and fire./6

3.4 The Government recognises the need to encourage the development of houses within the financial capacities of the urban population and, in particular, the lower-income population. To this end the Government's main thrust of

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_/4 Government of Kenya: Development Plan 1979-1983 Part I

_/5 Ibid.

_/6 Ibid.

investment is to the development of site-and-service projects throughout the Republic together with squatter upgrading programmes in order to maximise the resources of the total existing stock of dwellings. In both of these concepts the public authorities (both national and local) provide the overall planning and the provision of infrastructure, services and public facilities. The construction of the dwelling units is the responsibility of the plot owner. Built in to both these concepts is the policy of 'improveability' that is the encouragement of the improvement of the house over a period of time as the resources of the owner increase.

4
EXISTING SITUATION

4.1 Since the late sixties concerted efforts have been made by the Ministry of Housing and Social Services, through the National Housing Corporation, to implement both site-and-service and squatter upgrading shemes throughout the Republic. In addition, numerous studies have been undertaken by the Housing Research and Development Unit of the University of Nairobi and consultants on behalf of the Ministry to recommend optimum plot sizes, layouts, building designs and alternative forms of sewage treatment and disposal.

4.2 In some cases proposals for site-and-service projects which have beenprofessionally designed to provide housing for the lower income populations have not been implemented because they do not satisfy the requirements of the existing legislation and regulations governing the construction.

4.3 It would appear from initial discussions that the principal areas of conflict between the building legislation and the production of low-cost housing could lie in the following areas:

a. Lack of specific requirements

Comment has been made from a number of sources regarding the lack of specific requirements in the Building Codes and especially the Grade II Codes. This criticism has come from both developers and local government officials. The developers complain that due to lack of specification they are faced with inconsistent personal interpretations often, it is claimed, lacking any scientific or technical basis. The local government officials claim that they are forced to refer to the earlier building regulations (repealed in 1963) for guidance.

The powers of the Medical Officer of Health given under the Public Health Act 1972 also appear to cause considerable problems to developers due to:-

(i) the amount of personal interpretation involved and

(ii) the legal powers given by the Act for him to overrule the Building Codes and their interpretation.

The annoyance caused by the claimed arbitrary application of personal interpretation of the vague clauses in the legislation is aggravated by the lack of any authority to which aggrieved applicants can appeal. The decision of local authority officers, even if considered to be incorrect, is final.

b. Lack of unified legislation

This criticism applies to all the various legislation and regulations, but was strongest in relation to the various requirements for the provision of infrastructure. Comment has been made that sometimes the various sources of standards conflict with each other. The plea often heard has been for a unified set of standards in one document.

c. Inappropriate standards

This claim appears on initial investigation, to be complex. We have for example heard claims that the developers of the low-cost houses have been inhibited by local authorities insistence upon building materials far above these permitted by the Grade II Building Codes. Conversely we have been told that the house builders themselves are unhappy with some of the materials permitted and consider that only concrete blocks and reinforced conrete columns and beams constitute a 'real house'.

With regard to the infrastructure requirements it is accepted that the minimum standards demanded raise the overall cost of the project. There appears, however, to be an acceptance that the provision of potable water and a healthy collection and treatment of human waste is an absolute necessity. Therefore, the conflicts relate to

the engineering details of how these services are provided.

The required standards of construction of access roads seem to be a clear point of conflict, revolving around the high capital cost of constructing to adoptive standards versus the high maintenance costs of murram roads.

d. A too-cumbersome and time consuming adminstration system

The present system of approvals does not appear to cause too many problems so long as consultation with the administering authorities starts as early as possible to enable problems to be discussed and solutions sought early in the project. The lack of sufficient building inspectors for approvals after the construction has commenced and their lack of resources, such as transport to visit sites has been quoted as a delaying factor in the production of low-cost housing. In one instance it was suggested that the traditional role of the building inspector with respect to low-cost housing should be re-examined to create a more positive advisory role rather than simply a negative one.

e. A resistance to the concepts of low-cost housing as envisaged in Government policy

We have been made aware from discussions that the Government's policy to accommodate the needs of the low-income population by various methods including site-and-service and squatter upgrading projects, is not accepted by a number of people in both local and national government. These people believe that such schemes are a retrograde step and that the citizens of the Republic should be accommodated in what they consider to be good quality dwellings and not legalised slums. Whilst such laudable aspirations are out of touch with the more

realistic assessment made by the Ministry of Housing and Social Services, they do affect the attitudes of officers whose duty it is to approve housing projects at local level. The situation is made more difficult when such attitudes are held by the officers themselves.

This aspect of the study could be one of the most important for the satisfactory implementation of the technical recommendations of the study. Without an acceptance of the objectives of the Government's housing policy and the output of this study at both a technical and political level within the local authorities who administer the regulations little progress will be made.

It is suggested that during the course of the study the Ministry of Housing and Social Services should hold a one-day seminar at which the objectives and conclusions of the study can be explained to the relevant officers and councillors from the urban local authorities and their re-actions obtained. Such a seminar should be held in February 1980 after the production of the Discussion Papers has been completed so that the researches have been completed and draft recommendations have been formulated.

f. Lack of clearly defined allocation of responsibilities between authorities

We have received a comment that there is no clearcut definition of responsibility between the Ministry of Housing and Social Services, the Ministry of Local Government and local authorities. Thus where an executing agency is thwarted in its objective of implementing the Government's housing policies by a local authority it has no national authority to which to appeal. This aspect raises an interesting question of the powers of national authorities over local authorities and even of interministerial relationships.

4.4 Throughout this section of the report we have deliberately used the expressions 'seem', 'appear', 'from initial observation' etc. because we cannot at this stage confirm the impressions gained by our initial meetings. Further investigations will be made in order to prepare the Discussion Papers.

Mombasa - Approach to building - Msa building costs higher than NHB.

5 DISCUSSION PAPERS

5.1 The original terms of reference for the study as prepared by the Ministry of Housing and Social Services required the preparation of the following documents:-

(a) a report on the existing situation

(b) discussion papers on:-

- economics of building control
- technical and design aspects
- socio-political and administrative aspects
- environment and site planning
- infrastructure
- public health

5.2 The consultants in their proposals recommended the addition of an extra discussion paper on Community Participation. Preliminary work has indicated that this subject in the Kenyan context, whilst relevant, is more properly incorporated into the Paper on socio-political and administrative aspects. Further, the exclusion of a specific sociological input into the study in the final contract for services means that any crucial sociological matters would be covered by this joint paper.

5.3 Each of the Discussion Papers covers a specific aspect of the provision of low-cost housing and relevant legislation. It is therefore considered that the analysis of the existing situation (previously conceived as a separate report) should form the introduction to each Discussion Paper. This, it is considered, will obviate the necessity of referring back each time to a separate document.

5.4 Towns to be studied

At a meeting between representatives of the Ministry of Housing and Social Services, the World Bank and the Consultants held on the 11th July, 1979 it was agreed that

this study should be undertaken in close collaboration with the work of the Third Urban Project. We shall be working closely with the consultants appointed for the Third Urban Project and have selected the following urban areas to accommodate the variations of climate, sociological groupings and differing scales of local administration:

Nairobi Mombasa Kisumu	)	large scale authorities with differing climate and sociological situations
Thika Machakos	)	towns within the influence of the Nairobi Region and under strong growth pressures
Kakamega Webuye	)	towns in the Western Province subject to. pressures of growth
Nakuru	)	Rift Valley town
Meru	)	Eastern Province town
Lamu	)	small coastal town with strong cultural background
Isiolo	)	small arid area town

Kajiado

These eleven urban areas will, we believe, provide a useful geographical and social spread and at the same time provide guidance for the Third Urban Project.

5.5 Legislation affecting the provision of housing

From the discussions so far held it is considered that the following legislation and regulations affect the construction of low-income housing:-

a) Streets Adoption Act 1964
b) Fire Act
c) Electric Power Act 1972
d) Public Health Act 1972

e) Land Planning Act 1970
f) Building Codes 1968 (Grade I and especially Grade II)
g) Local Authorities Act
h) Local Government Regulation 1963
i) Law of Contract Act 1962
j) Standard of Road Construction
k) The relevant land Law Legislation, e.g. Registered Land Act, Cap 308
l) The Rent Acts
m) Local authority Town Planning regulations and policies

There are in addition other controls applied, such as:

requirements of the Commissioner of Lands related to the development of Government Land.

advice and requirements of the Physical Planning Department (Ministry of Lands and Settlement) as contained in the handbooks, circulars and policy documents.

5.6 Objectives of the Discussion Papers

The objectives of the Discussion Papers are to:

a. examine the existing situation related to the subject of the paper and define the areas of conflict or problems.
b. examine the problems in detail and propose possible alternative solutions.
c. recommend a preferred solution to the problem or problems that can be achieved by legislation or regulations.

5.7 Scope of the Discussion Papers

The Papers will concentrate predominantly on those aspects of the construction of low-cost housing which can be affected by the powers of legislation or regulations. Within this context it will also be necessary to consider the administrative and political aspects of the application of that legislation or regulations.

It will be necessary to consider the objectives of the current policies of providing low-cost housing in order to determine the objectives of the legislation and therefore the purposes to which the legislation should be geared. It will not be the intention of the Papers to evaluate the success or failures of various site and service and upgrading schemes except in so far as to determine the objectives and standards to be achieved. Within this context it is important to remember that legislation (and especially the Building Codes) should define the minimum standards necessary to ensure that the public are not endangered by the construction of the dwellings.

It will also be important to avoid the dangers of applying concepts and standards developed in other countries with different social and climatic situations. However an awareness of new concepts and building techniques will be relevant to the study.

5.8 Structure of Discussion Papers

In order to achieve a consistency between the different Discussion Papers it is proposed that each will have the following structure:

Analysis of existing situation

- statement of current requirements and their sources
- examination of the effects of such requirements upon the provision of low-cost housing
- conclusions

Analysis of requirements

- definitions of the basic objectives of the relevant requirements (especially those currently causing problems)
- examination of the technical or administrative means of achieving these objectives including new techniques,

traditional methods and international experience
- conclusions

Recommendations
- specific recommendations for new, revised or ammended requirements together with specific recommendations for technical or administrative solutions.

5.9 Methodology

There is a wealth of knowledge in Kenya regarding the various methods of providing low-cost housing. This knowledge is based upon practical experience in that it results directly from professional organisations actually involved in the provision of low-cost housing (i.e. Ministry of Housing and Social Services, National Housing Corporation, local authorities (especially the Housing Development Departments of Nairobi, Mombasa and Kisumu), IBRD, E.E.C. and USAID). Other departments of government (both national and local) have also been involved in low-cost housing i.e. Physical Planning Department and the Commissioner of Lands (Ministry of Lands and Settlement), local planning authorities, local Medical Officers of Health and local Building Surveyors. National Environmental

In addition the Housing Research and Development Unit has, since 1967 been undertaking research into the requirements of low-cost housing and analysing existing examples.

It is therefore considered that the most practical way of tackling the Discussion Papers will be to utilise the accumulated knowledge of all these professional organisations which will be brought together in the Discussions Papers (and subsequently in the Manual, Draft Final and Final Reports) together with the collected expertise of the members of the Study Team. Where it is shown to be necessary to use additional expertise we shall use the services of others as indicated in our Proposal.

5.10 Content of the Discussion Papers

A detailed brief for each of the discussion Papers is shown in the following Appendices:

D.P.1	Economics of building control
D.P.2	Environmental Health
D.P.3	Infrastructure
D.P.4/1	Political, administrative and community participation aspects
D.P.4/2	Legal aspects
D.P.5	Technical and design aspects
D.P.6	Environment and site planning

D.P.1

ECONOMICS OF BUILDING CONTROL

1. Objectives

1.1 The purpose of this discussion paper is to examine the economic circumstances that are likely to influence public as well as private decisions to vary dwelling standards. It will also develop propositions for further discussion on the possible efforts of changing standards in the low income housing market, especially the effect on the manner in which dwellings are developed, allocated, managed and maintained. Guidelines will be formulated for the benefit of the technical members of the Study Team on which to base their design and technical recommendations.

2. Scope of Paper

2.1 Although the main focus of the discussion paper will be on economic issues we will of necessity have to deal with associated social question in so far as they are relevant to the subject in hand. There is some overlap in that socio-economic issues will also feature in the paper on the political, administrative and community participation aspects.

2.2 On the basis of our study of existing documents and preliminary interviews it is apparent that a great deal of work has already been done in documenting the socio-economic characteristics of the urban poor e.g. in the various reports in the Second Urban Project series, the National Development Plan 1979-83, the Report on Human Settlements in Kenya, the Dandora Monitoring and Evaluation series of reports and several recent reports from the HRDU. We therefore feel it is not necessary to do a major field study; it will merely duplicate existing materials. What is badly needed is a critical and thorough analysis of existing data and professional opinions. The latter

have played an important role in the formulation of standards.

2.3 Apart from re-examining the familiar problems of rapid urbanisation, low incomes, large households, scarce resources and an irrational locational system, we shall examine the case for and against institutionalised building control as well as the various possible degrees of control. If less extravagant standards were introduced they would definitely have repurcussions on the quality and quantity of houses coming on the market.

Financing institutions and insurance companies might well have to modify their attitudes on what is acceptable in the form of materials and modes of construction. There would also need to be a restructuring of the way in which materials and skills are supplied and deployed.

2.4 We will take full advantage of recent experiences at Dandora and other site-and-services schemes, as well as other low-cost housing projects, especially the USAID projects in Nairobi and other towns. The self-help approach will be studied in considerable depth through a number of case histories at Dandora. The contents of the Discusssion Paper will be along the general lines shown below.

3. Content

3.1 Urbanisation and the role of site and service schemes

3.2 Affordability

3.3 Relevance/necessity of standards - effect of city size; residential location and dwelling standards

3.4 Economic arguments/justification for control

- levels of control
- public and private costs of control
- economics of enforcement

3.5 Case study
- Dandora: Standards and self-help

3.6 Changes in standards and effect on
- demand and supply
- quantity and quality
- cost of dwelling
- financing and mortgage market
- rental income
- security of income
- profitability
- operating costs including maintenance, insurance management and taxes
- rent control

3.7 Resource Use
- relevance to housing types, standards and technology
- materials, local and imported
- labour i.e. men, skills and management
- equipment and capital
- energy
- land

3.8 Infrastructure
- effect of standards on costs

3.9 Mixed land uses
- justification

3.10 Summary of Recommendations

D.P.2

ENVIRONMENTAL HEALTH

1. Objectives

1.1 To examine all Building Code legislation concerned with environmental health to ascertain how relevant that legislation is to the needs of low-cost housing development.

1.2 To examine the statutory relationships between this legislation and the Public Health Acts so as to fully understand the implications of any proposed changes to the Building Codes.

1.3 To review the health and disease problems of the various low-cost housing target populations and to assess the extent to which affordable low-cost housing will affect the levels of health in positive (and negative) ways.

1.4 Based on the above, to make draft recommendations for appropriate changes in the Building Codes on matters concerning health.

2. Scope of Paper

2.1 To collect, review and fully understand all Building Codes, municipal and urban by-laws concerned with environmental health in low-cost housing development.

2.2 To discuss with the various appropriate national bodies, urban councils (local authorities) and implementing organisations in the agreed sample of towns, to what extent these codes and by-laws constrain low-cost housing development and precisely which aspects of the codes and by-laws are concerned.

2.3 Together with the Team's legal adviser, to examine the statutory relationships between the Public Health Acts and the Building Codes and bye-laws and the various agencies charged with their implementation. These agencies include the Ministry of Health, the Ministry of Housing and Social Services, the Ministry

of Local Government, the Ministry of Lands and Settlement, the various urban councils and their Medical Officers of Health.

2.4 A thorough comprehension of these relationships is necessary if the Study is to propose realistic changes to the Building Codes concerning health. It will be essential to understand which agencies must approve such changes so that their support can be obtained in the course of the Study.

3. Methodology

3.1 In order to evaluate the existing Building Codes and bye-laws related to environmental health it will be necessary to compile an ill-health profile of the populations concerned. All available data will be collected, analysed and summarised and then widely discussed with all relevant bodies and individuals to assess its completeness and implications.

3.2 The ill-health profiles of the various populations will be employed to establish an assessment of health priorities. This is necessary because not all ill-health problems and diseases are of equal importance and an evaluation of the Building Codes must apply a differential weighting to the ways in which the Codes affect the various ill-health problems. For example, it may be that a certain aspect or aspects of the Building Codes present insurmountable obstacles to the lawful provision of low-cost housing within affordable levels. But it may also be the case that these aspects affect only low-priority health problems whereas the provision of affordable housing would favourably affect many high-priority health problems.

3.3 The relative importance of the ill-health problems of which the target populations are at risk will be assessed using a simple weighted scoring system for

(i) the community-wide prevalence of each ill-health condition or disease group, and

(ii) the seriousness of each condition for the individual, the family and the community at large

3.4 To borrow from medical terminology, housing and the components of its environment and infrastructure can be considered as 'interventions' in the community's ill-health problems. But the effectiveness of those interventions will be different for different ill-health conditions, and also, of course, each of the interventions will carry different cost implications.

Assessments will be made of the effectiveness of housing interventions in reducing the causes and risk factors associated with each of the ill-health conditions. A range of different 'low-cost housing types' will be assessed in this way.

3.5 From the above it will be possible to assess the performance of each such housing type across the whole range of relevant ill-health conditions and diseases so that each housing type will be given a relative health performance score.

3.6 Included in these housing types will be one or two 'do nothing' options i.e. allow the self-settled urban slum housing types to continue. Then the relative health benefits (disbenefits) of this - the situation that will largely prevail if existing Building Code standards are maintained - can be compared with those for various low-cost housing options.

3.7 This approach will greatly assist with the more systematic evaluation of Building Codes and their possible improvement. If, for example certain housing types can be shown to be technically feasible, within acceptable costs, and achieve relatively high health performance scores then it can be argued that the Building Codes and bye-laws should be re-written so as to lawfully allow low-cost housing of those types.

3.8 Whilst, of course, the quality of assessment will be variable and perfect information will not be available, the method outlined above provides the most objective approach available. Where 'best estimates' have to be employed, these and the reasons for them, will be as explicit as possible. Judgements will be made, therefore on a basis of the whole epidemiological picture and not only on subjective 'expert opinion'. In addition the method provides a framework for evaluation that can be readily improved in accuracy as new information becomes available throughout the course of the study and, indeed, thereafter.

3.9 Based on all of the above, the final task of STAGE II will be to draft the proposed changes to the Building Codes. These will be reviewed for their legal implications and for their acceptability to the relevant authorities - especially the Ministry of Health. If appropriate changes to the codes can be achieved without requiring changes to the Public Health Act, then of course implementation will be much easier.

4. Tasks

4.1 Collection and review of existing legislation

4.2 Discussion with relevant housing development authorities on the constraints exerted by the legislation.

4.3 To examine legal relationships and implications.

4.4 Collection and analysis of all relevant ill-health data; presentation in summary form and discussions with health agencies etc.

4.5 Collection and summary of all relevant low-cost housing type data (input from other members of the study).

4.6 Quantititative analysis of the health effectiveness of a range of low-cost housing types.

4.7 Detailed presentation of findings and production of evaluation charts.

4.8 Draft proposed changes to Building Codes.

4.9 Draft Final Discussion Paper.

D.P.3

INFRASTRUCTURE

1. Objectives

1.1 to identify the level of infrastructure required to achieve acceptable minimum standards of provision compatable with the needs of low-cost housing

1.2 to define the technical requirements of such acceptable minimum standards

1.3 to prepare recommendations for modifications or ammendments to the existing legislation or, where necessary, recommend new legislation

2. Scope of Paper

2.1 The study of infrastructure will include roads, storm-water drainage, foul sewerage and disposal/treatment works, water supply (reticulation and treatment), electricity supply, telephone services and refuse disposal system.

2.2 It is generally accepted that the provision of infrastructure constitutes the principal public investment in low-cost housing where such a provision entails site-and-service and upgrading schemes. Whilst such an investment is made by the public authorities its cost is reflected in the calculations of the plot rental and thus directly affects the total expenditure required by the target population.

2.3 The provision of potable water and an efficient and healthy system of human waste collection and treatment are basic requirements which cannot be ignored. However the detailed means of providing these essential services <u>are</u> the subject for further investigation in order to reduce costs.

2.4 The detailed specifications for road construction are clearly a field for further investigation, especially the present requirement of adoptive construction standards at the outset of the development.

D.P.4/1

POLITICAL AND ADMINISTRATIVE ASPECTS AND COMMUNITY PARTICIPATION

1. Objectives

1.1 This Discussion Paper will examine the existing institutional arrangements for administering housing standards. It will highlight the main bottlenecks and propose measures for administrative reform within the context of perceived political, financial and personnel constraints.

2. Scope of Paper

2.1 A thorough analysis of the relevant institutional framework calls for a comprehensive multi-level approach. For instance at site level the manner and effectiveness in which bye-laws operate depend on whether the site is in a metropolis, municipality, township, urban area or market center; at the ministerial level i.e. Housing and Social Services, Local Government, Health, Lands and Settlement. The Courts too determine policy in their own way in that local officials generally find it easier to enforce the bye-laws where a record of successful prosecutions has been established.

2.2 Community participation through political action, through harambee efforts and through practical demonstration could yield major benefits in gaining acceptance for the recommended standards.

2.3 In view of the wide diversity of community resources and organization in different parts of the country we believe it will be neither desirable nor possible to prescribe model administrative methods that would be applicable everywhere; rather it will be more relevant to identify the problems and set out a range of guidelines and performance standards for use by town clerks and other administrators as appropriate to the local situation. This is especially so since an arsenal of informal decision making tools has been built up over

the years by local administrators for the purpose of dealing with abnormal situations. Preliminary surveys have indicated that the major problems is the shortage, or even complete absence, of technical personnel rather than the paucity of managerial expertise. At the same time training programmes are virtually non-existent.

2.4 A questionnaire has been prepared for the purpose of interviewing officials in a carefully selected sample of towns noted in paragraph 5.4 (page 14)

3. Content

3.1 Administration

a) Administration of housing standards
b) Administrative machinery for approval; settlement of disputes
c) Decision-making process and flow of applications
d) Data storage and availability for other purposes
e) Police powers and enforcement; political outcomes
f) Preventive measures
g) Manpower and training
h) Inter-ministerial relationships

3.2 Political

a) The politics of housing standards and attitudes towards sites and services
b) Popular images and stereotypes of low-cost housing
c) Possible political outcomes of new standards
d) Corruption
e) Community participation in standards formations

3.3 Recommendations

Proposals for change

D.P.4/2

LEGAL ASPECTS

1. Objectives

1.1 to examine the legal powers of the various Act and regulations and to determine a hierarchy of such powers.

1.2 to examine the relative powers of the ministries concerned to enforce the application of the Government's policy related to low-cost housing.

1.3 to make recommendations to the Government on how the administrative and technical recommendations of the study may best be implemented within the legal powers existing at present.

2. Scope of the Paper

2.1 The legal aspects of the study are critical. Without a basis of legality, rules and regulations cannot be successfully applied and are therefore meaningless.

2.2 It is therefore necessary to define in detail the current legislation applicable to the construction of low-cost housing in Kenya. To achieve this objective it is necessary to interpret the legislation through case-law and to examine and analyse the conflicting interpretations and application of the present legislation by local authority officers.

2.3 Recommendations will then be made for the redrafting of the existing legislation and advice given on the ways and means of solving any disputes arising out of any conflict of the interpretations of the law.

2.4 We shall also make recommendations on the legal aspects of the most efficient way in which the legislation can be reviewed and updated to take account of socio-economic changes, new materials and advances in building technology.

3. Methodology

3.1 The legal advisor will undertake a library research on the current legislation, the law applicable and the overall legality of the legislation and attendant administrative action and will have discussions with legal experts who are involved in the building legislation in both national and local government.

4. Content

4.1 Current legislation

a) Street Adoption Act 1964
b) Fire Act
c) Electric Power Act 1972
d) Public Health Act 1972
e) Land Planning Act 1970
f) Building Codes 1968
g) Local Authorities Act
h) Local Government Regulation 1963
i) Law of Contract Act 1962
j) Standards of Road Construction
k) The relevant Land Law legislation, e.g. Registered Land Act, Cap 308
l) The Rent Acts
m) Housing Act

4.2 The legality of the legislation

a) The law applicable
b) Its legality
c) Interpretation of current legislation
d) The judicial attitude
e) The administrative attitude

4.3 The shortcomings of the legislation

a) How does the legislation inhibit solutions of low-cost housing?
b) The rationales of the legislation
c) How will reform legislation solve the low-cost housing problem?

4.4 Conclusions and recommendations

a) What are best ways of implementing the technical recommendations within the existing legal framework

b) What new legal powers (if any) are necessary

c) How can an appeal machinery be established and what legal powers should it have to ensure the implemet-ation of its decisions

d) How can reviews and updating of the legislation and regulations be most easily and quickly achieved

D.P.5

TECHNICAL AND DESIGN ASPECTS - BUILDING AND ITS PLOT.

1. Objectives (for the building and its plot)

   1.1 To investigate the requirements of existing legislation and analyse its applicability or otherwise to current needs and proposals for the production of low-cost housing.

   1.2 To examine revised standards of construction and use of materials and to recommend new, amended or revised regulations to the Government.

2. Scope of Paper

   2.1 This discussion paper will deal with the following aspects of legislation:-

   a) plot sizes - related to plot use
   b) plot coverage and building size
   c) design of houses and their use
   d) construction of houses : foundations
      walls
      roofs
      windows, doors, kitchens and showers/w.c.s.
   e) room sizes and ceiling heights
   f) building materials for all elements
   g) maintenance
   h) improvability

   2.2 The paper will investigate examples of current practice and traditional methods by means of interviews, site visits and examination of written studies already undertaken.

3. Methodology

   3.1 STAGE 1 - Examination of the technical and design aspects of existing legislation and comparison with the needs of low-cost housing.

This exercise will be undertaken primarily by examination of projects already implemented (or designed) and discussions with their designers. (NHC, local authority, HDD, private architects and engineers, etc.)

Solutions (both accepted and not-acceptable to Local Authorities) will be examined and noted.

NB. This exercise will cover a full range of types of development in different climatic, social and geographical variations.

Additionally the work of HRDU (both published and unpublished) will be examined and discussed.

It will be important also to discuss these problems with the local authorities. It is too easy to simply accept the applicant's viewpoint without trying to understand the reason (which may be quite realistic, practical and logical) for the non-approval of the proposals.

3.2 STAGE 2 - Analysis of the major points of conflict between the designers objectives and the legislation together with alternative solutions to these problems.

3.3 STAGE 3 - The production of specific recommendations for modification or ammendment to all the relevant legislation affecting the technical and design aspects of low-cost housing.

D.P.6

ENVIRONMENT AND SITE PLANNING

1. Objectives

For the planning and development of the housing area outside of the house plot.

1.1 to investigate the requirements of existing legislation and analyse its applicability or otherwise to the current needs and proposals for the production of low-cost housing.

1.2 to investigate revised standards of layout and land use for the development of areas of low-cost housing and to recommend new, ammended or revised regulations to the Government.

2. Scope of Paper

2.1 to examine the requirements for layouts of low-cost housing including:-

a) site conditions - soils, slope, drainage, etc.
b) density of development (dwelling/ha and Person/ha gross and net)
c) plot sizes - related to densities, security and privacy
d) orientation of plots
e) land subdivision
f) provision of open space and landscaping
g) sites for - schools
- health centres
- markets and shopping
- community centres
- public services
- employment centres
h) land ownership and disposal
i) reduction of noise nuisances
j) the possibilities of the use of shared facilities

2.2 overall provision of infrastructure:-

a) roads, carparking areas and footpaths

b) public transport
c) water supply
d) drainage system (foul and surface water)
e) electricity (including street and security lighting)
f) wayleaves for services
g) refuse collection system (excluding disposal off-site)

2.3 to allow for climatic and social variations for each of the above aspects thoughout the Republic.

3. Methodology

3.1 to gain an in-sight and understanding ~~of~~ the various aspects outlined above it will be necessary to examine:

(i) the specific requirements laid down in the Town Planning Regulations, (including the Town Planning Handbook 1971), subdivision requirements and local town planning requirements as embodied in local council minutes, requirements of Water and Sewerage and Public Health authorities.

(ii) to discuss with officers of the planning departments of Nairobi and Mombasa, the Physical Planning Department of the Ministry of Lands and Settlements and the office of the Commissioner of Lands, Water and Sewerage Departments (both local and national), and Public Health authorities (both local and national) their requirements and, where applicable, acceptable modifications for the layouts of low-cost housing areas with specific reference to site-and-service and slum upgrading schemes.

(iii) to discuss with organisations and professionals (both public and private) the problems they have encountered in obtaining approvals to their proposals.

(iv) to examine and analyse the reports of such organisation as the HRDU, World Bank and others regarding research and attempts at implementation of low-cost housing projects.

3.2 prepare a report outlining the major requirements of site planning and environmental legislation, to indicate those aspects which conflict with the objectives of low-cost housing whether they be financial, social or practical.

3.3 to suggest alternative proposals and make specific recommendations to the Government for modifications to existing legislation and/or for new regulations.

6
MANUAL/HANDBOOK

6.1 The Terms of Reference proposed that the Manual/Handbook will be prepared after the completion of the Discussion Papers and will illustrate their conclusions. However there are no definite descriptions of the contents of the manual. We consider that it could serve two purposes, either:

(a) a simplified illustrated guide to self-help building construction to help the plot-owners to construct their houses or

(b) an illustrated guide of the technical requirements of the clauses of the Building Codes and Town Planning Regulations

6.2 From initial meetings and observations we would recommend the second of these two alternatives for the following reasons:

- many plot-owners are capable of constructing their own houses either by themselves or more normally by use of fundis and/or small builders.
- often there is a mis-understanding of the correct requirements and interpretation of the Building Codes. This mis-understanding has two results:

(a) the form of construction is satisfactory but is condemned by the Building inspector, or

(b) the form of construction is too complex and results in expenses that the builder of low-cost housing need not incur

- such an illustrative guide would assist the officers of local authorities in understanding the clauses in the legislation especially where legal or quasi-legal written language is used
- the illustrations could, it is hoped, avoid mis-interpretation of the clauses.

3. Methodology

3.1 The existing legislation and regulations will be examined and their effects on the provision of infrastructure analysed.

3.2 The documents involved are:-

- Street Adoption Act 1964
- Water Act 1972
- Electric Power Act 1972
- The Kenya Posts & Telecommunications Corporation Act
- The Building Codes 1968
- Public Health (Drainage and Latrines) Rules 1972
- The Land Planning Act 1961/1968

together with such local modifications and ammendments as may have been made by local authorities and other organisations.

3.3 The analysis of the services already constructed (or designed) in Kenya, their failures and success especially in low-cost housing, site-and-service schemes as well as upgrading schemes. Particular interest will be given to the costs of installation, quality of materials, the standards and the specifications applicable.

3.4 Proposals for improved methods of infrastructure design and construction, bearing in mind the social status and habits of the communities served, availability of materials, costs and know-how.

3.5 Recommendations on new legislation. These should lead to a form of a Unified Code of Practice as opposed to the present situation where regulations affecting service infrastructure are found in several documents.

6.3 We would be grateful for the opinions of the Steering Committee, based upon their experience in the low-cost housing field in Kenya, in defining the precise purpose of this manual.

6.4 In either case we believe that more detailed knowledge gained during the preparation of the Discussion Papers will clarify the detailed objectives and content of this document.

7 DRAFT FINAL REPORT

7.1 The preparation of a series of Discussion Papers dealing with specific aspects of the whole process of building and development control, whilst allowing in-depth studies of these subjects, can easily lead to an overlapping of studies and especially recommendations. The phasing of the Discussion Papers has attempted to overcome these potential problems, but it will still be necessary to pull all the separate elements together.

7.2 The Draft Final Report will aim to achieve this objective. It will summarise the findings of each of the Discussion Papers and then draw overall conclusions for the total study.

7.3 Most importantly the Draft Final Report will define the specific legislative changes required. These may be simply ammendments to existing regulations and/or they may entail a completely new unified set of low-cost model housing bye-laws which will bring together into one document all the requirements currently found in different regulations, but with the benefit of the technical inputs of the study.

7.4 In addition it will, if considered necessary, recommend changes to the present administrative process or recommend a new system, especially where the present system cannot work efficiently due to a lack of technical manpower.

This recommendation may be vital for the smaller urban authorities who may not be able to attract sufficient technical staff of the right calibre.

7.5 Recommendations will be made for the establishment of a system to enable appeals against the adverse decisions of local authorities to be made where it is considered that there are no technical grounds for such adverse decisions or where it is considered that such decisions are contrary to national policy.

7.6 Building control legislation should not be static but should be able to accommodate changes in the socio-economic circumstances of the population, the availability of new materials and advances in building techniques. The legislation should be capable of accommodating these changes, if considered relevant, with the minimum of delay. We shall therefore suggest how this may be achieved both on a technical and on an administrative basis.

7.7 After comments have been received upon the Manual/Handbook it will be included as part of the Draft Final Report.

8
STEERING COMMTTEE

8.1 The Steering Committee has been selected to represent the interested parties in Government, Local Authorities, the National Housing Corporation, the Bureau of Standards, the University and the private engineering and architectural professions.

8.2

	Organisations	Representatives or alternate representative
1)	The Ministry of Housing & Social Services, NAIROBI	Mr. B.S. Rihal (Chairman) Mr. A.J. Marshall (Co-ordinator & recorder)
2)	The Ministry of Finance, NAIROBI	(Mr. F.M. Nthenge (Mr. F.E. Makila
3)	Ministry of Health, NAIROBI	Mr. N.M. Masai
4)	Ministry of Economic Planning and Community Affairs, NAIROBI	Mr. D. Mshila
5)	Ministry of Works, NAIROBI	Mr. D.M. Kabugua
6)	Ministry of Local Government, NAIROBI	Mr. Arap Kirui
7)	Department of Lands, NAIROBI	Mr. F.N. Mathenge
8)	Department of Physical Planning, NAIROBI	Mr. P.G. Kariuk
9)	Bureau of Standards, NAIROBI	Mr. J.E. Owino Okwero
10)	National Environment Secretariat, NAIROBI	(Mr. W.N. Mbote (Mrs. B. Mwaniki
11)	H.R.D.U University of Nairobi, NAIROBI	Mr. T.S. Chana
12)	Kisumu Municipal Council, KISUMU	Mr. M.A.O. Augo
13)	Mombasa Municipal Council, MOMBASA	Mr. S.O. Kiaye

14) Nairobi City Council, NAIROBI

Chief Planning Officer	Mr. H.C.M. Wangondo
Chief Public Health Officer	Mr. D.N. Kihara
Chief Fire Officer	Mr. G.M. Muchiri
Chief Counsel, Conveyancing	Mr. V.E. Muguku

15) National Housing Corporation, NAIROBI — Mr. J.E.D. Nyaseme

16) Architectural Association of Kenya, NAIROBI — Mr. R.W. Polkinghorne

17) Kenya Institute of Engineers, NAIROBI — Mr. I.G. Wanjohi

8.3 Through the Ministry of Housing and Social Services, the Study Team will submit its reports to the Steering Committee for its observations and comments.

8.4 It was also anticipated that the Steering Committee would provide valuable professional comment upon the various Discussion Papers produced, but we are concerned that with a total membership of 21 members, excluding the representatives of the Ministry of Housing & Social Services, the Committee is too unwieldy to meet regularly to consider the technical aspects of the Discussion Papers.

8.5 We therefore recommend that a series of smaller Working Parties be selected from the members of the Steering Committee to deal with the detailed consideration of the Discussion Papers. The Working Party should not have more than five or six members together with the Co-ordinator (Mr. A.J. Marshall), the Project Manager and the members of the Study Team concerned with the specific Discussion Paper.

8.6 By this means it is anticipated that all the members of

the Steering Committee would not have to attend every meeting, (and especially the representatives of Kisumu and Mombasa) although they would of course receive a copy of each Discussion Paper and will be able to submit their comments to the Working Party (providing they are not members) through the Co-ordinator.

8.7 A provisional suggested list of members of the Working Parties is shown in the following Appendix. It is recommended that the membership of the Working Parties be agreed at the first Steering Committee Meeting and that a chairman be appointed for each.

8.8 Therefore the role of the whole Steering Committee is reserved for policy decisions and overall agreement to the study although each individual member will have been involved in one or more technical aspects. As such, the Committee need only meet for the following purposes:-

a) to consider and comment upon the Inception Report
b) to comment upon all the Discussion Papers after detailed consideration by the Working Parties and to agree the purpose and form of the Manual/Handbook.
c) to agree on the draft Manual/Handbook
d) to comment upon the Draft Final Report
e) to accept the Final Report

8.9 The suggested dates for the meetings of both the Steering Committee and the Working Parties will be defined in Chapter 9:Programme of Work.

DISCUSSION PAPERS D.P.4/1 & D.P.4/2 - Political, Administrative and Community Participation Aspects.

* Mr. Arap Kirui	-	Ministry of Local Government, Nairobi
Mr. D. Mshila	-	Ministry of Economic Planning & Community Affairs
Dr. Chana		
Mr. F.N. Mathenge	-	Department of Lands, Nairobi
Mr. V.E. Muguku	-	Nairobi City Council
MR. R.W. Polkinghorne	-	Architectural Association of Kenya, Nairobi.
Dr. S.S. Yahya	-	Urban Economist)
Dr. G.M. Mutiso	-	Housing Administrator) Consultants
Mr. J.D. Murimi	-	Legal Advisor)

DISCUSSION PAPER D.P.5 Technical & Design Aspects.

* Mr. D.M. Kabugua	-	Ministry of Works, Nairobi
Mr. J.E.E. Owni Okero	-	Bureau of Standards, Nairobi
Mr. T.S. Chana	-	H.R.D.U., University of Nairobi
Mr. M.A.O. Augo	-	Kisumu Municipal Council
Mr. G.M. Mwaini	-	Nairobi City Council
Mr. R.W. Polkinghorne	-	Architectural Association of Kenya, Nairobi
Mr. I.G. Wanjohi	-	Kenya Institute of Engineers, Nairobi
Mr. A.S. Kitololo	-	Services Engineer) Consultants
Dr. S.M. Kaburu	-	Structural Engineer)

DISCUSSION PAPER D.P.6 - Environment and Site Planning

Mr. Mbote	-	National Environment Secretariat
Mr. P.G. Kariuki	-	Department of Physical Planning, Nairobi
Mr. S.O. Kiaye	-	Mombasa Municipal Council
Mt. T.S. Chana	-	H.R.D.U., University of Nairobi
* Mr. H.C.M. Wangondu	-	Nairobi City Council
Mr. R.W. Polkinghorne	-	Architectural Association of Kenya, Nairobi

V.N. Ludivadi
T. Teogia

Mr. J.E.D. Nyaseme	-	National Housing Corporation	
Mr. A.S. Kitololo	-	Services Engineer)	Consultants.
Mr. R.K. England	-	Public Health Advisor)	

9
PROGRAMME OF WORK

9.1. The overall period of the study, together with the principal reporting dates, were defined in the original Terms of Reference and ammended in the subsequent contract negotiations. Therefore, based upon the official study start date of the 1st August 1979, the following principal dates will apply:

Official start date	- 1st August 1979
Inception Report submission	- 1st September 1979
Completion of Discussion Papers	- 31st December 1979
Submission of Manual/Handbook	- 1st March 1980
Submission of Draft Final Report	- 9th April 1980

Assuming the proposed 2 months review period then:

Submission of Final Report	- 31st July 1980

9.2. Within these contractural dates it is necessary to determine the submission dates for the Discussion Papers. During the meeting with the Ministry of Housing and Social Services, the World Bank and the Consultants on the 11th July 1979 it was proposed that the submission of these Papers should be staggered to allow the fullest consideration of their content. Subsequent careful consideration of their content and their interdependence has re-inforced this proposal.

9.3. It is therefore proposed that the submission dates for the Discussion Papers will be:

DP 1	Economics of Building Control	24th October 1979
DP 2	Environmental Health	17th October 1979
DP 3	Infrastructure	31st October 1979
DP 4/1	Political, administrative and community participation	7th November 1979
DP 4/2	Legal aspects	21st November 1979
DP 5	Technical and design aspects	5th December 1979
DP 6	Environment and site planning	31st December 1979

9.4. The Working Parties would therefore meet to discuss these papers on the following dates:

Paper	Week commencing
DP 2	21st October 1979
DP 1	28th October 1979
DP 3	4th November 1979
DP 4/1	11th November 1979
DP 4/2	25th November 1979
DP 5	9th December 1979
DP 6	30th December 1979

9.5. Allowing sufficient time for the Steering Committee to consider the reports and to receive the comments of the Working Parties, it is suggested that the programme for its meetings would be:

Within the week commencing	Purpose
9th September 1979	To comment upon the Inception Report
11th November 1979	To agree the objectives and content of the Manual/Handbook
13th January 1980	To comment upon the Discussion Papers
16th March 1980	To comment upon the Manual/Handbook
9th April 1980	To receive the Draft Final Report and the Team's description of it
31st July 1980	To receive the Final Report

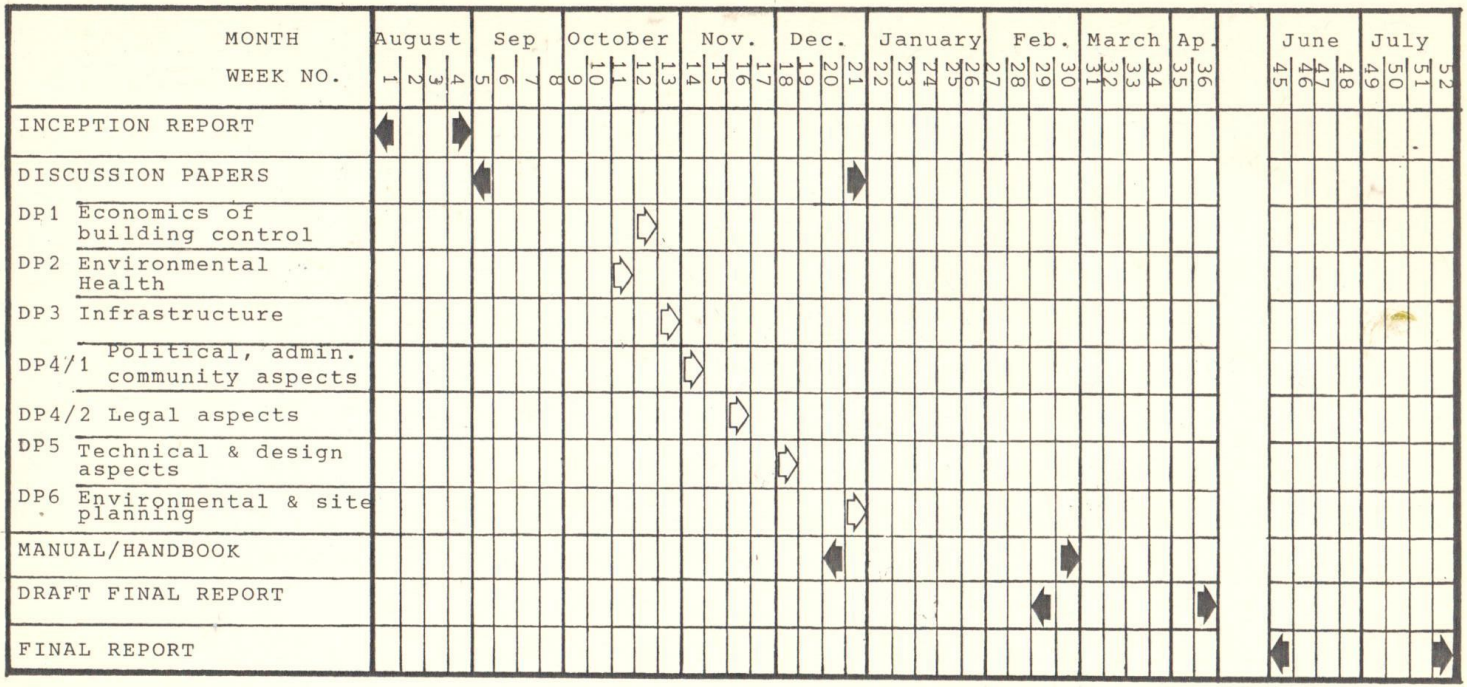
It may also be necessary for the Steering Committee to within the period from the 9th April to the 31st May 1980 in order to finalize their comments upon the Draft Final Report.

9.6. The Work Programme is shown graphically in the following Appendix.

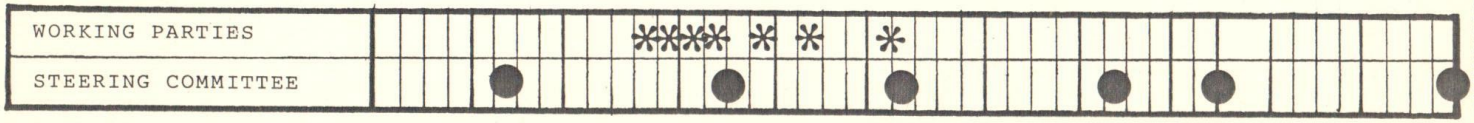
APPENDIX

WORK PROGRAMME

PROGRAMME OF WORK



MEETINGS



SECOND WORLD BANK/GOVERNMENT OF KENYA URBAN PROJECT

KENYA LOW-COST HOUSING BY-LAW STUDY

DISCUSSION PAPER
DP 1

THE ECONOMICS OF BUILDING CONTROL

NOVEMBER 1979

SAAD YAHYA & ASSOCIATES

KITOLOLO & PARTNERS

HALCROW FOX AND ASSOCIATES

FOREWORD

The Discussion Papers are prepared to enable members of the Steering Committee to fully contribute in the preparation of this Study. Therefore they are not final reports but evolving stages in the process of preparing the Manual/Handbook and the Draft Final Report. As such it is intended that their contents should receive the fullest attention of the members of the Working Parties and, subsequently all members of the Steering Committee.

This Discussion Paper DPI - THE ECONOMICS OF BUILDING CONTROL deals with the economic aspects of the building byelaws system as applicable to low-cost housing. It contains a number of tentative recommendations meant to guide subsequent phases of the Study as well as policy making in general.

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SUMMARY OF RECOMMENDATIONS

POLICY MAKING:

1. Refine the methodology for identifying low-cost housing and for isolating the various target groups in a heirarchy of priorities, while focusing attention on households in the 10th - 60th percentile in the income distribution range.
   Develop indicators that would be stable in the long term.
2. Initiate, through the Ministry of Local Government, a nation-wide survey of local authority fire services with a view to developing proposals for improving facilities especially equipment, transport, buildings, manpower and training.
3. Define the extent to which the armed forces can assist in fire control and prevention in urban areas.
4. Assist the NHC to prepare a land acquisition programme and to create a land bank.

PLANNING AND DESIGN:

5. Improve the design of cooking appliances and kitchens so as to minimise fire hazard.
6. Provide for the proper ventilation of kitchens.
7. Design a suitable method of storing the gas cylinder outside the house without it being stolen.
8. Provide adequate fire prevention and control service in the low-income neighbourhoods.
9. Provide adequate fire hydrants and access roads for the fire tender.
10. Widen the locational opportunities of the low-income households.
11. Develop and test suitable techniques for measuring site quality.

FINANCE:

12. Review the system for financing the construction of new fire stations and hydrants.

13. Take into account the lender's concern by reducing costs in invisible elements of the building.

14. Pay more attention to style, customer appeal and "packaging"

15. Promote the concept of fragile permanence, that is using "temporary" materials to produce durable construction.

16. Get the National Assurance Corporation, a state-owned company, to expand its fire business into the low-cost housing sector.

17. Make things easier for financiers, developers and subdividers through speedy approval of plans and less stringent conditions on infrastructure and excising of land.

18. Involve the Housing Finance Company of Kenya in lending for low-cost housing and in the design of fundable projects.

19. Review the amount of material loans from time to time to keep abreast of material prices.

20. Improve the capabilities of local authorities in the management and budgetting of infrastructure maintenance.

PROJECT IMPLEMENTATION:

21. Educate low-income families in the use of gas, paraffin and other inflammable fuels.

22. Prepare a list of approved fundis for use by house-builders; for example in a site and service scheme the list would be prepared and kept up-to-date by the project agency's representative on site.

23. Design a simple form of agreement for use between the developer and fundi.

24. Prepare a self-help construction manual with simple easily-understood specifications and details.

25. Prepare guidelines, model constitution and standing orders for the better administration of building groups.

26. Extend the housing extension service in local authorities.

27. Initiate a clearing agency and advice bureau for sub-tenants.

28. Prepare a suitable subletting agreement and encourage the use of rent books.

29. Encourage the formation of building groups in upgrading areas.

30. Compile a list of material suppliers and merchants for every town.

31. Devote more attention and expertise to site selection for public projects and sites and services schemes.

STANDARDS:

32. Restrict revised byelaws to single storey dwellings.

33. Take into account the special circumstances of the largest towns when designing a new code.

34. Make provision for the mixing of functions and land uses in residential areas.

35. Keep densities reasonably low i.e. not exceeding 200 persons per ha. net or plot sizes not less than $150m^2$.

36. Reduce fire hazard by means of appropriate barriers as well as by reducing fire risk at source i.e. in the kitchen, where the majority of household fires originate.

37. Allow the use of a temporary habitable shelter on construction sites.

38. Legalise the issue of the phased occupation certificate.

39. Permit the use of second-hand materials.

40. Prepare a unified set of standards incorporating relevant sections from Grade I and II Byelaws and public health legislation.

41. Recognise various cost implications of changes in the planning and design standards when approving building plans.

42. Develop guidelines on land suitability for housing purposes.

43. Integrate building control with the land use zoning system.

44. Restrict the felling of trees on building sites.

45. Seek further reductions in roads and sewerage standards and costs.

46. Promote non-waterborne sanitation and mobilise support for its use in appropriate circumstances.

47. Devise appropriate infrastructure standards for upgrading areas.

RESOURCE:

48. Design suitable house types to satisfy progressive development, affordability and partial subletting criteria.

TABLE 1.1: THE NUMBER OF TOWNS BY SIZE AND URBAN POPULATION IN 1948, 1962 AND 1969

Size of town	1948	1962	1969
Over 100,000	1	2	2
20,000-99,999	1	2	2
10,000-19,999	2	3	7
5,000-9,999	3	11	11
2,000-4,999	10	16	26
Total	17	34	48
Total Urban Population ('000')	276	671	1,082
Percentage of total population	5.1	7.8	9.9

Source: Human Settlement in Kenya 1978
Physical Planning Department

1.2.3 It is useful to note that during the three census years (1979 not yet out) about 70% of the total urban population (see Table 1.2) was located in Nairobi and Mombasa. The total urban share of the population is expected to rise from 9.9% in 1969 to 17.2% in 1983.

1.2.4 The existing level of service provision is inadequate. For example, the current urban housing shortfall stands at 290,000 units and an additional 30,000 units will be required annually during the current 1978 - 83 plan period. About 125,000 more units will be required annually for replacement due to obsolsence.

CHAPTER 1

URBANIZATION IN KENYA

INTRODUCTION:

Five hundred illegal dwellings are completed and occupied every week in urban Kenya. Three times as many come into being in the rural areas week by week. These numbers add to the vast "deficit" of 140 000 units and 500 000 units in urban and rural areas respectively needed if the existing obsolete or sub-standard stock were to be replaced. Replacement is obviously not even worth considering. It is impossible to even catch up with additional requirements at current acceptable standards. This means that our stock of sub-standard dwellings is increasing, fairly fast, and much faster in urban than rural areas.

Against this background one must then look at the towns' capacity to deal with this and associated problems. Meagre resources in the form of finance, manpower and access to the central Government ministries and key para-statals have constrained the capacity of local communities to help themselves.

1.2 URBANIZATION TRENDS:

1.2.1 Kenya when compared with other developing countries is urbanizing at a very high rate. Between 1969 and 1978 the annual urban population growth rate was 7.7% per annum of which 3.4% represented the natural growth rate and 3.3% the rural - urban migration rate. If this growth rate is sustained the total urban population will be four times the 1978 figure by the year 2000

1.2.2 In 1948 there were only 17 towns with a population of 2000 which represented only 5.1% of the total national population. However, in 1962, twelve years later the number of such towns had doubled. The latest 1969 census showed that there were 48 towns in Kenya. (see Table 1.1)

1.2.5 The problem is further complicated (see Table 1.3) by the fact that only 30% of Kenya's 440,000 urban households can afford the prescribed minimum conventional housing. This means that a solution must be found if the majority poor (representing 70% of the total urban households) are to be provided with shelter.

TABLE 1.3: NUMBER OF HOUSEHOLDS BY INCOME CATEGORIES, 1973 - 1978

Household Income p.m.shs.	Additional Households 1973 - 1978	%
A) Low income		
Less than 300	63,000	47
300 - 700	44,000	33
700 - 1,200	12,500	9
B) Medium income		
1,200 - 1,500	3,500	3
C) High income		
Over 1,500	11,000	8
Total	134,000	100

Source: Ministry of Housing

1.2.6 If the currently high urban population growth rate continues, coupled with the existing service shortfall, the consequences will pose a gigantic development problem.

Furthermore, the historical and unbalanced development of urbanization in Kenya has resulted in the dominance of Nairobi and Mombasa which have and will probably continue to experience most severely the acute problems of urbanization, such as inadequate and inappropriate housing, under and unemployment and the growth of uncontrolled settlements due to the continued adoption of high building and planning standards.

1.3 URBANIZATION STRATEGY:

1.3.1 The declared government urbanization strategy is aimed at:-

(a) The reduction of the national urban growth rate from 7.7% p.a. (1969-78) to 7.3% p.a by 1983, through preferential emphasis on integrated rural development and family planning programmes.

(b) The development of selected urban growth centres to control polarization towards Nairobi and Mombasa through provision of service infrastructure and more efficient utilization of existing urban services. Table 1.4 shows the distribution of designated service centres by province and the catchment population of each type of centre. The figures clearly portray the high population densities in Nyanza and Western province on the one hand and the high centre density in Central province.

TABLE 1.4: DISTRIBUTION OF DESIGNATED SERVICE CENTRES. 1/

Province	Designated Urban Centres	Theoretical Population served by each centre 1969	Designated Rural Centres	Theoretical Population served by each centre 1969	Designated Market Centres	Theoretical Population served by each centre 1969	Designated Local Centres	Theoretical Population served by each centre 1969	Total Designated Centres
Central	17	88,000	23	40,000	86	13,000	185	5,000	313
Coast	9	94,000	9	50,000	38	17,000	90	6,000	147
Eastern	17	100,000	29	40,000	93	14,000	173	6,000	314
North-Eastern	3	82,000	6	27,000	13	11,000	35	4,000	57
Nyanza	12	163,000	25	56,000	72	19,000	171	8,000	281
Rift Valley	18	105,000	37	38,000	74	17,000	263	6,000	395
Western	10	121,000	21	42,000	44	17,000	98	8,000	174
Total	86	113,000	150	38,000	420	16,000	1,015	6,000	1,681

1/ Desgnation is not solely based on present functions but also on an assessment of the future development potential and the level of service that should be provided in the urban hierarchical network of service centres.

Source: Human Settlements in Kenya.

TABLE 1.5: URBAN POPULATION IN KENYA DURING 1969-2000 (by province):

	Low Projection				High Projection		
Province	1969	1980	1990	2000	1980	1990	2000
Central	51.0	143.4	280.4	593.3	160.0	392.6	783.0
Coast	283.8	511.0	771.4	1,189.2	563.9	910.3	1,441.0
Eastern	37.9	103.0	212.2	490.2	116.3	304.6	640.0
North-Eastern	-	6.0	9.0	23.2	6.0	19.9	29.4
Nyanza	68.9	164.3	332.4	711.6	176.8	434.5	915.1
Rift Valley	151.0	296.0	522.7	955.9	341.7	690.4	1,282.8
Western	10.6	62.3	123.1	285.9	70.5	211.7	410.2
Nairobi	509.3	1,098.4	1,974.8	2,883.2	1,115.3	2,245.4	4,200.0
Total Urban	1,112.5	2,384.4	4,226.0	7,132.5	2.550.5	5,209.4	9,701.5

Source: National Urban Development Strategy for Kenya

CHAPTER 2

WHAT KENYANS CAN AFFORD

The National Development Plan 1979 - 83 estimates that of the existing 440 000 urban households only 30 per cent have sufficient income to afford minimum cost conventional housing. The plan pleads the case for sites and services:

> One proven method of reaching the majority of all urban families is through the development of site and service schemes. In these schemes the bulk of the construction work will be organised on an individual or collective self-help basis to keep the costs as low as possible.1/

1.1.1 A study has been commissioned by the Ministry of Housing and Social Services to evaluate the performance of the site and service programme. The results of the study will help the Ministry to initiate policy review in this sector. In the meantime the plan aims at the production of 74 000 dwellings during the plan period, excluding the traditional and informal sectors; of this figure the private sector will account for about a sixth and serviced plots 37 per cent. Whether this target will be achieved is another matter. In the 1970 - 74 plan period only 50% of the planned output of 25 000 units was achieved. In the subsequent plan period Only 9 000 units out of the planned 69 000 were produced, of which 3 000 were serviced plots.

1.1.2 The Ministry of Housing and Social Services has prepared a housing programme allocating £32 million during the period 1978 - 84 for low-cost housing in 38 urban centres, of which amount 45% is for the Second Urban Project in Nairobi, Mombasa and Kisumu. The target group is households earning shs. 300-1200 per month; those with incomes of less than shs. 300/= would be accommodated through subletting.

1/ Kenya, Development Plan 1979 - 83 p.172

AFFORDABILITY AND 'LOW COST' HOUSING:

1.2.1 In being concerned about low-cost housing, Government is appropriately endeavouring to provide accommodation that the majority of households can pay for. Thus Government has to monitor not only housing costs throughout the country, but also what families are earning and how they spend their money. It also has to differentiate between builders, purchasers and renters. Unfortunately, in the effort to increase the housing stock, too much attention has been directed towards builders and new construction, and too little towards purchasers of existing houses or renters. The latter group is especially important. There are no up-to-date statistics on the number of renters in urban areas but it will not be irresponsible to assume that they out-number the owners. Therefore low-cost housing should also include housing meant to provide low-rent accommodation. Table 2.1 shows the various criteria that could be used to identify low-cost or low-income housing for policy making purposes. The criteria are:-

- initial development costs
- market value
- rent
- household income
- dwelling quality
- residual approach
- location
- building height

1.2.2 The relevance and paracticability of each of the above approaches depends on the desired policy output.

TABLE 2.1:(Cont'd)

APPROACH/ CRITERION	MAIN INDICATOR	ADVANTAGES	DISADVANTAGES	PROBLEMS OF DEFINITION	WORKING RANGE A FOCUS	B INNER LIMITS	C OUTER LIMITS	REMARKS
Low income	Household income	Indicates the capacity to pay i.e. a measure of housing demand	Inadequate statistics. Must be converted to capital costs using rule-of-thumb methods	Non.monetary income difficult to value. Seasonal and self employed workers	sh.500 - 1500 p.m 20-60th percentile	shs.1500 - 2500 p.m	over shs.2500 p.m	The Development Plan 1979-83 assumes a medium monthly income in urban areas of shs.900 p.m and 25% of income devoted to housing expenditure - Ministry of Housing target is households earning sh.0 - 1200 p.m
Quality	Indicators include space standards access to services sanitation and environmental criteria	Quality control	Difficult to specify	Many qualitative aspects are not measurable	Minimum quality			Government specifies a minimum of two habitable rooms for all new housing.
Residual approach	Cost or rent below a certain level i.e.non-high cost	Conforms with prevailing attitudes and institutional practices	Unrealistic. concentrate attention and resources on the well-to-do.	What is a high income family?				
Location	Location in a certain area or zone	Physical and visible	Social stigma		Sites and services areas and upgrading areas.			
Height	Number of storeys	Single storey construction is the least expensive	Discriminates against multi-storey development		Single storey buildings			Some countries e.g. Tanzania have a simplified code for single storey houses.

HOUSEHOLD INCOMES:

2.3.1 The most widely used method is the income approach combined with rule-of-thumb techniques. For instance the Ministry of Housing approach of concentrating on households earning less than shs. 1200/= per month is well-considered since the upper limit is about the median income for Nairobi. Households earning below median income were also the target group in the USAID tenant - purchase schemes at Umoja in Nairobi and in thirteen other towns. In the estimates carried out by the USAID the income distribution in Nairobi (1976) was as follows:-

30%	Shs. 1047/= per month
40%	Shs. 1508/= " "
50%	shs. 1969/= " "

2.3.2 In a survey subsequently carried out for USAID at Umoja the median income of allottee families was found to be shs. 1190/= per month; non-allottees showed much higher figures. It is worth comparing these figures with reported incomes at Dandora (MEDIS 7, Survey date July 1978) where 55.5% of households earn less than shs. 700/= per month. This figure is still fairly high compared to incomes from wage employment in Nairobi, where 55.9% of employees earned less than shs. 600/= per month in 1977 (Table 2.2).

2.3.3 In the Second Urban Project the figures of household income distribution used for Nairobi show that families in the 3rd quintile earn between shs. 1501/= and shs. 2000/= per month (Table 2.3). In such projects it is normal to direct efforts towards households falling within the second and third quintiles or to areas where the majority say 80% of households fall within that income range. This type of approach

TABLE 2.3: NAIROBI HOUSEHOLD INCOME DISTRIBUTION,1977:

0 - 20%	Shs. 0 - 550
21 - 40%	551 - 1050
41 - 60%	1051 - 2000
61 - 80%	2001 - 4000
81 - 100%	over 4000

Source: Second Urban Project Appraisal Report

is quite valid provided that adequate data on income distribution are collected and presented to housing planners on a regular basis. For the purpose of this study we feel that emphasis should be placed on dwellings and structures meant to accommodate households within the 10% - 60% income distribution range.

SHELTER COSTS AND GRAIN PRICES:

1.4.1 In an effort to find a more stable measure of shelter costs we collected and analysed data on 93 public housing projects built in various parts of the country between 1965 and 1976. The cost per person was calculated on the basis of 2.5 persons per room, and the resulting figure was then related to the producer price of maize at the time of project completion. Maize was selected as a yardstick because of its importance as the staple food for the majority of Kenya's population. The cost of housing one person in terms of grain equivalent i.e. the number of maize bags that will buy enough shelter for one person, was fairly stable at about 50 bags until the major price increases in 1972 when the figure shot up to 90 and has remained roughly at that level till now (Figure 2.1). It is interesting to note that the mean cost per room

in public low-cost projects has risen from £100 in 1965 to £230 in 1976. 1/

1.4.2 The above method can supplement the rule-of-thumb techniques already in use e.g. the proportion of household income to be devoted to housing expenditure (25-33%) and the number of years' income that can build or buy a house (3-5).

CONCLUSIONS:

1.5.1 It is worth-while viewing the concept of affordability in a much broader and more dynamic context than hitherto. Relating housing programmes to cost limits, though useful in the short-term has its limitations, especially in an atmosphere of rapidly changing cost levels. In the long-term approaches based on household income distribution, and on the valuation of development costs in real terms, would seem to offer the least hazardous option. And whereas identifying the target group is fairly easy, ensuring the delivery of services to the intended group exclusively is impossible. It must be accepted that a proportion of the allottees or beneficiaries will come from wealthier sections of the community.

1/ For lack of space the raw statistics and computations are not included in this paper but are available from the Consultants as a separate Annex.

CHAPTER 3

FIRE HAZARDS:

. . On 3.11.78 at 2138 hours, a call was received from Mr.... to a house on fire at Kibera Drive - Olympic Village. On the arrival of the fire brigade it was found that a single mud room measuring approximately 12' x 12'was on fire. Two children were burnt to death; the third child had serious burns and was taken to Kenyatta Hospital in a 999 police car. The whole house was gutted. Fire loss approximately £800.

On 4.9.78, at 1233 hours, a call was received from Mr... to shanties on fire at Mathare Valley. On the arrival of the fire brigade it was found that a range of shanties constructed with corrugated iron sheets, hardboard and some with paper cartons were on fire. About 35 shanties and their contents were destroyed by fire. Fire loss approximately £5250. 1/

3.1.2 Minimising fire hazard is one of the prime objectives of building control. The building code goes to great lengths to specify the minimum requirements. Byelaws 71-76 relate exclusively to fire resistance in small houses. In this chapter we shall examine the pattern in which fire has occured in urban areas in recent years and the extent to which additional measures may assist in fire prevention and control. Attention will be focused upon the large towns especially Nairobi, Mombasa and, to a limited extent, Thika, because of the availability of fire statistics. Fire services do exist in some small towns, but they all depend upon Nairobi for the training of firemen, except for Mombasa which has its own training programme. In fact a new Training School has been proposed by the City Fire Officer who is already training men from other African countries as well as fire officers from the private sector.

1/ City Engineers Annual Report for 1978. Nairobi City Council, July 1979. p. 45

Fire Departments or Sections now exist in the following municipalities:-

- Nairobi
- Mombasa
- Thika
- Nakuru
- Eldoreti
- Kitale
- Nyeri
- Nanyuki (now covered by KAF)

3.2 FIRE CALLS:

3.2.1. An analysis has been carried out by the Study Team of all the reported fires in Nairobi for the three year period 1976 - 1978 for the purpose of ascertaining the location, cause and damage resulting from each fire. There is no consistent pattern from year to year as far the causes are concerned (Figure 3.1) but taking the three-year period as a whole the causes are unknown for about a third of the reported cases. The peak demand for fire services to residential buildings is in the dry hot season, that is December - February (Figure 3.2), although August does show a minor isolated peak possibly because of the more wide spread use of space heating during this cold month. The following list shows the rank order of recorded sources during the survey period:

1. Unknown/other
2. Doubtful - police to investigate
3. Electrical short-circuits in buildings
4. Paraffin, wax candle, lighted cigarette or electric motor in touch with clothes, cushions, bedding e.t.c
5. Hot charcoal burner
6. Escaping gas from gas cooker
7. Oil overflow in contact with a hot object
8. Family quarrel.

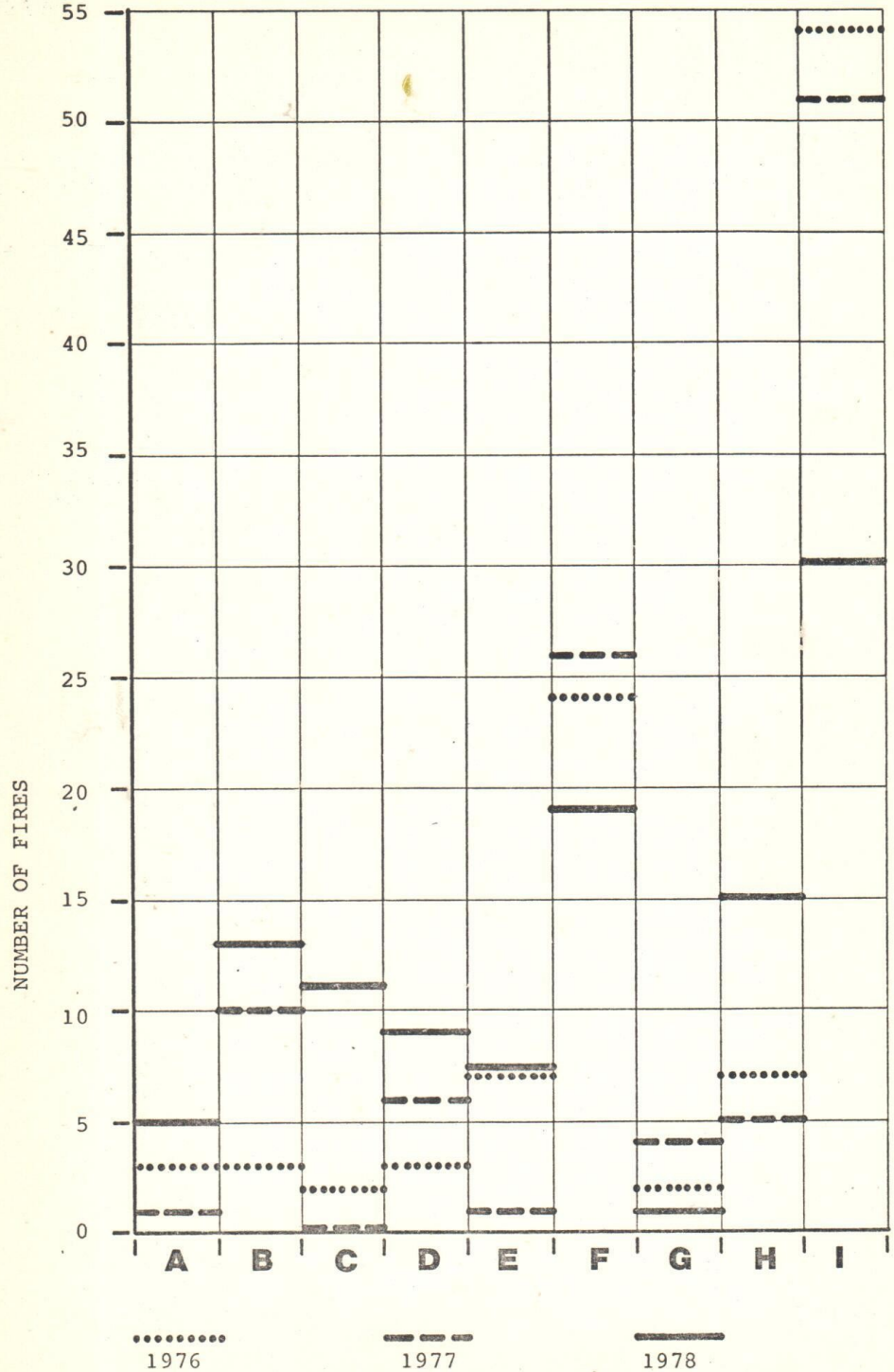

FIG. 3.1. FIRES REPORTED IN NAIROBI 1976-78 BY TYPE OF FIRE

KEY:

A. Oil overflow in contact with a hot object, getting ignited.

B. Short circuits in wiring in buildings.

C. Escaping gas from gas cooker

D. Lighted candle, cigarette or electric motor in touch with clothes/bedding/cushions.

E. Hot charcoal burner igniting a combustible material

F. Unknown

G. Family quarrel

H. Police investigation/doubtful

I. Other

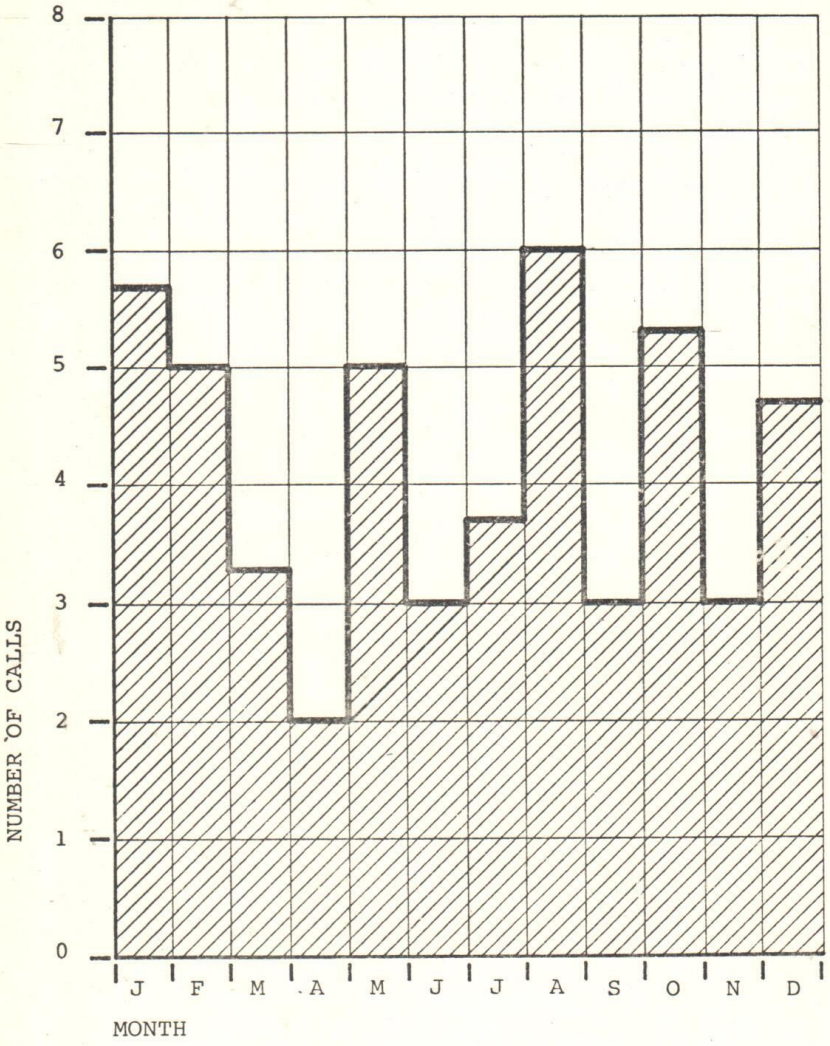

FIG. 3.2. REPORTED RESIDENTIAL FIRES IN NAIROBI 1976-78
(MONTHLY MEAN)

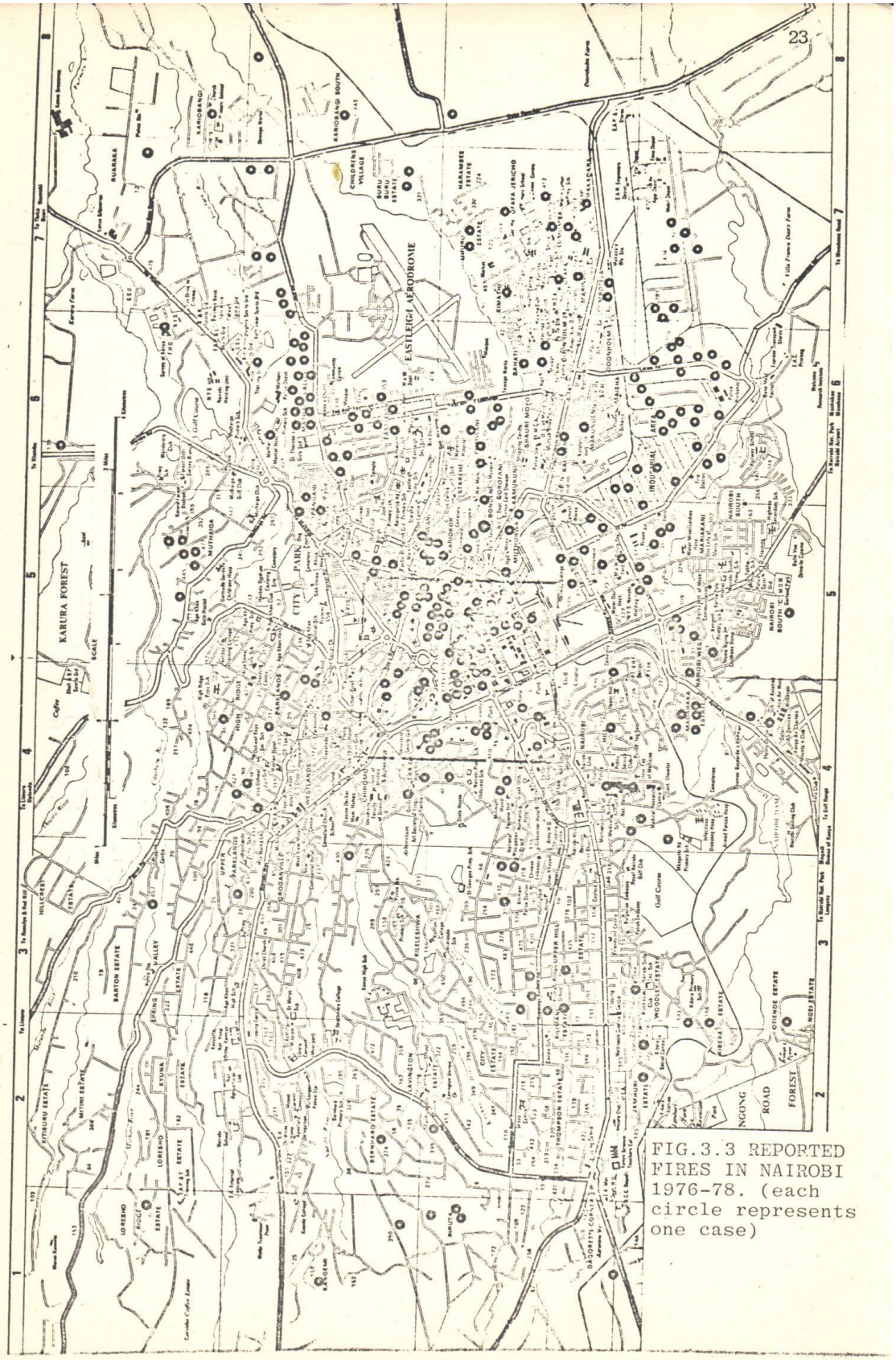

FIG.3.3 REPORTED FIRES IN NAIROBI 1976-78. (each circle represents one case)

3.2.2. The above list catagorises the various causes, but in reality they vary extensively in their nature. Some are relatively innocuous, such as rubbish in a dustbin; some are minor but well known to be dangerous, such as a cigarette butt left in a lift in an office block in Tom Mboya Street in May 1978; many originate from industrial processes such as coffee roasting, spray painting, boilers, laboratories As an example let us examine the source of fires and the damage done in a single month, February 1977 (Table 3.1). The whole period makes interesting reading, but we cannot include the complete list report for lack of space.

3.2.3. The incidence of fires in Nairobi shows three areas of concentration, that is:-

- the City centre, mainly in the area between Moi Avenue and the Nairobi River, where there is a large concentration of fish and chips shops, inexpensive eating places and car repair workshops.
- Eastleigh and Mathare Valley, the latter being a squatter colony with a history of regular fire outbreaks.
- the Industrial Area; the importance of this area is reflected by the presence of a branch fire station, the only one in Nairobi.

3.2.4. The above pattern emerges clearly from Figure 3.3., which also shows a higher concentration of fires in the eastern part of the City than in the western. While this phenomenon might be purely coincidental, it could also be associated with higher densities, a larger concentration of industrial activities, inferior building specifications and drier climate in this part of the City.

TABLE 3.1

FIRES REPORTED IN NAIROBI IN FEBRUARY 1977

Address	Type of Property	loss £	Source
Luthuli Ave	Fish & Chips Shop	750	Kitchen
Utalii College	Hotel	-	Bedroom-discarded cigarette
Car & General	Commercial	-	Electrical fault-printer
Argwings Kodhek	Depot	-	Watchman's shanty
Kariobangi	Market	74	Stall
St.Austins Rd.	Dwelling house	-	Dry grass
	Office	100	Lift-motor room
Parklands	Temple	50	Candle - ignited curtains
Mathare Valley	Shanties	400	Open fire spread from one room to several
Naivasha Rd.	Dwelling	50	Cable
Kimathi St.	Clothes Shop	1500	Clothes, etc.
Tom Mboya	Hotel	25	Cooking oil; spread to roof.

Source: Chief Fire Officer's Records.

3.2.5. In Mombasa the summary of calls received by the Fire and Ambulance Services from 1973 to 1978 is shown in Table 3.2. Again the peak demand is in December - March. Figure 3.4 shows the monthly average number of calls for 1976 - 1978. By far the greatest source during the dry season is burning vegatation and refuse, although the damage caused by these fires is quite small. The number of fire calls in Mombasa has been remarkably stable over the six-year period studied, even though the town's population will have increased by half as much as again.

3.2.6 Grass and vegatation are also the focus of the fire 'services' attention at Thika (Table 3.3) where household fires are surprisingly few. It must also be remembered that some of the calls are for fires occuring outside the township, since the town has to serve the surrounding rural areas. The Town Engineer reports that on 23rd March 1976 his men and sole fire tender spent six hours putting the out a fire at a factory in Thika and on the same day two other calls were received, one from the Market and the other from Makuyu; a child was severely burnt at the Market and died later in hospital.2/

3.3. FIRE LOSSES

3.3.1 The loss of life and limb is immeasurable in economic terms. In 1978 there were 8 fatal casualities, 43 non-fatal casualties and 3 cases of injured firemen in Nairobi. The fire force rescued 109 persons from burning buildings and motor vehicles. The financial loss during the

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2/ Municipal Council of Thika Annual Report for the year 1976.

TABLE 3.2:

SUMMARY OF CALLS: MOMBASA FIRE AND AMBULANCE SERVICES 1973 - 1978

	1973	1974	1975	1976	1977	1978
Fire calls	245	308	238	212	219	237
Special Service	184	192	210	239	232	280
False Alarm	31	49	51	39	36	45
Ambulance	10083	9353	9406	9176	8266	9717
TOTAL	10543	9902	9905	9666	8753	10279

TABLE 3.3

THIKA FIRE SERVICE: ANALYSIS OF CALLS 1970 - 1978

Year	Factory & Household	Grass & Vegitation	Motor Vehicles	Elect- rical	Special	Total	Damage £
1970	1	19	-	-	-	20	na
1971	3	40	1	-	-	44	na
1972	3	19	3	-	21	46	na
1973	3	31	3	-	24	61	6000
1974	4	41	2	-	41	88	50330
1975	4	53	3	2	37	99	1125
1976	2	66	1	1	106	176	10020
1977	1	22	7	1	36	67	3090
1978	3	31	-	-	47	71	20000

year was £216000. In Mombasa the loss during the year was £189000. Both in Nairobi and Mombasa 1978 was a good year compared to 1977. Table 3.4 and Figure 3.5 show the monthly fire losses in Mombasa from 1974 to 1978. There does not seem to be any direct relationship between the figures of fire losses recorded by the two major fire departments and insurance claims. The latter figures are much higher (Table 3.5) since they include all fires, whether urban or rural, and also a large element of industrial and commercial fires where claims could include loss of production, rent of alternative premises and other contigencies.

3.4 RESIDENTIAL FIRES

3.4.1 Although domestic fires may account for a significant proportion of total calls in any particular town the amount of financial damage done is relatively small (Table 3.6). The amount of fire loss in Mombasa by type of asset during the period 1976 - 1978 is shown in Table 3.7; it seems that 1977 was a particularly bad year because of the fire at the oil refinery (Figure 3.6).

3.4.2 In residential premises the main source of fire is the cooking appliance. The City Fire Officer feels that designers and housing administrators should pay more attention to the design of safe cooking appliances and methods and to the education of the low-income households in the use of different types of stoves and fuels. 3/
The charcoal burner is not now as popular as it used to be because of the mess it causes; storage problems; the need to cook outside caused by the fumes, which is difficult when it rains; and the rising cost of charcoal. Nonetheless it is still widely used among the urban poor. Paraffin stoves are preferred because they are cleaner, with the wick-type being safer than the pressure stove but less efficient. The gas cooker is more common among the richer households. With all these methods there are hazards involved. The City Fire Officer

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3/ Personal interview

TABLE 3.5

FIRE CLAIMS IN KENYA 1972 - 1975 (K£'000)

	1972	1973	1974	1975	1976	1977
Gross Claims	599	547	659	721	2956	1650
Less Reinsurance	160	145	164	154	855	466
Net Claims	439	402	495	567	2101	1184

Source: Statistical Abstract 1978, p. 197

TABLE 3.6

RESIDENTIAL FIRES AS PROPORTION OF TOTAL CALLS AND LOSSES IN MOMBASA 1976 - 1978*

	Calls %	Loss %
1976	39	18
1977	40	4
1978	35	3

* Excluding bush and rubbish fires

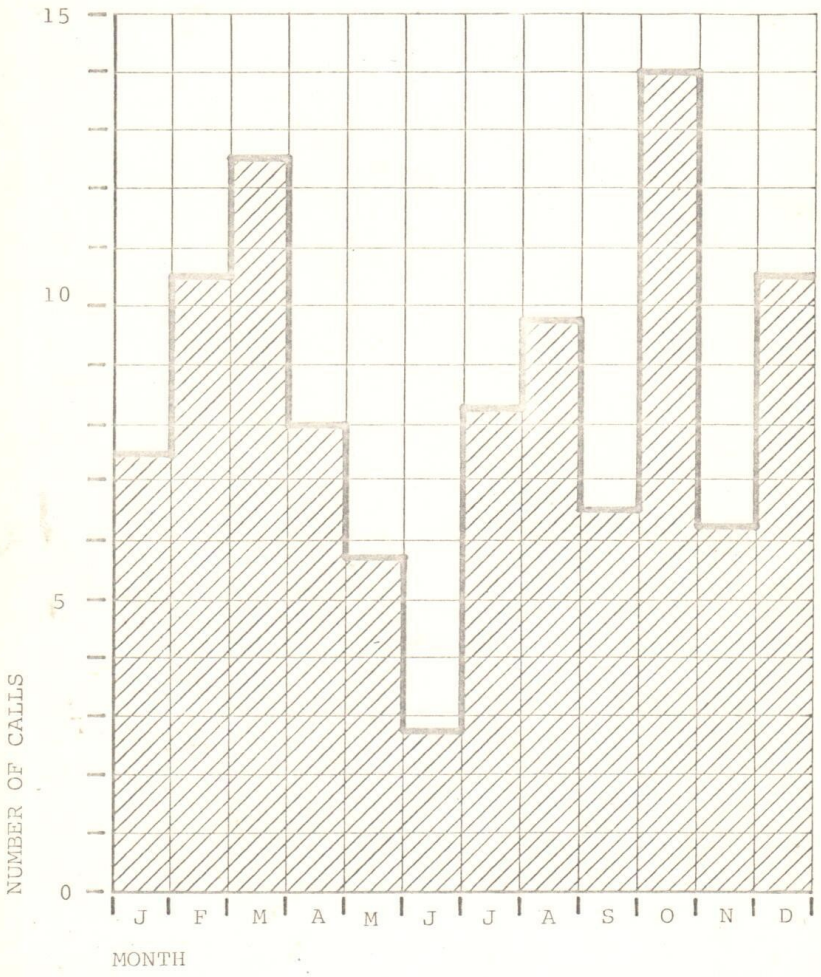

FIG. 3.4 REPORTED BUILDING FIRES IN MOMBASA (1976-78 MONTHLY MEAN)

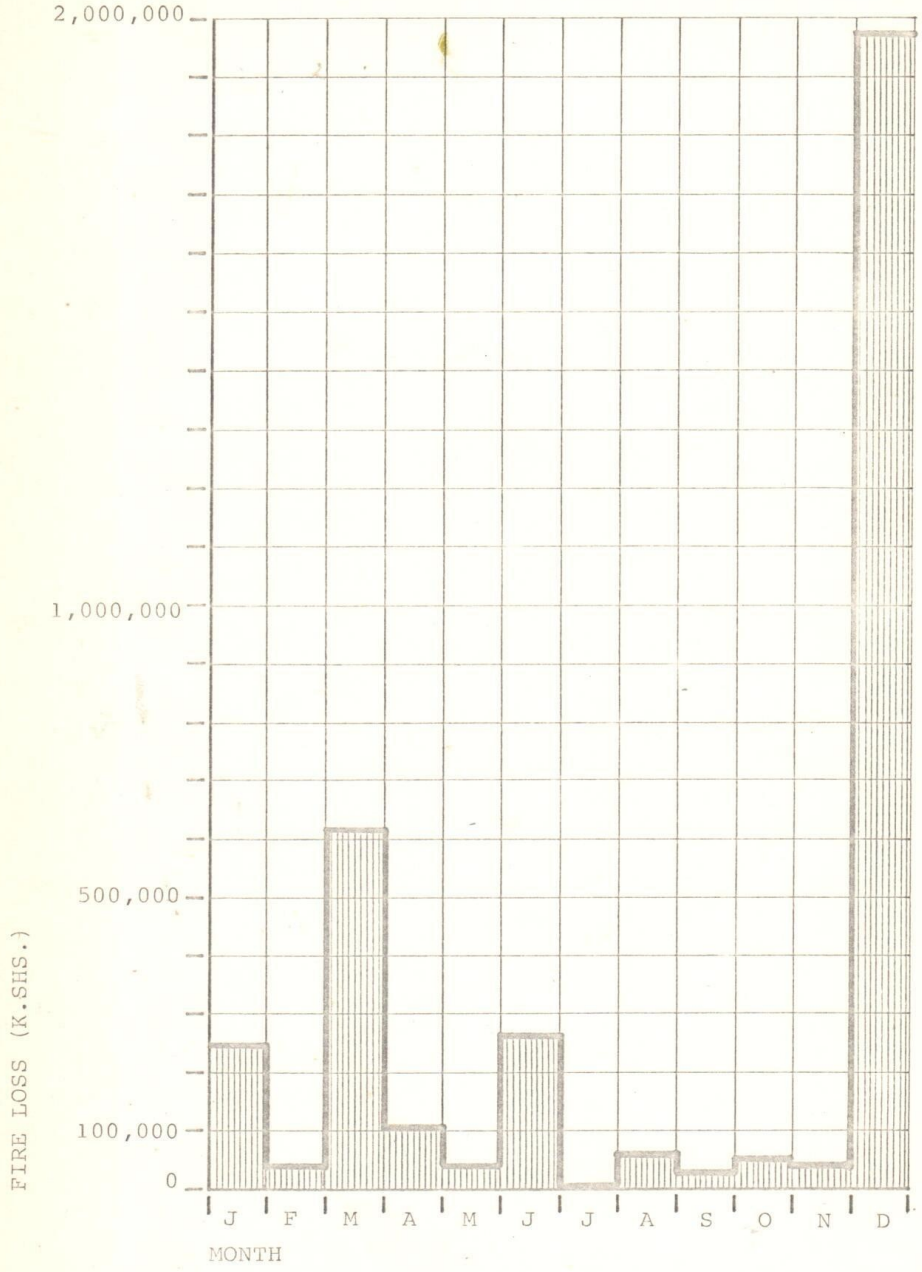

FIG. 3.5 MONTHLY FIRE LOSS IN MOMBASA, 1974-78

FIG. 3.6 RESIDENTIAL AND TOTAL FIRE LOSSES IN MOMBASA, 1976-78

notes the following common causes of domestic fires:-

- improper use of the kerosene pressure stove by putting in too much pressure or misusing the cleaning pin.
- "sufuria" (metal cooking pot) left to burn dry.
- undetected gas leaks causing explosions; people without the sense of smell should not use gas.
- burst gas cylinder: gas cylinders must be kept outside
- wood fire left to smoulder and not properly put out after use.
- inadequate electrical wiring.

3.4.3 Although electricians are licensed, many wiring jobs are undertaken by unqualified people. Moreover in low-cost housing, e.g. in the USAID tenant purchase schemes, it is normal to seek savings by allowing surface wiring (i.e. laying the wires on the wall surface) and to have the minimum number of outlets. It is also the custom in workers housing where the employer pays for electricity, to provide very few or no power outlets at all so as to minimise consumption. The dangers are obvious. When exposed wiring becomes loose the occupant may try to fix it with a nail. As incomes rise the household will consume more electricity for non-lighting purposes, resulting in serious overloading of the circuit and indiscriminate use of adaptors.

3.5 FIRE PREVENTION AND CONTROL

3.5.1 Although the byelaws pay a great deal of attention to minimising fire hazards, local fire brigades throughout the nation are generally understaffed, ill-equiped, and badly housed. Municipal Engineers' annual reports on the fire services are almost always a catalogue of complaints and

warnings of the consequences of neglect. It is worth while quoting the City Fire Officers' Report for 1978. 4/

> As it has been pointed out in every report of the previous years, the activities in the fire prevention are mainly coming to a halt so much that inspections in some areas of the city were not done adequately .....The City is yet to be fairly fire-covered until the proposed new fire substations in the areas for their construction is done. The issue of construction of new stations and staffing them in areas such as Outer Ring/Eastlands, Dagoreti/Karen; Westlands/Kabete and Roysambu is long overdue, and only when this will be done will the suffering of the people living in such suburbs, who fall in need of ourservices, be alleviated.

3.5.2 There are only two fire stations (excluding airports, military and private facilities), one in the city centre, the other in the Industrial Area. The eastern area of the city is not provided for, in spite of a large concentration of population at high densities and living in conditions that pose a relatively higher threat to life and property; the statistics show this. The City Fire Officer requested a site and funds for a fire station at Dandora. 5/ All he wanted was a shed for a fire tender. The response was not very encouraging. This is understandable in the context of budgetary restrictions. Nonetheless planners and designers must not only allocate land for fire stations but they must also endavour

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4/ Annual Report of the City Engineer 1978 Nairobi City Council July 1979 p. 39-48

5/ Personal interview.

to present a case for the necessary funding. Since the service does not reward decision makers and funding agencies with the same social and political benefits as say primary schools or markets, it will always end up low on the list of priorities. Even the provision of fire hydrants is sometimes a problem. Questions have been asked as to whether fire hydrants should be paid for, in the case of a large project such as Umoja or Dandora, from project funds or from the City Engineer's vote. This poor state of affairs is further illustrated by the situation at Thika.

> As reported in the previous years there is an urgent need of another Fire Vehicle and Ambulance, together with some modern Fire Fighting equipment. Our town is expanding industrially and so as to cope with the fire hazards in the industries modern equipment are essential.
>
> There is also a need of a fire-station as we do not have any. Currently the Fire Brigade and Ambulance are located in the depot where there are no facilities at all. For the maintenance of morale, discipline and above all training, the Fire Brigade and Ambulance require its own substation. 6/

3.5.3 Regular inspections of the following items need to be done, although this is normally not done because of lack of transport and men:-

- factories, hotels, public buildings, etc.; in Nairobi nearly 7000 buildings have to be inspected every year and 1200 full surveys made; in practice only 72 buildings were inspected and 28 full surveys made in 1978.
- fire hydrants
- occupation certificates
- inspections of godowns and factories at the request of the owner.

6/ Annual Report for 1976 Municipality of Thika, March 1977 p. 10.

- renewal of night-club licenses
- petrol station inspections

3.5.4 Whilst being shocked at the inadequacy of the fire service in the largest eight towns, we must also remember that many towns have no regular fire service at all, and they have to make do with ad hoc arrangements.

3.6 CONCLUSION AND RECOMMENDATIONS

3.6.1 Extra attention needs to be paid to the protection of low-income households and their dwellings from fire. Building byelaws should therefore endavour to allow less expensive construction with the same or higher level of protection as that which now exists. The quality of the fire service also needs to be improved. We therefore RECOMMEND as follows:

- improve the design of cooking appliances and kitchens so as to minimise fire hazard
- educate low-income families in the use of gas, paraffin and other inflammable fuels.
- provide for the proper ventilation of kitchens
- design a suitable method of storing the gas cylinder outside the house without it being stolen
- review the system for financing the construction of new fire stations and hydrants.
- provide adequate cover in the low-income areas
- initiate, through the Ministry of Local Government, a nation-wide survey of local authority fire services with a view to developing proposals for improving facilities, especially equipment, transport, buildings, manpower and training.
- define the extent to which the armed forces can assist in fire control and prevention in urban areas.

CHAPTER 4

BUILDING CONTROLS AND CITY STRUCTURE

4.1 This chapter examines in greater detail the relationship between dwelling standards and the urban structure or form. We shall discuss how permitted and real building standards affect residential location and the extent to which the urban economy is reflected through contraventions of the building codes. These contraventions are important; not only because they have a significant impact upon the visual and sanitary environment, but also because they form a useful starting point from which to begin the preparation of preventative measures.

4.2 TYPES OF CONTRAVENTIONS

4.2.1 If, as it is assumed, the building codes are in large measure irrelevant to the needs of the urban poor (who constitute a large proportion of the urban population) in what way are the codes violated? Where and how do the infringements occur? Our analysis of the vast range of contraventions observed shows that one could conveniently divide them into three categories:

a) mass squatting and illegal construction
b) isolated building contraventions
c) non-building contraventions

Each type of contravention is discussed in detail below.

a) Mass squatting

4.2.2 This contravention is found in the familiar squatter colony or illegal settlement of the type seen in the larger towns, eg. Mathare Valley and Nairobi Dam in Nairobi; Nyalenda and Pandiperi in Kisumu and Chaani in Mombasa. The characteristics of these settlements have been analysed at great length in the reports for the Second Urban Project. They are situated on unclaimed land close to the employment centres, possibly outside the town boundaries. They constitute discrete communities in every sense of the word. Virtually all the structures in such a settlement are illegal.

b) Isolated building contraventions

4.2.3 Such a category includes one or more structures which do not conform to the building codes. Their main features are that they are isolated or in small groups and there is no homogeneity. The illegal structures are intermixed with authorised buildings, or the same building may be partly authorised and partly illegal. The constituents of this category are:

- isolated squatters, usually found at the periphery of an established residential area or in a discrete corner of a vacant plot in a built-up area. The occupant is normally employed on another plot close by or he serves as a caretaker of a property near his structure
- unauthorised kiosks whose owners trade in food, soft drinks, cigarettes, etc. These structures are found in the industrial area and the town centre where they serve the low-income workers. In the high-income residential areas the kiosks provide, for certain items, a more convenient and accessible alternative to the formal neighbourhood shopping centre. The kiosks need an unused piece of open space with a road frontage and, if possible, proximity to a bus stop.
- semi-rural or peri-urban squatters. These may be genuine squatters or land owners who have erected unauthorised structures to provide more accommodation for their families or for rental. Densities are low and the predominant land use is still agriculuture, although the majority of the occupants of such structures would commute to the town to work. Examples are found in Dagoretti in Nairobi, Likoni and Kisauni in Mombasa and outside the smaller towns such as Thika and Muranga.
- old buildings that were erected before the building controls were introduced and which could not be built in their present form under existing legislation. Such buildings are to be found in the older cities of Mombasa and Lamu and in areas, formerly outside the townships, but which are now within the the extended urban boundaries.

For example, in Nakuru one finds old stone-and-tile farmhouses which are now within the Municipal Boundary, but which in many ways deficient as urban dwellings. In addition national monuments and buildings of historic interest would also fall within this classification.

- approved structures with minor illegal ammendments. That is those mainly built in accordance with an approved plan, but modified during construction, or after, to suit the owners requirements; to economise on building materials or to gain extra space for rental purposes. For example, a room shown on the approved drawing as a 'store' or 'garage' may, with minor modifications, be subsequently used as a habitable room; or a smaller sceptic tank may be constructed; or a room partitioned to provide two smaller rooms.
- unauthorised extensions or conversions to existing buildings. These happen most frequently in the low/medium income areas where there is a great demand for rental accommodation by the room. As a result the addition of only additional room provides the property owner with a substantial and stable income. For example in Eastleigh in Nairobi the local authority is under considerable pressure to permit the construction of additional rooms in the courtyards of the houses and to vary the permitted ground coverage. A plot of $500m^2$ with a permitted ground coverage of 50% produces $250m^2$ of undeveloped land which the owner wishes to exploit. If he can quietly construct an extra room or two, without being discovered, he will gain an additional rent of shs. 300/- per month on an investment of shs. 10,000/-. This represents a gross return of 36%.
- temporary shelters on a building site. These are normally condoned on sites-and-services schemes on the basis that they enable the owner/builder to live on the site whilst he constructs his dwelling and, at the same time, provides him with safe storage of his building materials. On more expensive building sites such temporary shelters are used by watchmen. The role of the temporary shelter in the process of house consolidation in sites-and-services projects will be discussed in detail in Chapter 6.

c) Change of use

4.2.4 The regulation of land-use is controlled primarily by town planning legislation and the conditions incorporated in the ground lease, and only secondarily by the building code. However, these three methods of control supplement each other. Moreover a change of use(r) in a building is often accompanied by structural or internal alterations. Thus where a dwelling house is converted to a bar and lodging house alterations may be necessary to the toilet facilities, storage facilities, kitchen and car parking. In addition the approval of the public health inspector is also required. Such a change of use is very popular along the main thoroughfares in the lower and middle income residential areas. The drinking 'clubs' found in the smaller rural centres are also, in many cases, conversions. The concern of development control is not only to ensure public safety, but to protect the neighbours from nuissance and noise.

4.2.5 Changing the intensity of development is a constant desire, particularly in or close to the centres of towns where land values are higher. As a result houses are converted into flats, whether legally or otherwise. This form of contravention is relatively easy to do and difficult to detect.

Subdivisions

4.2.6 Illegal subdivisions usually occur in the crowded rural-urban fringe where the pressure of population growth has forced former large farms to accommodate a number of families - each demanding its own homestead or shamba. This phenomenom is common in the Rift Valley and especially around Nakuru Town.1/ A number of farms have been bought by companies and co-operatives with thousands of members. With so many families settling on a farm de facto subdivision is inevitable, although in law the farm is one unit and its

1/C.S.Keriasek, TRENDS IN AGRICULTURAL LAND VALUES IN THE RIFT VALLEY PROVINCE. Unpublished M.A. Thesis, Dept. of Land Development, University of Nairobi, 1979

by economics.

4.2.9 The range of contraventions previously discussed are shown schematically in Figure 4.1. The examples given are merely illustrative and no attempt has been made, because of practical limitations, to assemble quantative data although this could be done on the basis of the model shown. Such data would show not only a great deal of overlapping (as shown in the diagram), but also some transformation in the nature and size of the contraventions as the town expands.

4.3 THE RELEVANCE OF TOWN SIZE

4.3.1 Kenya towns vary in size as discussed in Chapter 1. They also vary in their capacity to perceive and tackle problems. For the purpose of building control town size - as measured mainly in terms of population but also in the context of physical size - is important for the following reasons:-

4.3.2 Standards need to be more complex in bigger towns. In large towns dwelling and environmental standards are not only more necessary or relevant but they also need to be more complex to match the wide diversity of physical and user circumstances. The sheer size and densities of the residential areas magnify the health hazards and the fire risk. Thus there is not merely the greater potential for catastrophies but also the heightened awareness of the authorities. A cholera epidemic in Nairobi is a much more serious affair than one in, say, Kakamega. However the capacity to enforce standards and avert disasters is not necessarily greater in the larger cities.

4.3.3 The capacity to enforce dwelling standards is highest in the medium sized cities: The arguement is illustrated in Figure 4.2. The small towns have neither the manpower nor the resources to enforce legal standards. It is quite common to find one building inspector or survey assistant in charge of building control for a whole district. The largest towns however like Nairobi, Mombasa and Kisumu, though relatively

KEY
1. Large squatter settlements (e.g. Mathare)
2. Peri-urban settlements
3. Agricultural subdivisions outside towns
4. Conversion of dwelling to bar/lodging house; erecting a kiosk
5. Change of dwelling to shop etc. without structural alterations
6. Extensions of dwelling or other building
7. Unauthorised outbuildings

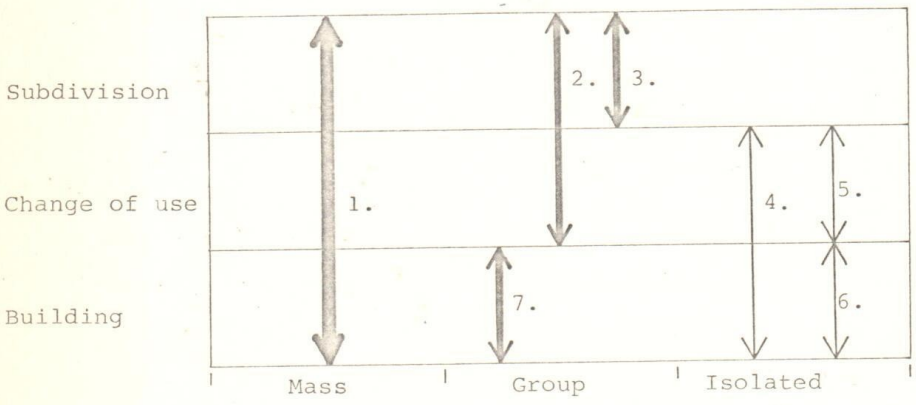

FIG. 4.1 VARIETIES OF CONTRAVENTIONS

well endowed in terms of manpower, lack the political muscle to demolish shanties and other unauthorised structures or to prosecute offenders.

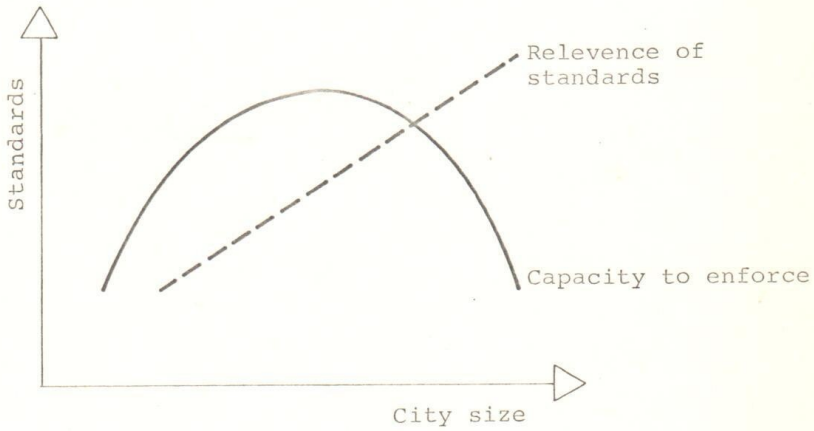

FIG. 4.2 CITY SIZE AND THE RELEVENCE AND ENFORCEMENT OF STANDARDS

4.3.4 The bigger the city, the more influential is the squatter lobby. The importance of Mathare Valley in city and national politics need not be stressed. In Mombasa the owners of 'temporary' houses on the Island and West Mainland have traditionally influenced any major urban development decisions. For instance the extension of Mombasa Airport in the early 1970's met a great deal of local opposition, while repeated efforts by a succession of Mayors to redevelop Majengo have met with little success.

4.3.5 Illegal settlements in the larger towns are more visible than in smaller. We are talking here not of visual impact but of consipicuousness among experts and officials. Substandard structures and conditions in the larger towns enjoy thorough scientific enquiry and better documentation. A case in point is the Urban Projects Series in Kenya which started with Nairobi and is now moving down the scale to the smaller settlements. Physical, economic and social

conditions in Nairobi have been better documented than those in the smaller towns.

4.3.6 The smaller the town the more difficult it is to assess the effective housing demand hence the desirable quality package. Housing designers and official suppliers are more likely to make mistakes and misread market preferences in the small towns than in the large. The market is not only limited in size, but it has unique local characteristics that are difficult to identify without a thorough pre-investment study and market analysis at the local level. There are numerous examples of well - intentioned tenant purchase and mortgage schemes built in the smaller centres which had to stay vacant for a long time because there were no eligible applicants. For instance the NHC houses at Mukueni remained vacant for over two years while the USAID/NHC scheme at Malindi failed to attract applicants and the houses had to be turned into a rental estate. Local people could find more spacious houses elsewhere in the town at the same price or even less.

4.3.7 Fire fighting services in the smaller towns are poor or non-existent. Only the four or five biggest towns in Kenya have a proper fire department. Therefore the capacity of the other local authorities to cope with a major fire is very limited and the standard infrastructure design practices regarding fire hydrants and access for the fire tender are irrelevant for most of the country. Infact standpipes and sand buckets may be more relevant in some situations.

4.3.8 It is easier for the bigger towns to attract finance and technical expertise for squatter upgrading. This point is related to what we have already written about visibility. Because of their manpower deficiencies, budgetary deficits, remoteness from core decision-making areas, low status in the local government heirarchy and lack of skills in project preparation, the smaller towns are immensely disadvantaged. This situation ought to be viewed in the context of the fact that upgrading projects are much more difficult to execute

than sites and services. It is natural that such towns should rely on the Ministry of Housing and the NHC for policy guidance and technical assistance, which raises other questions in the institutions area.

4.3.9 Intra-city variations in dwelling standards are more accentuated in the larger towns than in the smaller. Not only do standards vary, but the degree of variation is related to town size. The most expensive houses costing well over shs. 2 million each are built for occupation by top business executives, professionals and diplomats. The majority of these people are found in Nairobi and, to a limited extent, in Mombasa. At the lower end of the scale the most abject dwellings are erected in conditions of acute scarcity of land, materials and water. These too are conditions more likely to be found in Nairobi. Therefore, the minimum acceptable standards for the rest of the country may well be too high for Nairobi! Special standards may be needed for Nairobi (Figure 4.3) or certain parts thereof. In fact the city has traditionally used its own byelaws, which are legally different from the national building code but in substance more or less the same. These differences in housing standards or quality also apply to infrastructure where it is found that certain parts of Nairobi, Mombasa and Kisumu exhibit the worst kind of sanitation problems. The concept of special areas does not violate the overall principle of a uniform code.

4.3.10 What is the relevance of the above propositions? If anything they show that whereas a nationwide code may be administratively desirable and expedient, the performance and impacts may vary according to town size and there may even be cases where local circumstances warrant a local variation to the code. Some of these issues will come out more clearly in the discussion paper on political and administrative aspects.

KEY
1. Existing legal standards
2. Revised national standards
3. Exceptions

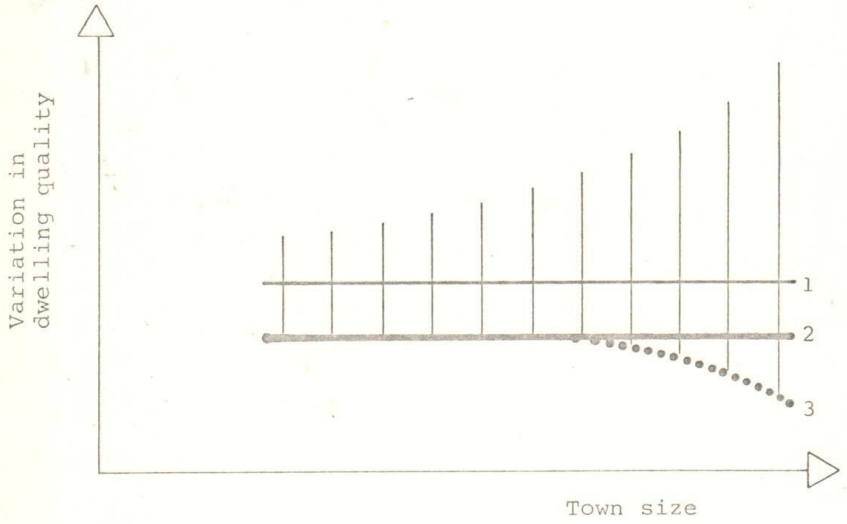

FIG. 4.3 TOWN SIZE AND VARIATIONS IN DWELLING QUALITY

4.4. BUILDING CONTROL AND LAND USE PATTERNS

4.4.1 The control of land use in urban areas is essentially a town planning matter. It is also a land management issue in that the Commissioner of Lands as ground lessor is empowered to regulate land use. This clear demarcation of regulatory domains has militated against a more liberal mixing of land uses in residential areas. An intermixing of functions would have several economic advantages, including:-

- creating new employment opportunities in the residential areas at minimal cost per job. A recent survey of small businesses in Dandora has shown a large incidence of small business enterprises. 3/
- reducing the demand for travel to and from distant centres of employment. Urban public transport services are already over-stretched while roads are congested at peak periods.
- bringing some essential services to residents, which would otherwise have to be surplus in other parts of the town. A doctor's surgery, lawyer's office or private nursery school will all be more economical to run if they are among the houses rather than in a separate neighbourhood centre.
- making fresh vegetables, fruits, eggs, and other necessities available through kiosks, street vendors and corner shops.
- making residential areas more heterogeneous, active and lively, the increased outdoor activity helping to improve neighbourhood security, especially in the evenings.
- creating a richer environment for children to grow up in especially in the context of being exposed to a wider range of experiences.

3/See MEDIS Report No. 7.

4.4.2 There are, of course, are qualifications to be made. We are discussing here low income residential areas. So the traditional argument about adversely affecting the value of adjoining properties does not apply. A shop front enhances rather than depreciates the value of a house. What must be avoided are the obvious nuisances and noisy activities e.g. a manufacturing plant in the middle of a residential area. Thus, far from advocating unplanned development, we are pleading the case for a more flexible approach towards land use planning and land use segregation. There is a strong case for extending the building control machinery to overlap with land use control since the central criterion is the use to which the building is put within the context of an overall general land use.

4.5. CONCLUSIONS

4.5.1 This Chapter has been more analytical than prescriptive. It has shown that the motives for contravening the byelaws or rather the reasons for non-compliance with them, are mainly economic. Various types of contraventions tend to appear in different parts of the town and a better understanding of this process can assist the authorities to take the necessary preventive measures.

4.5.2 The capacity of local authorities to administer and enforce building control is largely influenced by the size of the town, with the larger towns showing strong advantages over the smaller, although size does have its own peculiar handicap. In designing a national code, it is important that allowance is made for a wide variation in township size.

4.5.3 Finally the natural tendency towards land use mixing should not be resisted in appropriate circumstances. Small business enterprises in low income residential areas have a great potential for promoting employment, raising household incomes and enhancing community life.

CHAPTER 5

DWELLING STANDARDS AND HOUSING FINANCE

5.1 Two kinds of changes in the building control system are relevant to the manner in which dwellings are financed. The first is connected with changes in the technical specifications mainly for the building but also for the infrastructure. The other is the efficiency and speed with which development applications are processed and approved. In both cases minor changes would have important economic implications.

5.2 Where there is a cost-saving change in the specification of a building e.g. in wall thicknesses or in the quality of finishes, the reaction of the lender will be to re-examine the durability and marketability of the asset being offered as security for the loan. The more ephemeral the asset the greater the risk he has to bear. The mortgagee has traditionally been largely influenced by the following considerations in deciding whether and on what terms he should lend.

5.2.1 Permanence in all its aspects i.e the structural durability of the building itself; a reasonable long and stable title to the land; immunity from compulsory acquisition for slum clearance or some other public purpose; resistance to fire.

5.2.2 Legality, not only of the tenure but also of the building itself; thus the right document and the stamp of official approval are more important than the circumstances behind the granting of the title or approval; official documents and expert opinion are seldom questioned by the lender.

5.2.3 Marketability and value maintenance; that is specification changes are tolerable as long as they do not affect the saleability of property. There is thus more scope for "invisible" cost-saving devices than for those that affect the appearance of the property hence its attractiveness to potential purchasers. For example economies in the drainage system, floor thicknesses or timber framing in the roof would be more acceptable than reductions in say room sizes or plot sizes. The maintenance or enhancement of value on a long-term basis is also important.

5.2.4 The income-producing capacity of the borrower (mortgagor) as well as of the subject property. As far as the borrower is concerned changes in standards in the forms of a lower specification will bring into the mortgage market a new type of borrower who is interested in borrowing fairly small amounts, has a low salaried or business income and is most probably less educated than other borrowers; the result is an increasing degree of risk and higher administrative costs for the lender. However, the income producing capacity of the property itself is not likely to be adversely affected by a marginal drop or variation on specification since in the local property market the percentage return is higher for a poor building than for a quality one. That is, given the same location and space standards, rents are fairly inelastic in relation to construction standards. Nonetheless a lender who operates on the low income market has to bear the additional risk imposed by rent control which applies to all private dwellings let at not more than Shs.800/= per month or Shs.1,100/= if furnished.

5.3 It is obvious therefore that the lending institutions as presently constituted place a high value on permanence, stability, predictability and capital growth. Any innovation that threatens to upset these conditions will be unwelcome, unless sufficient guarantees and assurances are given by either the borrower or the Government, or both. We will see later how that could be done.

5.4 The second type of change in the building control system i.e. the improvement in the approval machinery will be welcomed by financiers because it will facilitate the development process and improve the turnover of funds. Development finance will be more efficiently used and the developer will lose less money through idle funds - even if invested on short-term deposit - as well as rent and taxes on idle land. We have received complaints that approval of development schemes takes too long, especially for large estates of low and middle income housing. In theory it should not take longer than a month for plans to be approved, since that is the normal frequency of the appropriate committee meetings in most local authorities. The usual time taken however is much longer, since quite apart from the local council, the "planning authority" involves several other agencies e.g. the Commissioner of Lands, the Director of Physical Planning, the Director of Surveys and the utility corporations. It is only in Nairobi that there is a Town Planning Liaison Committee to deal speedly and efficiently with abnormal cases.

5.5 The cost of delay is not only the difference between the loss rent (or loss of occupation benefits) and the interest accrueable from money on short call; it is also the increase in construction cost due to inflation. While the developer is supposed to allow for escalation the unpredictability of the length of the approval and certification process makes it difficult for him to estimate an appropriate price escalation rate. As a result many developers in the medium-income market have resorted to the practice of selling houses at a provisional price and collecting substantial deposits even before the foundation trenches are dug. They may also downgrade the specification so as to accommodate price increases.

5.6 Even after construction has commenced expensive delays can occur through no fault of the developer. We have been informed of recent and current schemes which have had to stop midway because it has been discovered that the contractor has built on say the road reserve or sewer easement. Such delays are not only costly but also cause unnecessary hardship to the prospective allottees.

5.7 Another source of delay and frustration is the insistence in some cases by the local authority that the developer or sub-divider should surrender unreasonably large quantities of land for public purposes, or that he should build the trunk infrastructure from the existing main sewer or road to his estate at this own expense, even though the intervening land is public land. One lending institution has contended that these stipulations are not only costly but also unfair. They may even be illegal. Above all they add to the final cost to the allottee of the dwelling or site.

A minor change in construction standards would not affect the prevailing ratios unless the durability of the building over the loan period is doubtful, since adjustments can be made elsewhere i.e. in the interest rate, repayment period and insurance premia.

5.8.3 INTEREST RATES : The prevailing rates as at the time of writing are 10-12% depending on whether the house is bought for owner occupation or for letting. In order to encourage owner-occupation lower interest rates are levied. These are already quite high for owner-occupied low income housing. For instance the monthly repayment on a Shs.50,000/= loan over 15 years @ 10% is shs. 546/=. At 7% over the same period the repayment would be shs. 458/=. Thus although lowering interest rates to more concessionary or compassionate rates would have a strong social appeal, it cannot be done unless cheap funds are available. However as soon as the houses are partly or fully let the picture changes completely. Evidence from various low cost schemes in Kenya shows that the income from subletting produces returns of 20% or more. If therefore subletting is acceptable as a matter of policy, an increase in interest rates resulting from a revision of the building code downwards would be quite tolerable. Such an increase in interest could be argued by lenders on the basis of the greater risk and administrative expenses incurred through handling a large number of small accounts held by poor and largely unsophisticated customers. Subsequently interest could be lowered as an incentive to improve the house.

5.8.4 REPAYMENT PERIOD : The normal periods favoured by lending authorities in Kenya are 10, 15 and 20 years.

Again lengthening the period would be more beneficial for the low income borrower; but it is characteristic of low cost housing that the tenure is normally short-term while the durability of the construction is suspect. Therefore a reduction in standards would have to be counterbalanced by a lengthening of the tenure. That is a mud and wattle house built to a high specification on a freehold or 99-year leasehold site should not have less mortgage appeal than a minimum grade concrete block structure built on a site held on a 35-year lease.

5.8.5 INSURANCES : In the private sector the mortgage agreement always insists that the property be insured against damage by fire, floods and other hazards. In the public sector the risk is normally carried by the government or the relevant local authority. Bye-laws or codes that increase fire risk will naturally result in higher premia assuming that the insurance companies will want to insure. The current rate for durable approved construction is from Shs.5/= to Shs.8/= per £100. One can foresee these rates going up as a result of the use of more timber, thatch, thinner walls and higher densities. These would be the insurance industry's reaction to the change, not necessarily logical. The experience in Mombasa, where there are extensive areas with thatched mud houses is that the incidence of fire is not any higher than in the high-grade neighbourhoods. What is important is not so much the materials used as the way they are used, the type of cooking facilities, dwelling densities, and proper servicing with access roads and fire hydrants. Thus fire risk, hence insurance premia, could be controlled through throughtful design both inside and outside the dwelling.

5.8.6 Middle-aged borrowers are normally required to insure their lives so that should they die the proceeds will go towards redeeming the loan. This small addition to the monthly costs seems to be quite justified. For instance the Housing Finance Company of Kenya requires the applicant for a loan to produce his birth certificate and the loan conditions stipulate:

- The security document will provide for the life of the Mortgagor to be insured by the company for a sum assured equivalent to the outstanding loan. The sum assured will be used to liquidate the outstanding loan should the Mortgagor die 1/

5.8.7 There is no direct relevance of this condition to the revision of dwelling standards especially as no relationship has to our knowledge been established between housing conditions and mortality among heads of households. If such a condition were applied rigorously the life business of insurance companies would certainly grow and more funds would be generated for investment in housing or other sectors. The alternative would be to have a mortgage guarantee or insurance scheme underwritten by the government or a parastatal organisation.

HOUSING FINANCE INSTITUTIONS

5.9.1 The lending methods and attitudes discussed above are applicable mainly to private lending institutions consisting of:-

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1/HFCK Loan Conditions, 1978 Editon

- Bulding societies and similar organisations, such as the Housing Finance Company of Kenya, East African Building Society, Savings and Loan Kenya Limited and Pioneer Building Society, which has very recently been formed; the Housing Finance Company of Kenya will be discussed in greater detail later in this chapter.

- Commercial banks which lend money for the purchase and construction of houses when liquidity is high. Lending policies vary from bank to bank but the terms are normally less favourable than those obtainable from building societies, with the repayment period rarely exceeding ten years.

- Insurance companies have contributed to housing development financing in two ways.Firstly by financing large scale estate development for the middle and high income market, and secondly by giving loans to their clients for house purchase.

5.9.2 Private institutions will also include the private individual who manages to raise money either through his own savings, or through relatives and friends, for purchasing or building a house. Such private sources normally cover the difference between the total cost and what the household can raise in the market by way of mortgages. In sites and services schemes, where loan facilities are limited, the owner/ builder has to rely mainly on his own resources. Here are the findings of one researcher:-

- Several women admitted having resorted to chang'aa (illegal liquor) brewing and selling to increase their regular income. Having completed their houses, they stopped the chang'aa business. One person

> turned to black market trading as a sideline. Yet another person obtained small 'loan' from people promising each of them the same room as soon as it was ready. By receiving many deposits in this way the house owner could complete the house. He later returned some of the deposits ..... That is, the illegal means made it possible to build a house, which later provided the house-owner with a legal income from sub-letting.2/

5.9.3 Financial stress and the desire to complete the dwelling forces plot owners into the informal and semi-formal credit market. At Dandora it has been found that about a third of all allottees borrowed money for construction in addition to the official materials loan, the sources being friends, relatives, co-operative society and employer in that order. The mean amount borrowed was Shs.3,500/=, having doubled in less than a year (December, 1977 - July, 1978) while the number of borrowers had almost tripled during the same period.3/ The HRDU sites and services evaluation study shows that a quarter of all allottees have borrowed from private sources.

5.9.4 Co-operative savings associations and building groups play an important role but there is very little documentation on these sources of housing finance. The building groups operating at Dandora are discussed in Chapter 6. Housing co-operatives are the subject of intensive discussions and new policy making in the Government at the moment and we understand that a Co-operative Housing Bank is in formation.

2/ M.S. Muller "House Building in some sites and services schemes: Some observations", HRDU June, 1977, p 12.

3/ Senga Ndeti & Associates, MEDIS 7, March, 1979

5.9.5 Public funds for low cost housing are mainly chanelled into:-

(a) development finance for mortgage schemes
(b) rental schemes
(c) tenant purchase schemes
(d) development of plots for sites and service projects
(e) materials loans for sites and services allottees.

The agencies involved are NHC and local authorities, with the central government not being directly involved.

5.9.6 In the case of rental schemes standards are usually high because of the liberal financing arrangements, the desire of the local authority to project a favourable development-oriented image, and the ability of such schemes to yield revenue surpluses. Our discussions with local authority officials have shown that rental schemes are very popular largely because of the revenues they yield, the enhancement of the council's assets, and the political benefits. Grade II Bye-laws have rarely, if ever, been used in rental schemes.

5.9.7 Tenant purchase is a variation of the mortgage arrangement, with the local authority acting as the developer and mortgage lender at the same time. The tenant is in fact a borrower. Nairobi City Council has successfully used this model for a long time. A well known example is Kimathi Estate in Nairobi. This was the first USAID project in Kenya, consisting of 343 three-room and four-room units built to a high specification. The money, approximately $2 million, was given to NCC through USAID by an insurance company in the United States at 7.75% for a maximum period of 20 years. The loan was guaranteed by both the Kenya Government and USAID. Allottees had to pay a 5% deposit and the remainder over a 10, 15 or 20 years period at 8½%.

5.9.8 The success of Kimathi enabled the USAID to arrange two further loans for low cost housing under its Housing Guaranty Programme. Ten million dollars were allocated to NCC for Umoja Estate and five million to NHC for tenant purchase schemes in twelve smaller towns. The financing terms were generally similar to Kimathi except that the interest had risen to 9.2%. Allottees had to pay 10%, the difference being NCC and NHC's administration fee. In these schemes Grade II Bye-Laws were used. Apart from Umoja Estate this series of tenant purchase schemes includes estates of varying sizes in the cost range £1800 -£3500 per unit at Eldoret, Embu, Kericho, Kisumu, Kitale, Malindi (subsequently converted to a rental scheme) Meru, Mombasa (two sites), Nakuru, Nanyuki and Thika. The schemes are now in various stages of construction, with many of them completed.

5.9.9 Finance of sites and services projects is administered by the National Housing Corporation and, for the World Bank series of projects, by the Nairobi, Mombasa and Kisumu municipalities. In the 1974 - 78 Development Plan period the NHC executed either on its own or with the help of consultants, 37 sites services schemes listing a total of £9.7 million. The NHC lends the money to local councils at about 6½% for a maximum of 20 years, and the councils onlend to the allottees, the maximum available to each plot-holder being Shs.14000/- of which 50 % is for infrastructure and services and 50%, i.e. Shs. 7000/-, is in the form of a materials loan.

The scheme is outlined in the NHC's Sites and Services Guidelines, which also specifies infrastructure standards and materials which may be used for building the house. For instance sawn timber, offcuts, mud and wattle and bamboo are allowed. Nonetheless many local authorities have been reluctant to allow the use of such materials. 4/

The operation of the materials loan concept is also illustrated in Chapter 6 in connection with the Dandora project. In the same chapter the First Urban Project is described. The Second Project involves sites and services and upgrading sites in Nairobi, Mombasa and Kisumu plus the normal peripherals like housing loans, community facilities and technical assistance. 5/ The project is expected to cost about K.£29 million of which a third is to be provided by Kenya Government and the remainder through an IBRD/IDA credit.

4/ As one Town Clerk has remarked, "we approve of Grade II Bye-Laws and the NHC Guidelines, but we are not going to create slums in our town.

5/ See Appraisal Report, Second Urban Project

Another donor agency that is involved in financing low cost housing is the European Development Fund which has identified three project sites in Nairobi, for which a sum of K£2 million has been committed.

5.9.10 The reason for mentioning these three funding agencies is that they have played, and will continue to play, a very important role in the formulation of appropriate housing standards. Because of the influence and expertise that they command the major donor agencies are in a position to initiate and execute changes that would be very difficult for the Government to initiate internally.

5.9.11 Although the private lending institutions mentioned earlier have been financially very successful there are reasons for concern and complaint as far as low cost housing are concerned. None of them has been actively involved in low cost housing although there is nothing in law or in principle that prevents them from doing so. For instance HFCK is empowered to give loans of as little as Shs.22500/=. The resistance has arisen out of traditional attitudes towards what is an acceptable security. Traditional rules have tended to favour the well-endowed in terms of initial capital, personal income, regular employment, secure tenure, and favourable locations. At the same time the role of the African as a serious and responsible borrower has only crystallised over the last decade or so. This emergence of a new type of client has not been matched by innovative concepts and routines to suit his social and financial needs, in spite of numerous exhortations by government that lending institutions should be more flexible.

5.9.12 It is apparent therefore that major policy initiatives are called for on the part of government. These should focus an extending and liberalising the activities of either or both of the two state-owned building societies i.e. HFCK and SLK so that they:-

- adopt a more liberal approach to low cost housing and sites and services schemes.
- simplify the formalities that a borrower has to go through.
- lend to owners in the upgrading areas.
- establish branches in the smaller towns, expecially those to be covered by the Third Urban Project.

5.9.13 A more detailed look at the operations of the HFCK may now be useful.

THE HOUSING FINANCE COMPANY OF KENYA LTD

5.10.1 The Estate (Buru Buru) continues to live to its reputation as an outstanding example of co-ordinated urban development and the largest single Mortgage Housing Project in East Africa. Constructed and finished to very high standards, the selling prices have been competitive to meet the needs of the lower and medium income groups, for which the estate was designed.

5.10.2 The above is an extract from the Annual Report and Accounts for 1976 of the Housing Finance Company of Kenya Ltd. Buru Buru is one of the more successful estates they have handled recently. There are others e.g.

- Kericho Mortgage Scheme (NHC)
- United Housing Co., Ngong Road (private)
- Section 58 Mortgage Scheme Nakuru (NHC)
- Tom Mboya Mortgage Scheme Kisumu (NHC)
- Ngei Estate (NHC)
- Old Race Course Road (Ministry of Housing)

As mentioned earlier the lower lending limit is Shs.22,500/=, fixed about ten years ago. Thus a house built for say Shs.30,000/=, provided it is in permanent materials and the plans have been approved by the local authority, could be considered for financing. Within the general considerations discussed earlier, there are no specific guidelines or rules as to what constitutes as acceptable standard. For instance a mud and wattle house finished to a high standard i.e. with plastered walls, ceilings, running water, WC and tarmac access road could be seriously considered. The question of approval does not arise since no such application has yet been made. We have for instance been assured that the type of houses now being built at Dandora are "very mortgageable", assuming that these neighbourhoods are permanent in the long term and will not be subject to slum clearance. In such a case then the problems would seem to arise from the tenure, since in site and services schemes the allottees are not given title deeds. The HFCK insists on 30 years of unexpired title after repayment.

5.10.6 A 90 % loan of Shs.22,500/= means a house costing Shs.25,000/=, which at 10% over 20 years (the maximum repayment period) ca be purchased on monthly repayments of Shs.220/= excluding land rent and other charges. A household earning 660/= per month could purchase such a house. The HFCK rule that the loanable amount should not exceed three times the annual income means that the minimum loan is available to a household earning Shs.625/= per month. This income group is well within the recognised low-income category however one would like to define it. In fact the early HFCK schemes were within this category e.g. Buru Buru Phase I (Shs.36,000/= loan) and Kibera (Shs.27,000/=). Subsequent rises in construction costs have unfortunately pushed HFCK well outside this cost bracket.

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5.10.8 The 1978 lending record (estate development only) of HFCK is illustrated by Table 5.2 and 5.3 which show that the bulk of the beneficiaries are in the £3500-£5000 income range and repayments have averaged well over Shs.2000/= per month.

It is quite evident that HFCK is not paying as much attention as it should to the lower end of the market. There are plans however to extend its services to the smaller towns and to obtain more permanent funds from local sources:

- Conclusive discussions with the Treasury and Central Bank, on the future availability of relatively permanent funds, have placed the Company's future lending position on very positive grounds. The Company now aims at establishing the needs of the country as a whole and then attempting to raise the required finance to meet these needs. 7/

The opportunity has therefore presented itself for involving HFCK in the IBRD Urban Project Series. The possibility of channeling some of the funds through a special sites and services unit within HFCK should be explored. In fact HFCK has built up a considerable amount of expertise over the years and that is why the USAID used the company to administer the loans for the first phase of Umoja.

CONCLUSIONS AND RECOMMENDATIONS

5.11.1 Extending the scope of legalised construction will open up new possibilities for the lending institutions and insurance companies, possibilities that could be both profitable as well as consistent with long term social goals. However certain assurances and incentives will be needed before established commercial concerns can be expected to assume radical attitudes and methods, especially government support in the form of adequate legislation, an efficient administration of Town Hall, sensible and understandable urban planning, and possibly cheap funds from the Treasury.

7/ HFCK Annual Report and Accounts 1977

To summarise then the following steps are RECOMMENDED with a view to achieving more economical dwelling standards.

- cut down on invisible frills i.e. those building components that are at the same time inessential.
- introduce innovations in the following areas, which are the most likely ones to succeed:-

(a) fragile permanence i.e. durable construction that is not necessarily permanent. There is great scope for marrying the traditional with modern.

(b) style i.e. customer appeal, rather than content. The appearance of the dwelling is most important to the financier; which means that good 'packaging' should receive more attention.

(c) long term tenure, probably something midway between 35 and 99 years, if the latter is considered too long. Has the use of freehold tenure in sites and services been considered? The disadvantages may not be as strong as they are believed to be.

- Keep densities low wherever possible. Although economy and visual effect depend in large measure on site planning, we find that very high densities i.e. those exceeding 200 persons per ha. net or plot sizes smaller than $200m^2$ need an extra planning effort and tend to be more difficult for the financier to accept.

- Reduce fire hazard by means of appropriate barriers as well as by reducing the risk of fire at source i.e. in the kitchen; the majority of household fires are caused by cooking appliances.

- Provide adequate fire hydrants and access road for the fire tender.

- Get the National Assurance Corporation, a state-owned company, to expand their fire business into the low cost housing sector. At the moment the major housing insurer is the Insurance Company of East African Ltd. Premiums, even if competitive, may well be proportionately higher than for the more expensive dwellings, but in absolute terms the figures will be quite tolerable. Even at the rate of Shs.7/50 per £100, which is 50% higher than normal rates, the annual premium on a house with a replacement value of Shs.50,000/= is Shs.187/50. In fact a more direct involvement in housing development by the insurance companies has been called for by the Minister of Finance. 8/

- Make things easier for developers and subdividers e.g. through speedy approval of plans, and less stringent conditions on infrastructure and excising of land.

- Involve HFCK in lending for low cost housing.

- Involve HFCK in the design of low cost housing schemes.

8/ Hon. Mwai Kibaki addressing a luncheon hosted by the Kenya National Assurance Co. reported in The Standard, June 30th, 1979. He had raised the same point in his Budget Speech.

chapter therefore describes the different forms of self-help practiced, and their influences and limitations on the housing standards.

6.1.4 The following topics will be dealt with:-

(a) The background of a site and services project, including the kind of housing standards adopted.

(b) The meaning of self-help in sites and services projects, including the kind of housing standards adopted.

(c) Different forms of self-help, their characteristics and examples.

(d) Comparative evaluation of the different forms of self-help.

6.2 METHODOLOGY FOR EVALUATION OF THE INFLUENCE OF, SELF-HELP ON HOUSING STANDARDS.

6.2.1 A sites and services project. The Dandora Community Development Project is examined as a case study; it will be briefly described from project identification to implementation. Reference to housing standards is made during the process of the project planning in order to highlight the adoption of a given set of housing standards.

6.2.2 From this sites-and-services project several allottee families were carefully selected in order to derive a cross-sectional representation of self-help practices. The criterias applied in selection of the sample were as follows:-

- The accessibility to interview
- Typical forms of self-help
- Different socio-economic and attitudinal characteristics
- Plot types and level of completion.

6.2.3 Based on these criteria nine allottee families were identified for interviewing. The interviews were treated as open-ended indepth discussions. The interviews portray the life patterns of the owner-builders and unfolds the actual process of their house construction; problems faced by them, identification of resources for the purposes of house construction and general options on self-help methods as a result of adopting a given set of housing standards.

6.2.4 Main Criteria for evaluation of self-help in connection with housing Standards in Sites and Services Projects.

For our purpose the following criteria are seen as relevant in evaluating the role of standards in the adoption of self-help in the site and services approach:-

1. The extent to which the owner-builder is left to mobilise and decide the application of his own resources.
2. The autonomy of decision making in housing planning and construction; its decentralisation and incremental progression.
3. The extent to which official standards facilitate or hinder self-build methods.
4. The degree of improvement in socio-economic status of the allottees after joining the housing estate.

6.3 THE DANDORA COMMUNITY DEVELOPMENT PROJECT (DCDP)

6.3.1 The Dandora Community Development Project evolved in four different but overlapping stages:

- Project Definition (November 1970 - December 1974)
- Project Preparation (January 1973 - May 1974)
- Project Appraisal (June 1974 - May 1975)
- Project Implementation (May 1975 - to date)

It is not necessary to discuss each of the first three stages in detail, attention will be focused on project implementation since it is at this stage that self-help is most important.

6.3.2 The project was defined or identified by Nairobi City Council with the assistance of IBRD early in the current decade. Both the Nairobi Metropolitan Growth Strategy and the Interior Urbanisation Project prepared by the City Engineer were instrumental in laying the foundation and defining the basic concepts on which the Project was later to be formulated. A Housing Task Force (HTF) was then formed by the Town Clerk. In October 1973 it produced a Draft Project Report for discussion with IBRD. The two-volume report defined the following principles:-

> The authority demarcates plots and provides basic services including water, drainage, sanitation, paths, roads, electricity, and telephone at a standard compatible with the ability of the plot occupants to pay ..... responsibility for the provision of housing rests with the occupants under the supervision of the authority..... minimum dwellings (consisting of WC, store, cooking space and two habitable rooms) are to be built to the requirements of the authority within 18 to 24 months of allocation.

6.3.3. The Draft Report contained proposals for the necessary institutional and legal arrangements a preliminary financial plan and preliminary house, designs and plot layouts. The site chosen was Dandora, about 11 km north-west of the City centre.

6.3.4 During the project preparation stage two issues concerning physical standards posed a conflict within the NCC which led to an important debate over the relevance of site and services as a housing strategy in the Kenya context. The first one was the extent to which Dandora should cater for private car ownership and the second was the desire for a water borne sewerage system which provided individual connections to each plot at a cost affordable to the participant income group. The two issues are of interest because of the different light each sheds on the question of standards.
The problem of waterborne sewerage was of concern primarily to the technical specialists. The battle lines were drawn between the engineers in the HTF who were designing the system and those in the City Council's Water and Sewerage Department who would have to operate it. It is significant to note that at this point the opinion of the City Medical Officer of Health was not sought. His evaluation of the proposal came only after the first 100 plots had been prepared.

6.3.5 The question - perceived purely in technical terms - was how much could the design of the system deviate from standard Council practice in an effort to save money without creating additional maintenance problems. It was seen as a trade-off between lower development costs and higher maintenance costs.
The designers proposed locating main sewer lines in way-leaves on private property. They urgued that this solution would result in significant cost savings of K.Shs.1700/= per plot over the conventional approach which positioned mains under the streets and used long branch mains to connect the individual core units to the main. A similar proposal for on-plot water distribution was advance, with concomitant cost savings of K.shs.320 (22). The disadvantage of the proposal was that the short branch connecting the core units furthest from the main had to pass under the core units adjacent to the main.

See Figure 6.1. The Water and Sewerage Department also argued that the proposed sewerage layout, resulting in manholes and inspection chambers deep inside private property, did not allow easy maintenance of the system. In the rush to finalize the project design before June 1974, the designer's proposal was adopted with the support of the Town Clerk. Further debate was still to come, however, when the Ministry of Health reviewed the design some two years later.

6.3.6 As regards accommodating car ownership the NUSG had recommended a car ownership rate of 3.6% for the target income group that is about 110 cars per 1000 plots. However, the politicians were calling for a much larger allocation. In the rush to finalize the project layout, the principle of one car per plot was accepted.

6.3.7 The IBRD sent a mission to Nairobi, to appraise the Projec The appraised form of the DCDP consisted of the following components:-

(a) New Residential Plots: The project was to provide about 6000 plots with individual water and sewer connections and related basic services and infrastructure, including roads, security lighting, and refuse collection. The 6000 lots included about 1800 of 100 m^2, 2100 of 120 m^2, 1800 of 140 m^2 and 300 of 160 m^2 each. The people to whom residential plots were to be allocated were to have leasehold tenure for a period of 50 years. Title deeds to each plot would be issued after allottees had constructed a dwelling approved by the Dandora Project Department (DPD), the implementing organ of the NCC. The gross density of the project was to be 32 plots per hectare (13 plots per acre). Plot occupancy rates were assumed to be 10 people per plot, giving gross residential population densities of 320 people per hectare. This compares

with densities of 310, 291 and 271 for Maringo, Makadara and Mbotela respectively, three of Nairobi's most densely populated residential areas. The results of a land use profile analysis of Phase 1 of the whole project are summarised in the table below. The land use 'conforms' to normal standards, with roads a little high at 24%.

	Phase 1 1000 plots (ha)	Total 6000 plots (ha)	Average %
Gross Area	46.5	218.2	
Unusable Area Quarries, excessive slope,etc)	13.8	32.7	
Area available for development	32.7	185.5	100%
Residential	15.0	89.8	48%
Circulation	8.2	44.5	24%
Community Facilities	9.5	51.2	28%

(Source: World Bank, Appraisal of a S/S Project in Kenya IBRD; Report 607 KE Annex 4. Page 5)

(b) Core Units: Each plot to be provided with basic services consisting of water connections to wc, shower and basin, sewerage and stormwater drains in a contractor built superstructure --- "Wet Core". In order to accommodate different income levels within the low income sector, three options of "Wet Core" and shelter units were to be provided:

Option A: (65%) 3900 lots, including 30 reserved for demonstration units in three different sizes - 100, 120 and 140 m^2. Each was to have the basic plot services to the wet cores and participants would be offered a construction materials loan (K.shs. 4800) for developing their shelter. Owners were expected to develop the shelter through

self-help or hired labour. Total plot development costs, inclusive of the materials loan and physical contingencies, were estimated at between shs. 1100 and shs. 12000 per plot depending upon the size. About 30 of the 3900 plots were to be developed with different materials and room layouts by the Project Department for demonstration purposes at a per unit cost of about shs. 14700.

Option B: (30%) 1800 plots in three different sizes - 100, 120 and 140 m^2. In addition to the "Wet Core" outlined in Option A above each would have one contractor- built room (Kitchen) and a store. Plot owners were to be offered a construction materials loan (shs.2400) for further development of the shelter to suit personal requirements using either self-help or subcontracting. Total development costs including materials loans ranged between shs. 12000 and shs. 13000.

Option C: (5%) 330 plots, all 160 m^2 in area, will have a contractor -built dwelling consisting of two rooms. No material loan would be offered to plot owners. The development cost of Option C plots was estimated to about shs. 16500.

(c) Material Loan Fund and Repayment: Material loans would be made available to project participants for self help extensions to supplement other sources of funds, including personal savings and borrowings. Participants would contract and extend their own dwellings on the basis of approved designs. The DPD, through it's Financial Division was to operate the material loan scheme. Loans would be made in cash for the value of the materials in that portion of the house already constructed. The rate of interest was 8.5%. For Option A the loans repayable for "Plot Loan" was 30 years, and for Option B 20 years.

Material Loan repayment period for Option A was 30 years (with five years grace to principal only) and for Option B 20 years.
At the time of the Appraisal period, the maximum loan for Option A allottees was K.shs. 4800, sufficient to build two rooms and K.shs.2400 for Option B allottees, sufficient to build one room. However, since the occupation of the plots in Phase 1, the loans were increased to K.shs. 5760 respectively, an increase of about 16.5%. This was mainly due to price increases since the project actually started. All the loans are repayable in equal monthly instalments.
Repayment of material loans would commence 18 months (during which period the construction of the plot will have been completed) after the date thefirst instalment of the plot loan was due to be paid. The interest accrued during the construction period of 18 months on any material loans borrowed will be capitalised and the total amount of principal and interest will be repayable by Option B allottee over 18½ years - this period will coincide with the remaining plot loan repayment period at the time. Similarly Option A allottees, who have a five years grace period for principal only, will pay after 18 months, interest only for 3½ years on any material loans borrowed and accrued interest during the 18 months. After 3½ years their grace period would have expired and then they would commence not only paying interest but also repaying principal for the next 25 years.

(d) Community Facilities: The project was to construct primary schools, health centres, multi-purpose community centres incorporating day care facilities, sports facilities and markets. Primary schools, accounting for about 60% of the investment in community facilities, would provide about 5600 student places - allowing the project area the

same level of provision as the rest of Nairobi.

(e) Trunk Infrastructure: The trunk sewers would comprise of two branch sewers from the project area to the proposed main city trunk; 14.5 km of main trunk sewer running alongside the Nairobi river to a sewerage treatment works, a temporary stabilisation pond to serve the first 1000 housing plots by mid 1976, and a sewage treatment works to serve the equivalent of 230000 people.

(f) Other Components: Those consisted of technical assistance in the form of finance for detailed design and various studies; studies on municipal finances and NCC housing operations and preparation of subsequent projects; monitoring and evaluation of the project; and a nutrition component.

6.3.8 Infrastructure Standards. The following Infrastructure standards were adopted:-

(a)Roads and Surface Water Drainage: The site would have a circulation network providing a primary order framework around which the layout is developed. The site is linked to the city network from Komo Rock Road. A main through street running along the ridge which also forms the spine containing the community facilities. This main street is linked to a network of secondary roads and footpaths running transversely within the residential zones on either side of the spine. Standards and specifications adopted were as follows:-

1. Main Roads: serving as collector roads carrying bus traffic were to be constructed to bus route standards with an overall reservation of about 20 m. The carriageway was to be paved and would have foot paths. The footpath construction comprises of 150 mm murrum paving on compacted formation. The surface water drainage comprises of concrete invert block channels with 50 mm concrete slabs.

2. Secondary Roads: Would provide vehicular and pedestrian accesses to the residential plots. These roads were to have an overall reservation of about 12 m with a murrum carriageway and footpaths on both sides with a surface water drainage ditch on each side of the footpaths. The footpath construction comprises of 100 mm murrum paving and the surface water drainage ditch was to be the same as described for main roads.
3. Parking Areas: Were to be provided along the secondary roads at convenient locations and would consist of 150 mm murrum paving on graded and compacted formation. Connecting footpaths and surface water drainage was to be provided.

(b) Water Supply: Individual metered connections would be provided to each plot to serve a water closet, a shower, an outside tap with provision for installing a water tap and sink in the kitchen at a later date.

(c) Sewerage: Individual wet core units with water borne sewerage facilities. The sewerage system is designed to conform to NCC water and sewerage department specifications.

(d) Electricity: A system of street lighting and security lighting at communal areas would be installed. Individual metered electric connections would be available from the East Africa Power and Lighting Co., on application by a stated number of households.

(e) Refuse Collection: Approximately 120 concrete hardstandings would be provided for the whole area. NCC would provide the necessary bins collection services and charge plot holders accordingly.

6.3.9 Total project costs were estimated at K.shs. 211 million at January 1975 base prices. Physical contingencies of 15% on site preparation and infrastructure and 5% on community facilities and core units were included. Price escalation was calculated at 15% in 1975 and 12% annually for the period 1976 through 1979. Foreign exchange costs were estimated at about 26%.

6.3.10 The implementing organs were to consist of the Water and Sewerage Department of NCC and the Dandora Project Department, an implementing unit to be located on site.

6.3.11 The Project Department was especially created to implement the sites and services component. It would consist of 13 professional staff in three divisions: Technical, Financial, and Community Development.

6.3.12 The Technical Division was to be responsible for supervising detailed engineering and preparation of tender documents for site infrastructure, wet cores community facilities and for ensuring proper supervision of construction. The Financial Division was to be responsible for keeping all project accounts involving expenditure related to the project. The Division was to develop an accounting and financial management system acceptable to the Bank. The Community Development Division was to publicize the project, solicit and process applications, orient and train allottees prior to the occupation of plots, work with families during the construction phase and assist residents to develop the institutions and programmes which will enable them to create a genuine community.

6.4.3 Approval of Building Plans: An important issue regarding standards was raised during the construction of Phase 1. In May 1976 comments on the overall layout plans of Phase 1 were received by the DCDP Department. According to comments of the Medical Officer of Health the plans could not be approved. This led to a long controversy over the approval of building plans. The plans were prepared in accordance with the design standards and cost estimates outlined in the Appraisal Report. Moreover the Works and Town Planning Committee on January 15, 1975 had on recommendations for the City Engineer approved the structure plan for the Dandora Project and designated the project area as a 'Grade II' byelaw zone to which special density provisions would be applicable. The Medical Officer would not approve the plans since the design standards did not conform to the Building Code and the Public Health Act. After about six months of discussions and meetings the plans were accepted by the joint meeting of the Works and Town Planning Committee and the Project Committee held on January 20, 1977. The delay caused by the above controversy resulted in delays in the issuing of type plans to the plot allottees and delays in the construction of demonstration houses. Furthermore, the impact of such a controversial issue was to cause an extra K.£1.3 million for the modifications of Phase II of development when the technical section had to review the design, incorporating the standards which the Medical Officer had specified.

6.4.4 Plot Allocations: Application forms were sold in March 1975 at 20/-each. Out of 16018 application forms which were received 6710 were not qualified. The other 9308 were balloted upon by use of computer on September 24, 1976. Applicants had to meet the following conditions:

(a) The total income at the time of application of the allottee and such members of his family as will

live with him on the plot to be between K.shs. 280 and K.shs.500 per month for Option A and K.shs.450 and K.shs.650 per month for Option B plots.

(b) The prospective allottee had lived in Nairobi for at least two years immediately prior to his application for a plot and did not own any residential property in Nairobi.

(c) The allottee family (spouse, if any, or children) did at the time of application, and would, upon allocation of a plot reside with the allottee

6.4.5 Once the allocation was completed it was felt necessary to have public meetings with people who had been successful in getting plots. The purpose of the meetings was to explain clearly to the allottees about the project, their personal participation in the project, the Department's role, their responsibility to the project, etc. The meetings went on from October 18 to November 1. Allottees of Phase 1 plots were informed from October 7th that they pay and take possession of the plots within 6 weeks. By December 1st, all plots except 55 had been paid for. The 55 were then re-offered to the next successful applicants on the allocation list. Keys to the plots were issued to applicants who had paid their deposits as from November 20, 1976.

6.4.6 The letter of Offer required the allottee to:

(a) undertake to erect his own dwelling according to minimum standards, either with his own materials, if these be deemed adequate or with materials obtained under the materials loan scheme, within 18 months of signing of the lease. He can use help in construction but other than technical assistance available on the site, he must bear all costs of such outside assistance.

pay all charges promptly and in general conform to all lease conditions.

(c) sublet rooms only on conditions specified by the Project Administration and make the identity of the tenant known to it prior to subletting.

(d) Notify the administration of intention to leave the project and conform to the project rules and regulations regarding the transfer.

Soon after occupying the plots the allottee is faced with one of the first major decisions. How to commence construction of the dwelling in accordance with the prescribed forms of construction and conform with the general planning and building standards. Given the individuals background and resources the task of construction forms the initial challenge.

6.4.7 Participant observation with the allottee families has revealed several characteristics of their situations which determine the forms of self help methods for planning and construction of the dwelling. In principle these are:-

1 Ability to apply one-self in:
   1. Techniques of actual construction
   2. Supervision of construction and financial management,
   3. Organising a construction team which may consist of hired labour (skilled or semi-skilled), relatives and or friends.

11 Constraints and stresses of the plotholder including:-
   1. Financial limitations
   2. Size of the family and responsibilities towards the youngand the old.

3. Commitments to one's job and ensuring a regular income.
4. Availability of time to apply personal labour (skilled or semi skilled) to supervise and to manage the construction.

111 Attitudes of the allottee towards:-

1. Savings on labour and materials.
2. Rate of construction
3. Satisfaction in building one's home with one's own hands.

IV Impact of official rules and regulations on the allottee's resources and their effect on:-

1. Phasing of construction and eligibility for the material loans.
2. The role of the temporary shelter
3. Enforcement of the standards during the construction phase.

6.5 FORMS OF SELF-HELP

6.5.1 There is a basic distinction between the type A plot holder and type B plot holder. Generally the former builds a temporary structure first which is used for several purposes:

(a) providing accommodation during the construction of the permanent dwelling, thus saving on the rent for the previous residence,
(b) providing storage space for some of the construction materials and
(c) forming a natural surveillance point over the construction team.

The type B plotholder does not build a temporary structure; the kitchen is used for the same purposes as the temporary shelter in the case of type A.

6.5.2 The decision to adopt a particular form of self-help is largely based on a number of factors, chief among which is the hope to save in every stage of the construction process and in doing this there is no exclusive form of self help, rather a combination of several types. For analytical purposes we have identified two predominant forms that is:-

(I) self help by the allotte
(II) self help through subcontracting and
(III) self help through a building group.

In practice both forms coexist. The latter form of self help is a combination of the allottee-build, sub-contracting form and mutual assistance forms of self help. For discussion purposes this form of self help is treated differently since the essence of this form lies in the organisation of the allottees in the first instance, primarily to pool together their financial resources. It is then followed by the sub contract form of self help.

6.6 SELF HELP BY THE ALLOTTEE

6.6.1 This is the true of pure form of self help and self reliance by the owner-builder in planning, constructing and managing the whole process of building. The decision making process is a reflection of the owner builder's attitude towards maximising savings on labour and utilisation of the least expensive materials. The ability of the allottee to apply his energies in construction, supervision and purchasing materials is demonstrated and tested in the whole sequence of building. The organisation of all activities are finely tuned with the allottee's available time. Although the owner-builder is responsible for all the operation, he may seek

extra help. This sort of help is often 'free', meaning not paid for in cash. The help is either skilled or semi-skilled. The owner-builder returns the favour in an equivalent manner.

6.6.2 The case studies reveal that although allottee built is a true form of self help it is conducted through such pressures and constraints as lack of finance at the start, commitment towards one's job or sometimes the sheer size of the family.

6.6.3 Financial stresses turn out to be by and large the most pressing issue for the allottee and perhaps one of the major reasons for applying one's own labour. As a result, the owner builder works on the project when ever possible; seeks cheap materials, often reused one's, transportation is on foot or by hand cart, and/does he spend money on fares for public/rarely transport.

6.6.4 In this form of self help the other major restrictive factor is the rules set by the projects agency and the housing standards set by the local authority. Often the self-built house does not conform to the legal housing standards. For instance, the quality of construction, useage of building materials, and types of finishes tend to require higher forms of construction skills than what the owner builder possesses. In fact the process of organising the construction in a manner which would conform to the recognised housing standards is simply beyond the capacity of the average owner-builder

An Example of allottee built form of self help

6.6.5 The best known example of self help by the allottee is seen during the erection of the temporary shelter.

6.6.6 Building Materials used for the temporary shelter are those which are easy to find, cheap to buy and easy to handle in construction.

The most frequently used materials are mud and wattle, corrugated iron sheets and timber. Generally the roof is built in gci laid on timber purlins. Mud and wattle construction is common for walls. For an entry to the dwelling either a used door in timber or gci on a timber frame or even a curtain hung in the doorway is used. There are no finshes, the floor is left in murrum, sometimes compacted to/an even the surface. Table (6.1) gives a breakdown of various building materials used in the construction of the temporary shelter, the sources from which they were obtained and approximate costs.

6.6.7 General Standards of the temporary shelter: are 'crude'; the construction is rough, often the walls are not alligned properly, the door is crudely fixed, and there is no adequate natural lighting or enough air circulation. Generally an average of 12 m^2 floor area is built. The temporary shelter is located in a corner of the plot, generally on the entrance side of the plot. Figure 6.1 shows two examples of the temporary shelter.

6.6.8 The process of building the temporary shelter could be broken down into the following stages:

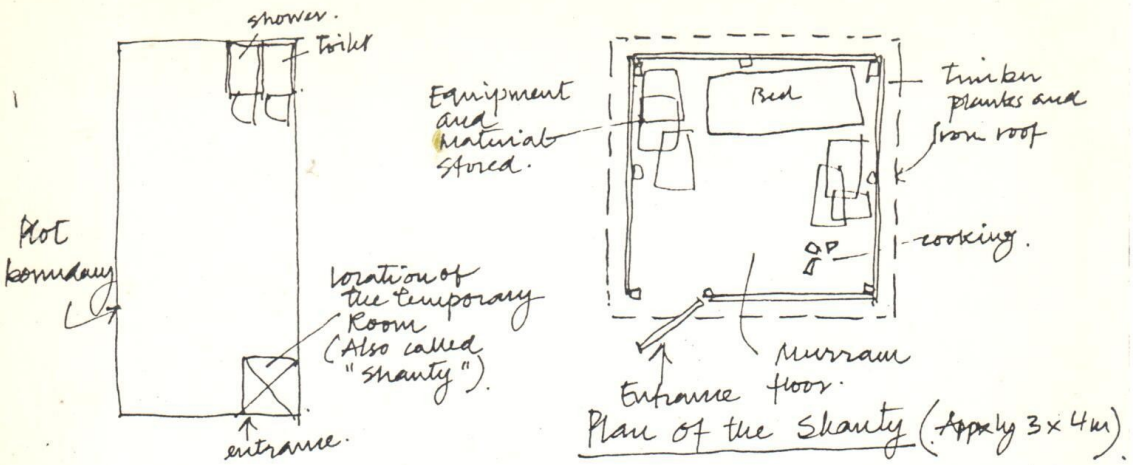
Stage 1: A rough marking is done to locate the position of the walls of the shelter. It is located in one of the corners of the plot so that during the construction of the permanent shelter the remaining space may be used.

Stage 2: Building materials are bought by the allottee. The quantities bought is determine according to the amount affordable by the allottee and the necessity of the materials during a particular stage of operation. For instance, during the erection of the walls just enough iron sheets would be brought in together with the timber for the frames. The frame is erected which takes about half a day and iron sheets nailed or screwed to the frame.

TABLE 6.1

Temporary Shelter - Materials, Prices, Places Purchased From and Approximate Transportation Costs

Material	Typical Places Purchased	Price (Kshs)	Transport Cost
Mud	Within Estate, Ruiru, Njiru	Free	By foot
Wattle	Njiru, Ruiru, Estate, Eastleigh	3/- per piece (about 5 feet long)	3/- bus fare, two ways
Corrugated iron sheet	Ruiru, Njiru Estate	45/- per piece, 26 gauge. Reused one about half this price	2/- bus fare, two way
Nails	Eastleigh	6/-per kg.	2/- bus fare, two way
String	Eastleigh, Ruiru	10/- a ball	2/- bus fare, two way
Cement	Ruiru, Njiru Estate	28/- per bag	2/- bus fare, two way
Sisal cutting	Kayole Village	Free	By foot
Reused timber pieces	City centre, Industrial area, Eastleigh	120/- for material used for a temporary dwelling, appx'ly $12m^2$ in area.	4/- bus fare, two way



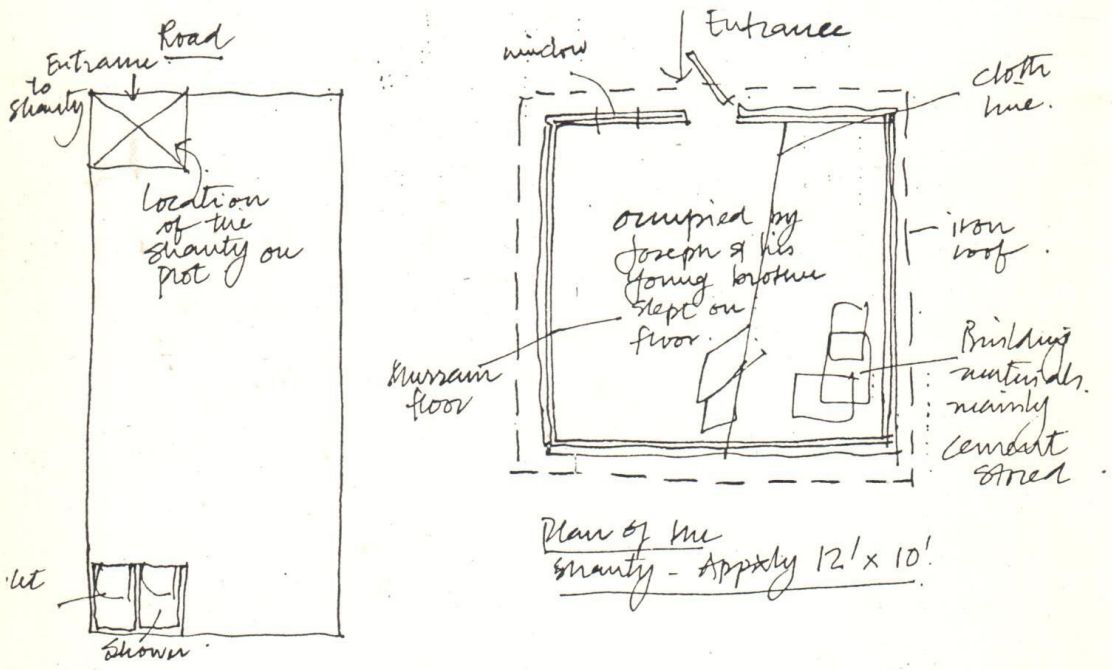


FIG.6.1 TWO TYPICAL LAYOUTS OF TEMPORARY DWELLINGS
Plans show a) location of the temporary dwelling on the plot
b) plan of the dwelling

6.6.9 There are no specific ways in which the quantities are decided, rather they are bought according to convenience of transportation and the funds available. Similarly, in the case of a shelter where mud and wattle is used for walls materials are bought in stages. For instance Joseph reports:

> Since I had no money I went around to collect whatever material which could be used to construct the temporary room with. I went to a nearby village (the Kayole Village) to cut some sisal plants which I used to build the walls of the shanty. The material was brought by myself on foot over some two miles distance. I would make two trips everyday to gather enough for the walls. The actual process of gathering the materials was started in December 1976 and completed by the end of February 1977. The entire shanty was built by me without any assistance from anyone. For buying the roof I borrowed shs. 100/- from a friend and bought eight used iron sheets. It took about one day to put the roof. After building the roof I applied wet murrum soil to the sisal material and the frame. By early March the shanty was ready for occupation. 1/

6.6.10 This is a typical case of self help by the allottee where incremental development is a dominant way of building.

6.7 SELF HELP THROUGH SUBCONTRACTING

6.7.1 Operationally, this form of self-help entails contracting out such activities as are not feasible within the means and resources of the allottee. Skilled and manual labour is recruited at various points in the construction of the dwelling. Basically, there are two sets of actors -- the allottee and the fundi (fundi is a local term used for a skilled artisan or contractor). Together with the fundi there are generally some semi-skilled helpers, locally known

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1/ Personal interview with an allottee

as kibarua (plural is vibarua). The decision-making process is more complex in this form of self-help.

6.7.2 Most of the technical decisions are made by the fundi.These generally deal with building materials; types, quantities and stages of purchasing; equipment for construction and organisation of the construction team. The latter involves such tasks as delegating responsibilities and tasks to the 'kibarua'. As the technical inputs consume most of the cost of the construction the decisions made by the fundi results in the allottee following them, often without questioning. The allottee's role is to endorse the decisions made by the fundi during all the stages of the construction, supervise the construction team and oversee financial matters.

6.7.3 Since the entire programming of the construction is arranged by the fundi it leaves little room for the allottee to adjust any of the tasks or activities. As a consequence the allottee is more of an 'outsider' than a full member of the construction team. The role of the allottee is dominant at the start of the organisation of the construction team, while agreeing on remuneration, the general tasks of the fundi and the period of engagement.

6.7.4 The allottee is occupied with his usual routines, for instance at his job or business and therefore cannot find sufficient time to attend to actually work on the construction site. The constraints are the lack of enough money to begin sub contracting, lack of a formal contractual agreement with the fundi and sheer family responsibilities. The allottee family is often large enough to enable potential application of members labour but most of them would be earning a living through a formal job or business.

6.7.9 The common material used for the roof is 24 gauge corrugated iron sheets,. There are some instances where both asbestos and clay tiles have been used for the roof. Timber is generally used for the framing.

6.7.10 For the windows metal frame and glass are popularly used while timber flush doors and batten doors are common.

6.7.11 There is a variation in finishes. Either there are no finishes, that is the walls and floor are left in natural material or walls are simply plastered without paint. In some cases the walls are painted.

6.7.12 Reinforced concrete is limited to use in lintols, cast insitu over wall and door openings, and in strip foundations. Iron loops are used as reinforcement for the wall construction. A water proof membrane is laid in either bituminous felt or strips of plastic membrane at the foot of wall construction to prevent dampness from climbing into the walls.

6.7.13 Table 6.2 gives a breakdown of the common building materials used in the permanent dwelling. It lists the materials, equipment, transportation and labour costs.

Construction Process: The overall construction process of the permanent dwelling is not a 'one shot', smooth operation. It is distinguished by several stages of construction, each stage being characterised by several decisions and activities. These stages could be divided as follows:

Stage:I Identification of the sub contractor and organisation of the construction team. Verbal contractual agreements between the two sets of actors take place

Stage II: Setting out of the rooms.

Table 6.2

An Example of Costs for Building Materials, Equipment, Transportation and Labour in a permanent Dwelling

Date	Materials, Equipment, Transportation and Labour	Cost (K.Shs.)
1/4/77	Wheel barrow	210
1/4/77	Two spades	50
1/4/77	50 ft. water hose pipe	100
6/4/77	Sand, two lorries of stones each (including transportation cost)	600
6/4/77	Foundation stones, (9"x8), 1 lorry	350
7/4/77	Ballast or Kokoto, 1 lorry (including transportation cost)	210
9/4/77	Cement 15 bags, (including transportation cost)	402
9/4/77	Digging foundation trenches	150
9/4/77	Site measuring pegs wooden	35
11/4/77	Hardcore, 3 lorries (including transportation cost)	220
11/4/77	1 bundle steel straps	20
12/4/77	3 lorried of blocks, 9"x6", 750 blocks, (including transportation cost)	1685
13/4/77	Hardcore, 1 lorry (including transportation cost)	120
13/4/77	Foundation stone, 1 lorry, 9"x9", (including transportation cost)	350
15/4/77	Expenses in transport to get some materials which were not avilable	50
16/4/77	Cement, 10 bags	293
19/4/77	Paid fundi and helper	45
20/4/77	Paid Mr. Munene, another fundi	200
20/4/77	5 bags of cement (including transportation cost)	140
20/4/77	2 three-eight inch steel rod	70
20/4/77	Expenses for food and bus	10
21/4/77	Paid fundi	200
21/4/77	10 bags of cement (including transportation cost)	280

21/4/77	Personal expenses	15
22/4/77	Roofing wooden panels	253
22/4/77	1 kg of nails	5
22/4/77	Personal expenses	15
23/4/77	Iron sheets, gauge 26, 24 sheets (including transportation cost)	1604
23/4/77	Roofing nails, 2 kg	10
23/4/77	Personal expenses	15
23/4/77	Paid fundi	300
25/4/77	Fitted 5 door frames @ 50/- each	250
25/4/77	Nails, 3 kg	18
25/4/77	Plumbing in the kitchen, paid for labour	10
25/4/77	Personal expenses	10
26/4/77	2 iron sheets, gauge 28	58
26/4/77	Fascia boards, 70 ft run	77
26/4/77	Personal expenses	10
27/4/77	5 T&G Doors (including transportation cost)	500
27/4/77	5 bags cement (including transportation cost)	140
27/4/77	Personal expenses	10
28/4/77	Window frames (including transportation cost)	500
28/4/77	Paint	40
28/4/77	Paid fundi	305
28/4/77	Personal expenses	10
29/4/77	5 bags of cement (including transportation cost	140
29/4/77	Red oxide, 5 kg	36
29/4/77	Paid fundi	60
30/4/77	Personal expenses	10
30/4/77	5 mortice locks, each @ 85/-	425
30/4/77	Window locks	66
30/4/77	Personal expenses	10
3/5/77	Paid fundi	200
3/5/77	Nails, 2 kg	10
3/5/77	5 bags cement (including transportation cost)	140
4/5/77	paid fundi	60
4/5/77	Cigarettes for the helpers	5

4/5/77	2 iron bolts	45
4/5/77	Hedges	30
4/5/77	Personal expenses	7
6/5/77	1 lorry sand, 7 tons	350
7/5/77	Paid fundi	300
10/5/77	5 bags of cement	140
12/5/77	11 ft of fascia board	17
13/5/77	paid fundi	100
14/5/77	Ventilation block	5
14/5/77	Assigned a mason and a helper	40
17/5/77	Kitchen plastering	56
17/5/77	2 bags cement	56
18/5/77	Red oxide	27
22/5/77	paid fundi	20
22/5/77	Kitchen water fittings	330
22/5/77	Paid for carrying unwanted soil	50
23/5/77	Yellow oxide for spraying	100
25/5/77	Spraying charges	55
26/5/77	Glasses for window fittings	110
26/5/77	Labour for fitting window glasses	40
30/5/77	Outside pavement preparation	30
30/5/77	Completing store	30
30/5/77	Completing pavement	60
31/5/77	Paint	300
31/5/77	Labour for painting	100
2/6/77	Construction of the chimney, labour & material	250

(A) Building material and labour costs during April and May 1977.

(B) Prices for Two Rooms and a kitchen store

Source: Extract from the personal diary of holder of Plot No.....

6.7.16 Allottee finds it difficult to assess all the needs for every stage of the construction. He lacks an overview of the construction process. Rather, the allottee leaves it to incremental stages to decide; he decides from situation to situation. As a result of this there is rarely any case where just one fundi is employed to construct the entire room or house; the allottee changes the fundi from stage to stage of construction. Continuing with the case of Mwangi:

> Mwangi befriended a fundi who was working at one of the plots nearby. Mwangi asked the fundi about the places where he could buy building materials. One day the fundi took Mwangi to Njiru, a nearby trade centre to show some of the materials. The purpose was to gain some information on type of materials and prices.

6.7.17 Together with the identification of the fundi the allottee also begins to inquire about the building materials, their prices, sources and types. There is also an attempt to cross check the information which the allottee gathers with other sources:

> Next day, Mwangi went to Project Agency for some more advice. Once again, he was inquiring about the materials and their prices. At the office he was advised to use concrete blocks, iron sheets and so forth. All these materials could be purchased from the city centre, was the advice given to Mwangi.

6.7.18 Based on this comparision the allottee begins to decide about the choice of fundi and materials. The role of the fundi is to lead the construction of the dwelling. Generally, he organises his own construction team which has an average of two to three Vibarua. The number of vibarua varies from task to task. Vibarua help the fundi on all technical matters and are expected to follow his instructions.

6.7.19 Negotiations and verbal contract: Negotiations with the fundi deals with the tasks and the general responsibilities which the fund is expected to assume. They also deal with the daily rates or the amount to be paid on a lump sum basis. The negotiations are informal and there is no written contract. Two cases are quoted here to illustrate the procedure of negotiations:

> Mwangi's brother-in-law resided in Kariobangi. He knew of a fundi whose mother resided in Dandora. This fundi would be able to do the work at a special price. Mwangi negotiated with this fundi at a rate of 600/- per room. This was the price of labour agreed. It was up to the fundi then to bring whatever extra men required.

6.7.20 Similarly in the case of another plot holder:

> Lucy negotiated with the fundi about the rate and days during which he would work and any additional sources of labour required. The fundi was paid 40/- per day and since he was a full time employee in the construction company he would work only during Saturday afternoon and whole of Sundays. The fundi also got two more fundis. Both of these were paid 35/- per day, Both of them would work during the same days and hours as the main fundi. The two fundis were however, paid half the rate during the Saturdays since they worked half days.

6.7.21 Such verbal negotiations form the basic agreements between the allottee and the fundi about the rate and the method of payment. Agreements do not stipulate the definite tasks, only the specific stages of construction Defaults, delays and time schedules as is the case in the formal contractual agreements are rarely discussed. As will be seen later in this chapter the deficiences in such verbal and informal contracts often lead to loss of time, materials and labour to the allottee. Furthermore there is no mechanism for enforcing the agreements.

6.7.22 Stage II: Setting out of the Rooms: Figure 6.2 shows the typical house plans used by the allottees in the Dandora Project. These house plans are prepared by the Technical Division of the Project Agency and sold to individual allottees at 20/- for a set of drawings. A set of drawings consists of a house layout, location of the drains in relation to individual's plots and details of the 'wet core' facilities. Allottees are expected to conform to the specifications shown on the drawings.

6.7.23 The individual plots are demarcated by the project agency and the 'wet core' forms a point of reference for setting out the rooms. Generally, the setting out is done by fundi although in some cases it is done by the plot owner and a building foreman from the Project Agency. The whole house is marked, including thicknesses of the walls and partitions. The location and the thicknesses are indicated by strings.

6.7.24 Where the setting out is carried out by the fundi it costs about 50/- for the whole setting out and takes about two days. For such a task when a fundi is hired a lump sum amount is paid.

6.7.25 Stage III: The First Phase of the Construction: After the setting out is approved by the Project Agency the next stage is excavation of the foundation trenches and construction of the foundation walls for the 'minimum' number of rooms, generally two rooms in the case of type A plot and one room in type B. In the former case one of the rooms is a kitchen. This stage of the construction is referred to as the 'First Phase" since the allottee commences with the 'minimum' number of rooms.

6.7.26 Trenches are excavated according to the foundation details provided by the building specifications. Generally a depth of about three feet is excavated. There are some instances where the soil happens to be 'black cotton' (not suitable for load bearing) and as a result the foundation trenches dug much deeper till solid rock is reached. In such a particular case the Project Agency compensates the additional cost of the excavation and the construction of the foundation through an extra material loan.

6.7.27 Excavation is done either by sub contracting to a fundi or by the allottee. Sub contracting to a fundi is done because of the strenuous physical labour required for the excavation process. Generally the fundi is helped by two vibarua. The method of payment is based on a lump sum, at an average of about 100/- for excavation of foundation trenches for one room. The payment is made to the fundi who inturn has his own arrangement to pay vibarua.

6.7.28 Generally, the allottee prefers to get the trenches excavated for at least the minimum number of rooms required. There are also cases where the allottees have excavated the trenches for the entire house with a view to building the foundation walls for the entire house.

6.7.29 Where the allottee decides to excavate the trenches on his own he does so (a) to save on a task which involves purely physical labour and (b) to utilise the free time available such as in the case of a member of a building group. Excavation made by the allottee generally takes on an average of twice the time taken by the fundi.

6.7.30 Construction of the foundation walls starts after the excavation is made. The excavation is inspected and approved by the Project Agency. The construction of the foundation and the footing involves purchasing building materials, preparing concrete for the footing and laying the foundation. On the organisation side of the construction the

team has to be assembled since the previous fundi is not retained. Building materials used for this stage of the construction are either solid concrete blocks or stones, cement/sand mortar, and reinforced concrete.

6.7.31 On the organisation side of the construction a new team has to be assembled at this stage since the previous fundi often departs for the following reasons:

(a) after the trenches have been excavated there is a waiting period of often upto four weeks during which the allottee is organising the purchase of materials; the fundi therefore decides to find a job elsewhere or

(b) the allottee may have experienced problems with the previous fundi who did the excavation, for instance an unanticipated rise in his labour charges.

6.7.32 There are materials suppliers operating at the estate. Often the allottees patronize these suppliers, primarily because of the convenience in delivery a service provided by the suppliers. Furthermore, agents of the suppliers go round the estate to inquire personally about the needs of the allottees for any building materials. Generally the materials bought from suppliers at the estate tend to be 10% to 12% more expensive than material prices in Ruaraka and Njiru, each about 5 km away.

6.7.33 Generally the fundi has no say in material purchases. Allottees attempt to get favourable prices; bargaining is common and they tend to save on small items through bargaining.

6.7.34 Building materials are purchased in small quantities according to the situation defined by the sub contractor. Material is stored either on site, in the open (except for cement) or in the temporary shelter. Where mutual assistance is practiced between neighbours

material is often bought in large quantities. This results in savings on transportation costs, better prices for large quantities and fewer visits to the supplier. On the other hand the two disadvantages experienced in this particular case are:-

(a) lack of control over the useage of the materials and

(b) risk of theft of the materials while stored.

6.7.35 The fundi is generally assisted by two vibarua . In this part of the stage of construction a lump sum contract is not negotiated. The daily wage of the fundi is about 30/- while that of the kibarua is 15/-. Thus the cost of labour totals 60/- per day, each fundi having generally two vibarua.

6.7.36 During the construction of the foundation the allottee assumes the role of supervisor Often a relative or a friend of the allottee helps to supervise. The allottee's own presence at the site during the 'working hours' tends to be minimal, due to commitments at work. Generally, the 'working hours' of fundi and his assistants, are from seven in the morning till late in the evening, often till seven. There is a wide range of total time taken to complete the foundations, depending on the method of payment to the fundi. The team works only on such days as the allottee is expected to pay. On the days when the allottee is unable to pay the fundi the team does not work, while the allottee seeks to raise some money.

6.7.37 For a typical room the team manages to complete the foundation in about two working days. Then about four to five days are required for the concrete footing to set before erecting the foundation walls.

6.7.38 In case of a room being built by an allottee who is a member of a building group the entire labour cost is agreed upon by the organisation of the building group from the start. There are therefore no variations in the labour costs at either this stage of the construction or in the remaining stages. A lump sum is agreed upon to complete the construction of a room, from excavation to roofing and finishes.

6.7.39 Once the foundation walls are built, the hardcore filling is compacted by the construction team. A building supervisor comes to inspect the foundation in order to approve the construction upto this stage and also to approve the first stage of the material loan which the allottee is eligible for. This material loan is to help the next stage of construction.

6.7.40 At this stage of the construction those allottees who may have erected the foundation walls for more than the minimum number of required rooms are given material loans sufficient for only the two rooms in case of type A plot and one room in case of type B. That is why many houses are completed to plinth level only while the allottees are waiting for other finance to complete the rest of the rooms.

6.7.41 Stage IV: Construction of the Walls: The building materials used for the construction of the walls, both external and internal are: concrete blocks, stones (about nine inches in thickness for the external walls and about four and six inches for the internal walls), iron hoop for reinforcing the walls, cement/sand mortar and reinforced concrete for lintol.

A typical cost range of these materials is given below for three rooms (one of which is a kitchen):

Sand	2 lorries (7 tons each 350/- per lorry. This also includes cost of transportation. Supplier from Ruaraka.
Stones	4 lorries. Each lorry carries about 350 ft. run of stones. Per foot run cost of the stone is -/80 cents

Cement	15 bags @ 27/20 per bag. This also includes transportation cost. Supplier from the Dandora estate.
Reinforcement bars	9 bars, three-eight inch in diameter, @ 1/30 per foot run.
Damp proof membrane	150/-

6.7.42 These materials are bought by the allottee in small quantities as defined by the fund and financial resources. There are some cases where through mutual assistance neighbouring allottees bought materials in bulk. This resulted in better prices, reduced transportation costs and fewer trips to purchase the materials.

6.7.43 In this stage of construction there are three variations in the organisation of the construction team.

(a) The previous team continues.

(b) A new team is formed by the allottee and

(c) having had some experience the allottee leads the construction team. That is, the allottee assumes the role of a fundi. In such a case, the fundi is still hired to ensure allottee's performance is adequate.

6.7.44 Where the previous team assumes the task of construction of the walls the allottee is already accustomed to the ways of working of the fundi. Observations suggest that the fundi and the vibarua continue to receive the same amount of renumeration as before, that is, 30/- per day to the fundi and 15/- per day to a kibarua.

6.7.45 When a new team has to be assembled there is a slight rise in the cost of labour, particularly for the fundi 35/- to 40/- per day is common. Kibarua receives the same amount as before. Besides, a new working relationship needs to be established between the allottee and the team. The fundi has to be oriented to the expectations of the allottee.

6.7.46 There are some instances where allottees have shown enthusiasm to learn the process of laying blocks. Although some of these allottees are full time employees they took some time off to participate with the construction team in the manual work of laying the blocks and building walls. However, in this case there are no appreciable savings since the fundi is still retained to ensure the allottee's participation is adequate in construction matters. Besides, allottees tend to participate during such time as when they are 'free'.

6.7.47 There is a wide range of total time taken to complete the walls up to wall plate level. Observations suggest that three weeks is an average time period for erection of the walls for three rooms. Rarely do the walls get built in one go.

6.7.48 Stage V: Construction of the Roof: Construction of the walls represented a major activity towards shaping the room formation. After this the allottees also obtained their material loans. Type A plot occupants get a maximum of 2400/- for completion of the walls for two rooms, one of which is a kitchen. Type B plot occupants get a maximum of 1200/- for completion of the walls for one room.

6.7.49 This amount of loan is generally channelled into purchasing building materials for the roof and paying for the labour costs. Almost the whole amount is spent in purchasing the materials for the roof, such as iron sheets and timber rafters and purlins. In many cases allottees have subsidized the costs of materials with their own income or loans from other sources. A typical range of material is given below for two rooms:

Timber purlins and rafters	400/- supplier at Ruaraka.

Corrugated iron sheets	30 sheets, 24 gauge. 1600/=. Supplier on the estate.
Fascia board	80/=. Supplier at Ruaraka

6.7.50 Materials are bought by the allottees and transported either by public transport or on foot. Often allottees experience the need to travel on foot, over some two to three miles distance, carrying iron sheets on the head. This is in the hope of saving in transportation costs. Where mutual assistance is practiced between neighbouring allottees material is bought in bulk with obvious advantages. Also at this stage where the allottees practice mutual assistance a bond of trust develops to the extent of relying upon one of the allottees to go around and do the 'shopping' for the materials. In cases where the other allottees are full time employees such an arrangement is convenient and also saves in time and costs of transport and frequency of visists.

6.7.51 The organisation of the construction team also varies. In this stage of construction there is either the previous team continuing with the consent of the allottee or a new team is assembled. The latter is the case when the allottee has to wait and prepare for financing the stage of roof construction and the previous team decides to seek job opportunities elsewhere.

6.7.52 When a new team is organised the allottee tends to negotiate payments in lump sum. This is particularly because of financial stress. The lump sum is believed to help in saving when the time period of constructing the roof is not ascertained. Labour costs at this stage also begin to impose a financial strain more severely. Where the allottee decides to pay on a daily basis the previous rates apply. Some of the materials, especially roofing sheets, from the temporary shelter are reused.

6.7.53 The process of laying the roof starts with timber rafters. This forms the basic structure and grid for the roof on which iron sheets are then nailed. The underside of the roof is left as it is, without any ceiling.

6.8 THE BUILDING GROUP

6.8.1 The building group as a combination of the first two forms of self-help and mutual assistance is another form worth mentioning, particularly as the former is one of the most important forms of self-help.

6.8.2 The purpose of a building group is to organise the financial and managerial resources of plot holders, whose basic aim is to build at least one room. Allottees who form building groups are often those plot owners who are in real need of assistance; they are 'helpless' Once the building group has organised the financial component of construction and identified a construction team the rest of the building is undertaken as discussed earlier.

Allottees who are members of a building group are often those who have no regular jobs, are unable to find jobs, or are too old. The earning capacity of an allottee is minimal except for an occational casual job. Allottees who are in such a situation wish to utilise their time in generating income through self employment on such activities as building their own house. They value their own potential involvement. The building group is thus an organisation to facilitate such aspirations.

6.8.4 'Mutual financial assistance', the principle upon which the building group is based creates an organisation whereby the allottee can build at least one room through the financial support of the group members. Once such a room is completed the income produced by subletting is used to construct another room while the allottee continues to stay in either a temporary shelter or kitchen. The allottee starts repaying his share of the contribution towards the building group until such time as the other members of the group complete their rooms.

Table 6.3 BUILDING GROUPS AT DANDORA

Group Name	Date contributions started	Total No. of Members	M	F	No. rms Planned	No. rms built October'78	Monthly contributions K.shs.	How Contributions Used
Mwireri	March '77	12	7	5	18	12	100 for 2 rms	Labour only
Giikaro		11	2	9	11	11	550/rm built	Labour only
Komo Rock		16	8	8	16	16	50 for 1 rm	Labour only
Mwako		8	2	6	16	16	120 for 2 rms	Lb.& some materials
Baraka		13	7	6	13	13	100 for 1 rm	Lab.& some materials
Mwangaza	April 1977	6	1	5	12	12	100 for 2 rms	Lab.& some materials
Subira		13	2	11	26	24	100 for 2 rms	Lab.& some materials
Kugeria		10	6	4	19	16	2500 total for 2 rms	Lab.& some materials
Upendo	July 1977	10	0	10	20	14	150 for 2 rms	Lab.& some materials
Muungano		11	8	3	11	9	150 for 1 rm	Lab.& some materials
Bahati	August'77	10	4	6	20	12	150 for 2 rms	Lab. & some materials
Umeme		13	8	5	26	14	100 for 2 rms	Lab.&some materials
Mwenge		10	9	1	20	11	110 for 2 rms	Lab.& some materials
Rumwe	Sept. '77	7	2	5	14	8	100 for 2 rms	Lab.& some materials
St.John	Nov.1977	8	2	6	15	6	100 for 2 rms	Lab.& some materials
	TOTAL	158	68	90	257	194		

Source: Monitoring & Evaluation Study of the DCDP, March 1979

6.8.9 The secretary keeps all the records of those who contribute. Two secretaries are selected by the group to ensure the smooth functioning of the group. One of the secretaries assumes the task of looking for a fundi, negotiates the rates and the responsibilities of the fundi. Once again the contractural agreements between the fundi and the building group is verbal. Generally only one fundi is agreed upon to complete the construction of one room for each of the members of -the group An approximate time is also agreed upon for completion of one room. Generally when a building group employs a fundi he is paid on a lump sum basis for either a particular stage of the construction of the rooms or the entire construction of the room.

6.8.10 The chairperson is elected by the members of the group. His role is to call meetings regularly, ensure functioning of the committee members and attends to matters affecting the general interests of the group.

6.8.11 Frequently during regular meetings of the building group a representative from Project Agency attends to assist the group in technical, organisational and financial matters. Generally delinquent members are removed from the group. The process of removal is through unanimous decision of the members of the group.

6.8.12 Rules of the Building Group:

1. Since there are about fifteen members in a group a method needs to be devised for selecting a rota system for the members whose rooms would be built. Generally alternatives are discussed in meetings but the most common method is through balloting.
2. Each member of the group has to contribute a certain amount of money every month until every member's room is completed. For instance, in the 'Komo Rock' group, each member had to contribute 50/- every month. This money is paid to the fundi

for the cost of labour. During one month the contribution of the 'Komo Rock' group would total 800/-. The fundi is expected to complete the construction of the room within this period or its equivalent time period.

3. Whenever a room for any member of the group has to be started every member has to contribute a specific about of money. For instance, a nominal amount of 5/- in case of the 'Komo Rock' group. A total amount of 80/- is collected. This amount is paid for the labour cost of the fundi who is hired to excavate trenches for the foundation. This fundi is different from the one who is hired by the group. Generally the fundi who does the excavation is hired by the allottee rather than the group.

4. After formation of the group and organisation of the committee, the members of the group collect their first amount of material loan, 400/-. In the case of "komo Rock" group it totaled to 6400/-. Out of this sum the building group offers a lump sum amount to the first and second eligible allottees to commence the construction of their rooms.

5. As the construction of the room continues the allottee receives the material loan through various stages, in small increments. Table 6.4. All these loans have to be returned to the building group until the amount which the allottee had taken at the start of the construction of the room is completely repaid For those who do not pay their contribution regularly a small fine is imposed by the group. When a member fails to pay at all the committee may remove him from the group.

6.8.13 The Role of an Allottee: Members of the building group are expected to participate in group meetings. Through their participation the group hopes to increase the awareness of allottees in the organisation and management of the

construction of their rooms. Allottees discuss their problems during their group meetings. Such problems range from personal problems to technical matters. Once the group hires the fundi the role of the allottee is primarily similar to the one described in the case of self help through sub-contracting. It is also true in the case of the building group that the allottee's role as limited to purchasing building materials and general supervision of the sub contractor.

6.8.14 Some Advantages and Disadvantages of Building Group:

1. Advantages:

1. Most of the allottees have no money at all at the start of the construction. The building group's financial rotation system and facility to pay in lump sums for the construction of a room reduces the financial stress on the part of the allottees. With a lump sum the allottee is at least in a position to initiate the first stage of construction - setting out and excavation.

2. The building group also finds the sub contractors on behalf of the allottees of the group; a task which in itself requires identification and negotiations before a suitable fundi is found. The building group has often various skills and resources; identification and negotiation is carried out carefully by the committee members of the group.

3. Regular meetings of the group benefit the allottees. Allottees' experiences and situations are discussed and the group members attempt to find some solutions. For instance, how to approach the project Agency to seek some specific help, how to arrange for transport by using a friend's vehicle, what are the best times during which the performanceof the fundi should be judged, e.t.c.

4. The Project Agency has a sympathetic attitude towards assisting the groups and seeking ways to alleviate personal problems of the member. For instance, many allottees run into arrears. According to the regulations of the Project Agency allottees who run into arrears of three consecutive months are to be evicted fromthe project in order to recover the plot cost and the material loans through resale of the plot and whatever completed room (s). The group often prepares the individual's case on merit with a view to seeking an extension on behalf of the allottee member.

II. Disadvantages:

1. Although the spirit and activity of building group represents a true picture of self-help the members of the group often take undue advantage of the group. Building groups also a form political platform for some of the members. No records are kept regarding the contribution and payments. The accounting system is often poor. Some of the more knowledgeable members tend to take advantage of their colleagues. In Dandora project there are several building groups. Collectively, the group's overall output is relatively less than that of non members. Often this is viewed as a result of groups being grounds for wasteful meetings, lengthy discussions, gossiping and finding loopholes in the Projects system.

2. During the negotiations and verbal agreements between the building group and the fundi the discussion is limited to simple tasks expected to be performed by the fundi and the remuneration. There are no specific stipulations about defaults, defects and liabilities, as in the more formal contractural agreements between client and a

contractor or a sub contractor. Besides, the agreement often reached is between the committee member and the fundi. In practice when the fundi is working at one of the plots of a member, the fundi is in a better position to interpret the contractual terms with the allottee member; often to the fundi's advantage.

3. There are many delinquent members within a group. Often the members do not turn up for the meetings, or pay their contributions. In a building group there are both active and dormant members. It is difficult to remove a member.

4. With delays in contributions and decision-making during group meetings there arise frustrations among some members. Often members who had started in good spirit and joined the group decides to leave quite soon just because nothing seems to happen. There is also a rapid turnover amongst the committee members. Often slack performance/members loose heart. /makes

6.9 CONCLUSIONS:

6.9.1 Using the criteria determined in Section 6.2.4, it is possible to focus upon a comparative evaluation of the three forms of selfhelp. For this purpose four plans of "completed" dwellings are presented in the conclusion of this chapter in order to portray a visual comparison of the type of dwellings that are currently implemented. For analytical purposes, the four are described as 'good', 'average' and 'poor' dwellings. These qualities define the construction standards as well as the maintenance and usage standards.

6.9.2 A 'good' dwelling (Figure 6.3) is one where the owner has utilised the total permitted built-up space, the outdoor and indoor spaces are fully utilised for

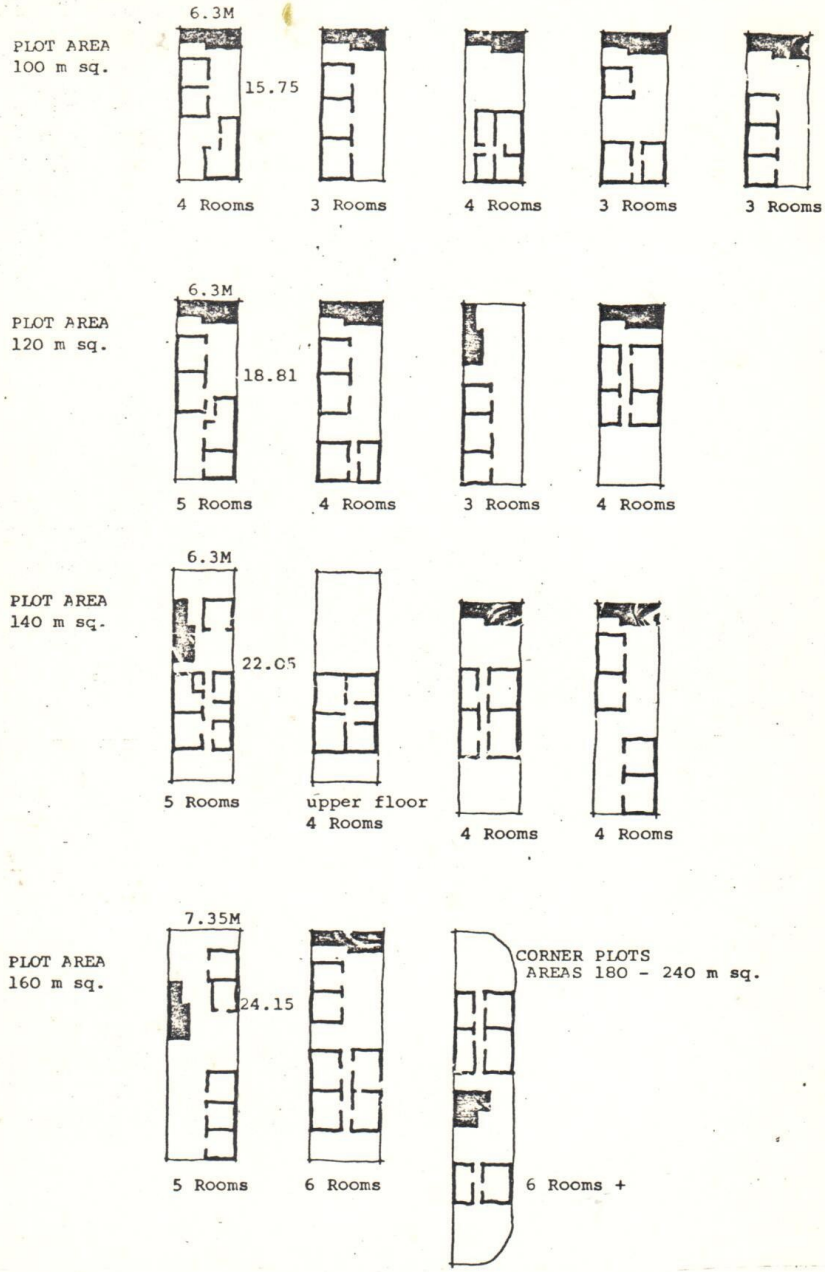


FIG. 6.2 TYPICAL HOUSE PLANS PREPARED BY THE TECHNICAL SECTION OF THE PROJECT AGENCY

Source: Monitoring and Evaluation Study of Dandora

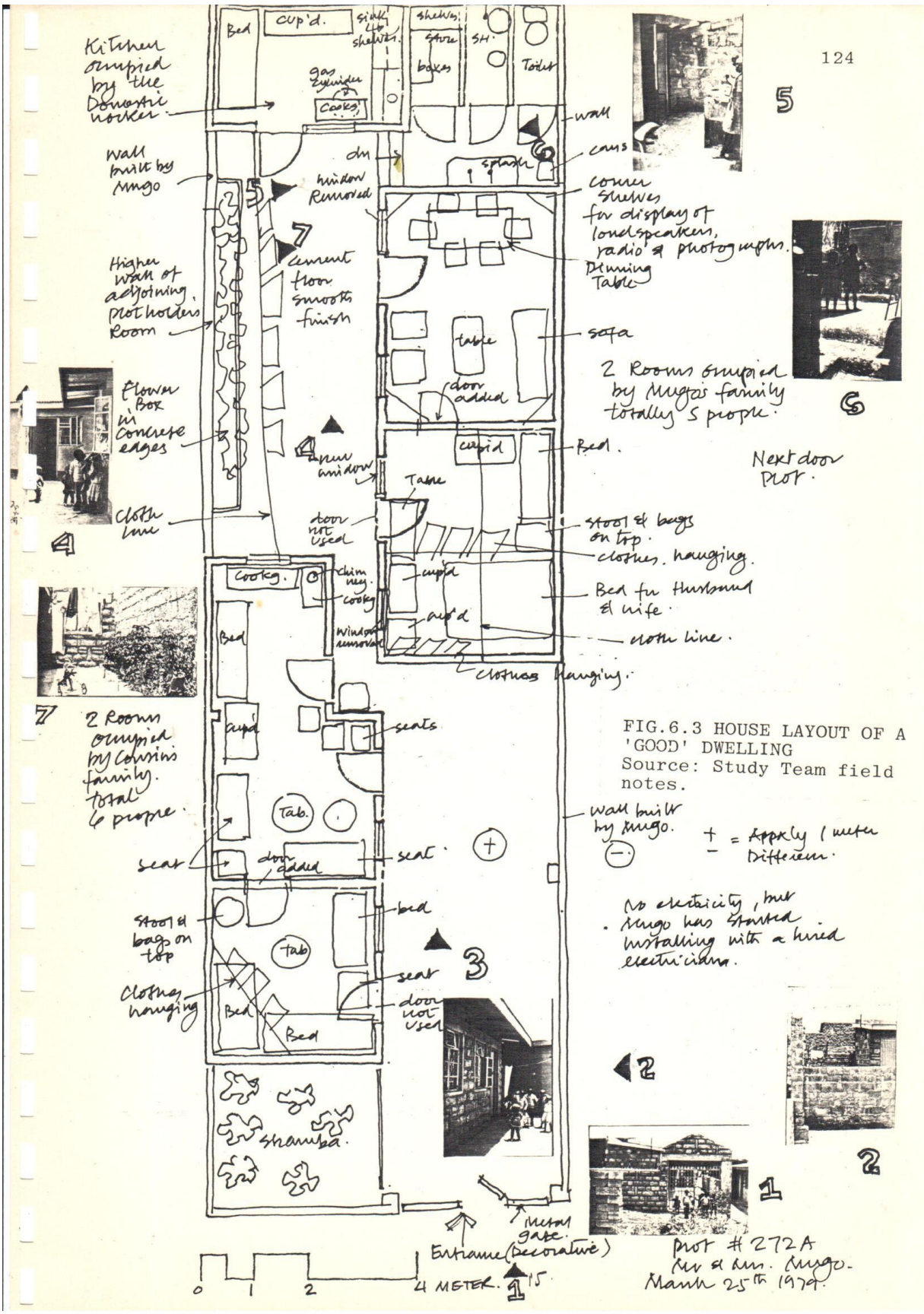


FIG.6.3 HOUSE LAYOUT OF A 'GOOD' DWELLING
Source: Study Team field notes.

household functions; the exterior is carefully finished and maintained, often some vegetables are grown and on the whole, the attitude of the owner towards the maintenance of the dwelling is geared towards improvement and better utilisation. Whilst the owner is often using such a dwelling for partial subletting (for income-generation), he also occupies it himself with his family. The plot is well defined by boundary walls often with a decorative gate and the concept of personal space is beginning to be achieved whilst the treatment of the physical aspects of the dwelling creates some kind of identity.

6.9.3 An "average" dwelling (Figure 6.4) is one where the minimum amount of construction has taken place; that is two rooms in the case of a type A plot and one room in the case of type B plot. Some attempt has been made to add more rooms, but, as yet, they are not completed. The outdoor space is not well treated, that is the ground is still undeveloped, the plot is not well defined and as a result the adjoining plot - owners share the same open spaces. The actual standards of construction and utilisation are more or less the same as the description of a 'good' dwelling.

6.9.4 A'poor' dwelling (Figure 6.5) is distinguished by the extent to which the owner has been able to complete the required amount of construction. This means, that the owner has either not been able to build two rooms (in the case of type A plot) and has not yet completed the finishes in the case of type B plot. For several reasons the construction may be very haphazard; even the standard of construction is generally poor compared to other dwellings. What is more obvious is the poor quality of the interior and exterior environment. The outdoor and indoor spaces are badly maintained. The wet core area is often unhygienic, water from the toilet or shower drains through the plot into an open area. The plot itself lacks any kind of distinction, lacks a physical boundary and the dwelling is partially sublet.

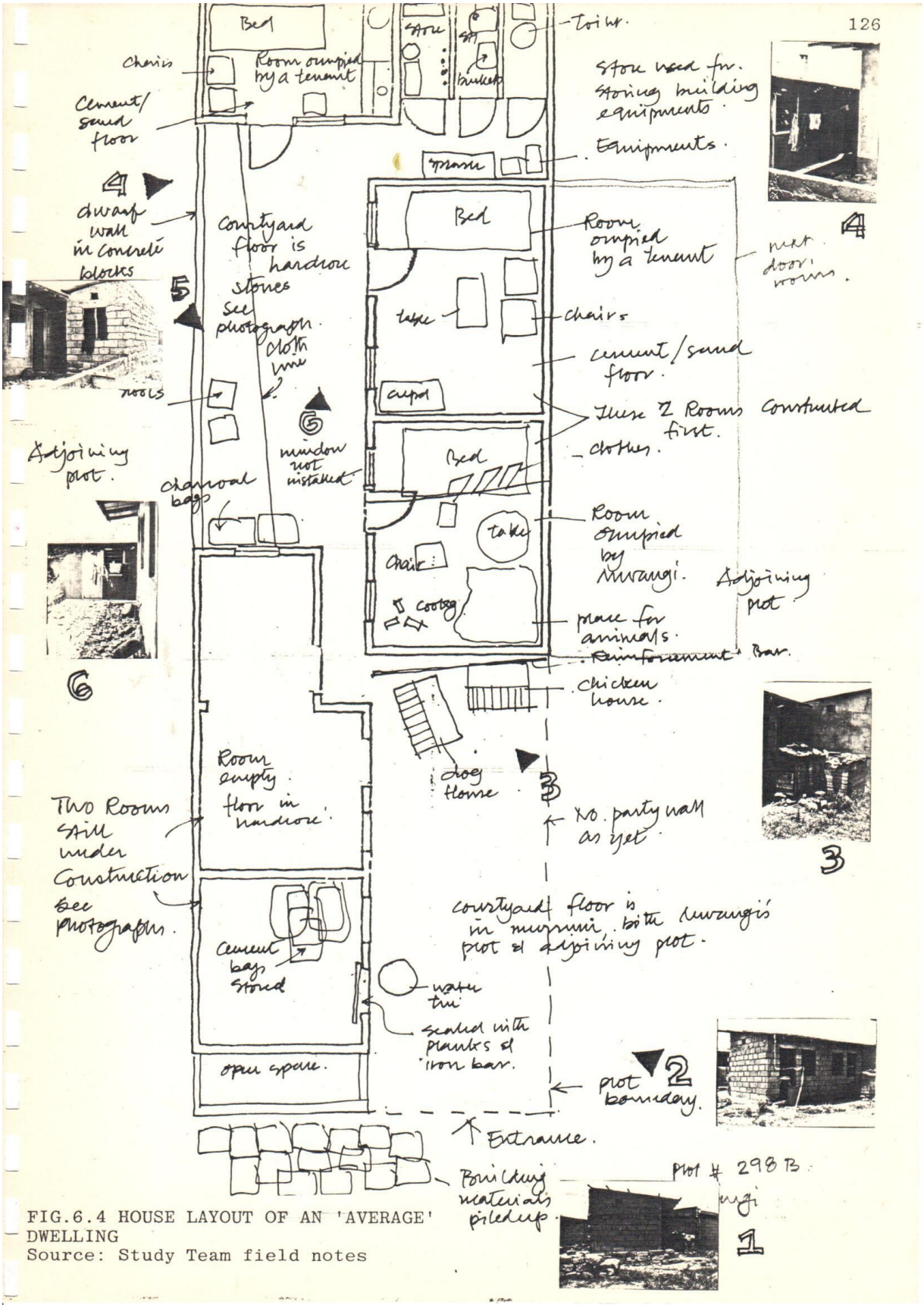


FIG.6.4 HOUSE LAYOUT OF AN 'AVERAGE' DWELLING
Source: Study Team field notes

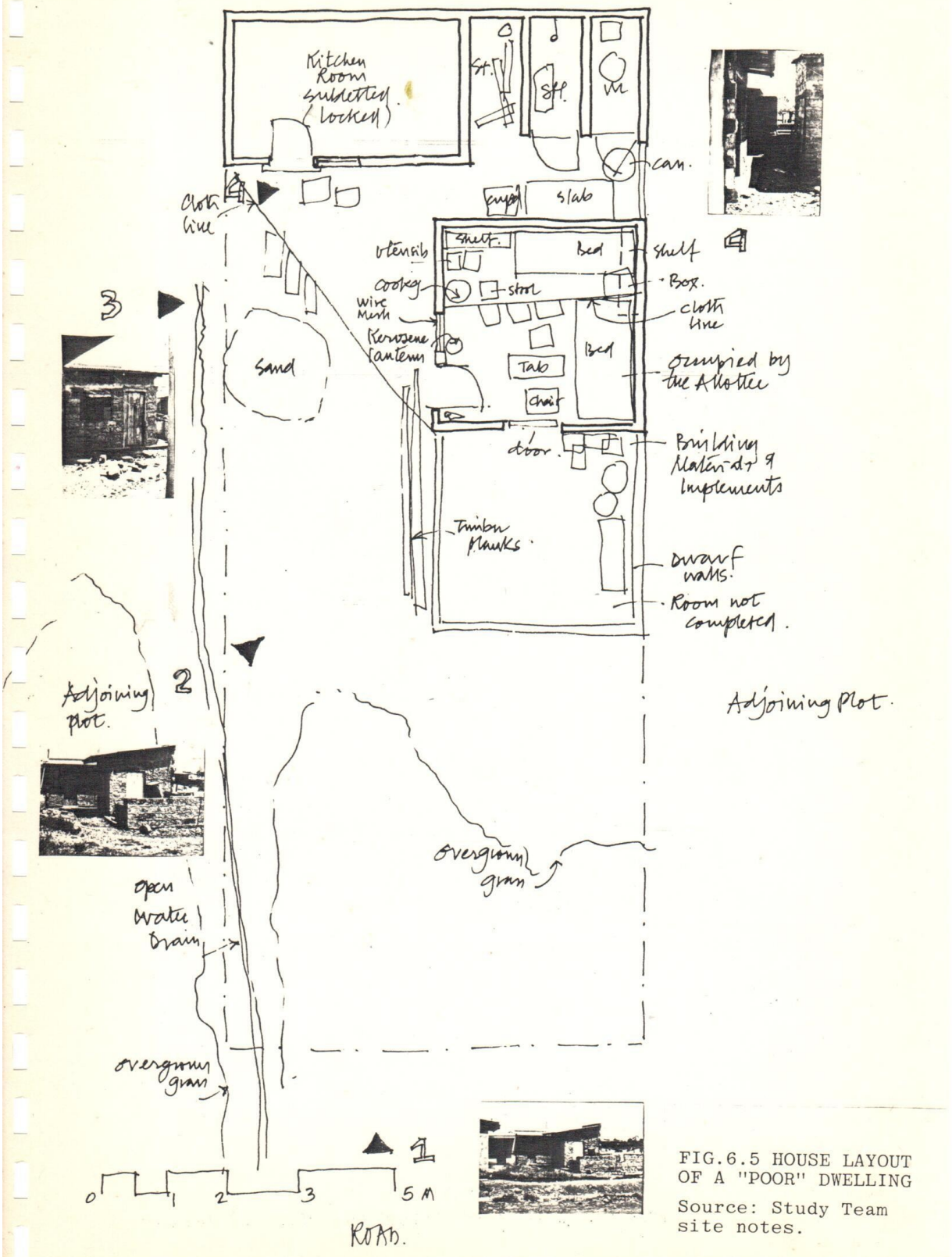


FIG.6.5 HOUSE LAYOUT OF A "POOR" DWELLING

Source: Study Team site notes.

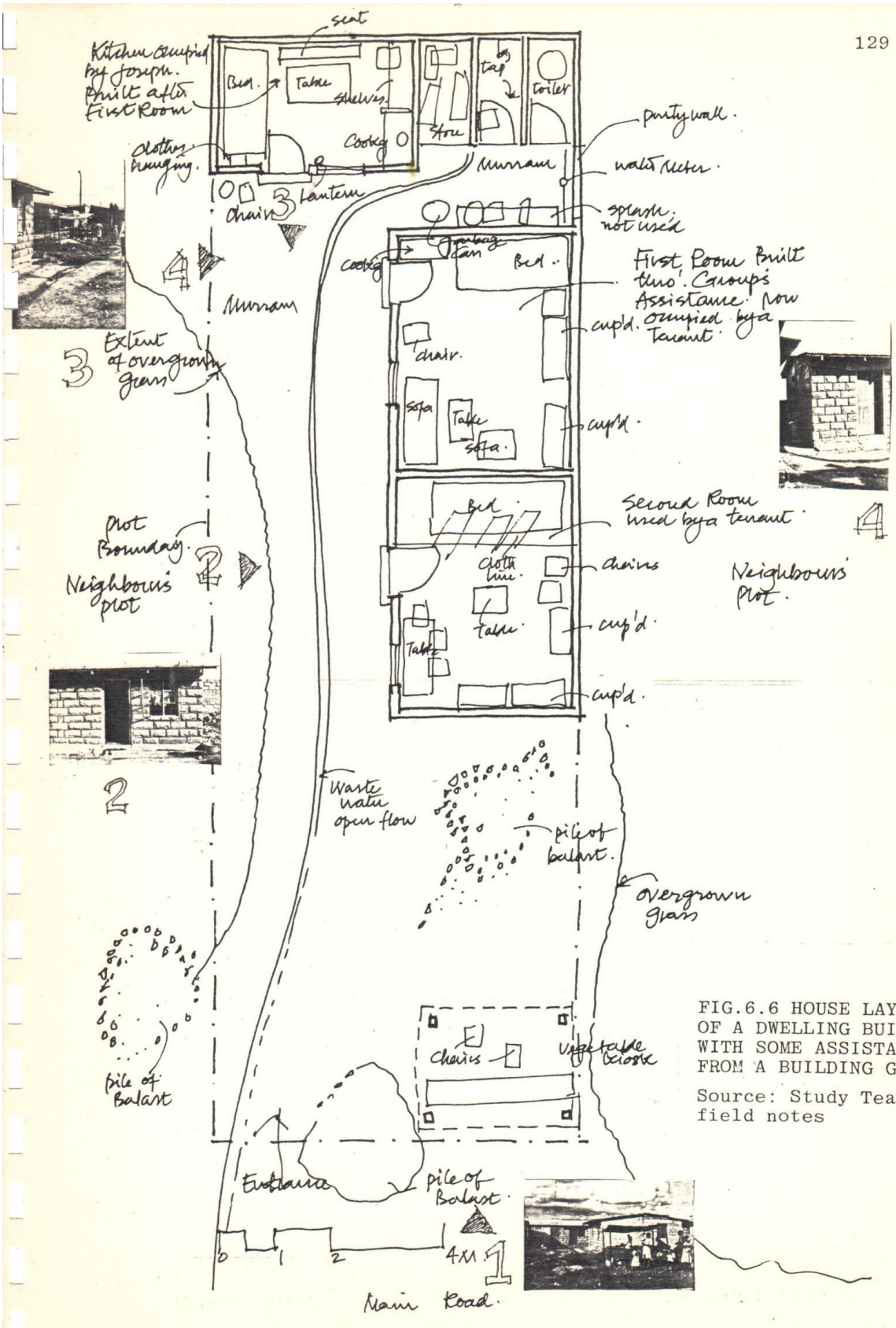


FIG.6.6 HOUSE LAYOUT OF A DWELLING BUILT WITH SOME ASSISTANCE FROM A BUILDING GROUP

Source: Study Team field notes

individuality and self-reliance take a secondary position. Nonetheless, it is clear that the mobilisation of resources through a group presupposes adequate and effective leadership.

6.9.9. Criteria 2: THE AUTONOMY OF THE DECISION MAKING PROCESS IN HOUSE PLANNING AND CONSTRUCTION, ITS DECENTRALISATION AND INCREMENTAL PROGRESSION: Autonomy suggests the extent to which the owner builder manages to apply himself in planning and/or construction. Planning requires his skills in designing a house layout and making decisions. Incremental or step-by-step investment is necessary due to the limited resources of the owner/builder. In practice the stages of construction are sequential so as to achieve the best combination of benefits and economic savings. This view of self-help by the allottee reflects an 'ideal' situation, that is decision making in planning and construction is antonomous.

6.9.10 The subcontract form of self-help on the other hand has more than one actor, that is the owner/builder and the fundi(s). Each stage of the construction programme requires different fundi(s) either because the owner/builder is unable to afford continuously hired labour or all the skills necessary are not normally available in one fundi. The owner/builder is expected to adopt the fundi's decisions. As a result the owner's role is marginal; he is in fact an 'outsider'. The role of allottees generally is to purchase building materials, renumerate the fundis, seek finance and organise their team. However, in these tasks the allottee is not experienced. As a result the owner/builder has to seek advice from friends, neighbours and the Project Agency.

6.9.11 The construction of the permanent shelter also necessitates incremental stages of construction. Such incremental construction over a period of eighteen months (two rooms for type A plot and one room for type B plot)shows that there is one group of allottees which manages to construct the required number of rooms in time, while the remainder cannot or even find it difficult to commence. The commencement of construction is an important phase for the subsequent progress since whatever construction that is completed is utilised for some kind of economic benefit.

6.9.12 When the minimum number of rooms are completed the remaining plot is left vacant until such a time as the owner/builder has sufficient resources to continue with the construction. Observations suggest that allottees experience some kind of a limbo and stop after the minimum number of rooms are constructed. There are hurdles or thresholds to overcome at this point. The required standards of construction is one of them. Perhaps this is one of the reasons why so many plots are not yet utilised to the maximum, despite nearly three years of occupancy.

6.9.13 In the case of a building group the room(s) that have to be constructed, through the group's efforts, are done by subcontracting all the activities to a fundi. The fundi is employed on a lump sum basis, the contractual agreement is made by the group's representative with the fundi. This helps the owner/builder/member to overcome some of the difficulties experienced by non members when employing a fundi. In this case therefore it is clear that, in the actual decision making process of planning the tasks of construction, the groups collective effort is applied and an individual's direct participation reduced.

6.9.14 Criteria 3. THE EXTENT TO WHICH OFFICIAL STANDARDS FACILITATE OR HINDER SELF-BUILD METHODS: In self help by the allottee, a temporary shelter is first built. However, within the official rules and standards such a a shelter is considered "temporary" partly because of the materials used, the form of and construction but also because of the functions that the temporary shelter serves. Taking the official view this kind of shelter does not conform with any standards. On the contrary, it is not "acceptable" or "desirable" since this kind of shelter projects the image of a squatter and is therefore considered to be undesirable. As a result in the early stages of the Dandora Project, such temporary shelters were not permitted to be erected. It was only after realising that only by providing such temporary accommodation could the owners commence construction of the permanent dwelling that the official view changed.

6.9.15 The phenomena of the temporary shelter is an important element of the self-help effort; perhaps never conceived by the planners in their concepts of house construction. This phenomena demonstrated the extent of the owner's ability and limitations. It was only when the local authorities realised that this kind of a temporary shelter was a pre-condition to any further plot development did they relax their rules.

6.9.16 The official view extended the useage of such a structure until the permanent house is completed. Thereafter, the temporary structure must be removed. The sub-contract form of self-help is perhaps the only realistic way of constructing dwellings which would meet official standards. The process of construction necessitates an understanding of the type of materials

to be used, when and how. This knowledge is also lacking amongst the owner-builders.

6.9.17 As a consequence, it is necessary to sub-contract those tasks which are beyond the allottees' abilities. In an attempt to do this the owner-builder falls into other pitfalls due to the need for contractual negotiations, enforcement of verbal agreements, and financial management. All thse issues arise when the allottee hires and fires fundis.

6.9.18 To summarise therefore, it is clear that in an attempt to conform to the official standards the concept of self-help is grossly reduced. Only the construction of a temporary shelter is done fully on a self-help basis: thereafter the construction of a permanent dwelling is less and less a self-help process.

6.9.19 The official view of building groups advocates the idea of group participation, demonstration and even technical assistance, A building group however requires more management, record-keeping and equitable distribution of resources. Practice reveals that far more resources are required for a building group to function effectively. Once again the official standards can help but, at present, the pattern of standards hardly corelates with building groups as a resource.

6.9.20 Criteria 4: THE DEGREE OF IMPROVEMENT IN THE SOCIO-ECONOMIC STATUS OF THE ALLOTTEES AFTER JOINING THE HOUSING ESTATE: One of the broader objectives of the project was to alleviate the "housing problem" through the sites and services policy. This objective is conceived as the improvement of the socio-economic condition of the allottee and environmental quality of the dwelling. Observations suggest that most of the allottees were previously residents of squatter settlements, such as Mathare Valley, Pumwani, Embakazi and Dagoreti. The quality of these previous areas, whilst varying, could be considered, from the authorities view, as 'undesirable'

6.9.21 The present residents of the Dandora project can be broadly grouped under three categories in order to observe the degree of improvement in their socio-economic status after moving to the estate.

6.9.22 The first group, where there is an appreciable economic change. Incomes have risen suddenly due to the income from renting, either partly or fully, and from small business enterprises.

6.9.23 The second group of allottees experience no adverse effects on their income level, either due to better management of their finances or to partial subletting to meet some of the principal costs of house construction.

6.9.24 Thirdly, a large group of allottees have experienced an adverse impact upon their income level. For several reasons their income has fallen compared to that enjoyed before joining the estate. This is due to poor management of house utilisation, record keeping or the need to change their job due to change in residence.

6.9.25 On the social side there are both benefits and costs accrueing from the project. On the positive side there is the sense of security through tenureship of a property and investment which rapidly appreciates in the market and lastly, the educational experience derived out of participation in erecting a dwelling and in finding a foothold in the urban economy.

6.9.26 Social costs include the breaking up of the extended family. Often this is due to a lack of sufficient rooms in the estate, the need to partly sublet and earn extra income. Most importantly, the financial stress that the allottee now bears. The repayment period, for example, is about 30 years and this indeed is a long time for a person to shoulder the stress. The other social or personal

costs are temporary but noticeable during the course of house construction. These are the pressure of working alongside a fundi, seeking approvals from the authorities and raising enough finance to meet the cost; often the allottee has to partly sublet the dwelling at the cost of privacy and overuseage of the wetcore facilities.

6.10 RECOMMENDATIONS:

6.10.1 Having studied in some detail the operation of self-build methods at Dandora we wish to RECOMMEND as follows. These recommendations apply to low cost housing in general and not just to sites and services schemes:

- Allow the building of a temporary shelter on construction sites
- Prepare a list of approved fundis for use by house builders; for example in a sites and services project, the list would be prepared and kept up-to-date by the project agency's representative on site.
- Design a simple form of agreement for use between the developer and fundi.
- Prepare a self-help construction manual with simple easily understood specifications and details.
- Prepare guidelines, model constitution and standing orders for the better administration of building groups
- Expand the housing extension service in local authorities
- Legalize the issue of the phased occupation certificates
- Initiate a clearing agency and advice bureau for subtenants.
- Prepare a suitable subletting agreement and encourage the use of rent books.

- Review the amount of material loan from time to time to keep abreast of material prices.
- Permit the use of second-hand materials.
- Encourage the formation of building groups in the upgrading areas.
- Compile a list of materials suppliers and merchants for every town.

CHAPTER 7

INITIAL AND OPERATING COSTS

7.1 7.1.1. If there were no legal controls over the choice of materials, building techniques and space standards building practice would then be governed by non-legal parameters; the most important of which would be the market. However there are other principles that would also influence dwelling quality and cost. These are the traditional building practices; available materials, land tenure, personal preferences and the need to innovate and emulate; and social rules regarding location and nearness to community leaders. Each of these determinants will be discussed in turn:

7.1.2 If there were no building code, the market would still see to it that quality dwellings are built. As long as there is demand for spacious, well built and well equiped houses, owner builders and developers will supply those houses. That means that even if codes or byelaws are instituted, they need not cover every aspect of dwelling supply. They ought merely to cover those aspects aimed at public safety and safeguarding public health. Matters relating to comfort, convenience, and famoly life-style can best be left to market processes. The consumer of a house of certain price or rent catagory demands a particular standard of comfort and fittings and the developer or landlord knows that he must provides those facilities if he is to get a purchaser/tenant. For example whether the byelaws require it or not a three-bedroomed suburban house or maisonette costing £15,000 or more would have hot water, a bath-tub, fitted cupboards in the kitchen and bedrooms, hidden electric wiring, and servants' quarters. That is why the Commissioner of lands normally inserts a building covenant in the ground lease requireing the allottee to build a house or other building at minimum cost of so much. A cost 'floor' is a

convenient way of specifying building standards, subject to it equating with the inflation of building costs.

7.1.3 Building techniques learnt through apprenticeship and handed down from generation to generation to ensure that acceptable standards are achieve. Although the quality and sophistication of craftsmanship will vary from society to society, or from tribe to tribe, it is found that the more intricate designs and technologies are available in the more sedentary societies with a tradition of specialization and long apprenticeship for the "fundis", while the simplest are evident among the nomadic societies. In an urban situation with a relatively advanced building technology quality would be ensured, for the richer, by competition among 'fundis' to excell and to establish a reputation. For the poor, who cannot afford to pay for competent craftsmen, the quality of design and construction would be extremely low. This is in fact what happens even in a controlled situation for it has not been possible to couple building control as a legal instrument with economic measures that would ensure its compliance.

7.1.4 Residential location in the absence of building control would be partly determined by the land tenure system. The landowners or the chiefs would allocate the choice plots to relatives or community influentials, who because of competition amoung themselves and because of their desire to get noticed by the top leaders, could erect substantial dwellings. In such situations physical proximity to leaders and decision makers is an important consideration. That is standards are determined by who builds where. Certain people are expected by society to erect dwellings of a certain standard. Moreover, the importance of a site in terms of its owner, its potential occupant and its proximity to other sites dictates that a structure of a particular cost level (hence quality) should be built upon it.

This does not happen at present. Legal standards are constrained yet the capacity to meet them declines with time while expectations are rising.

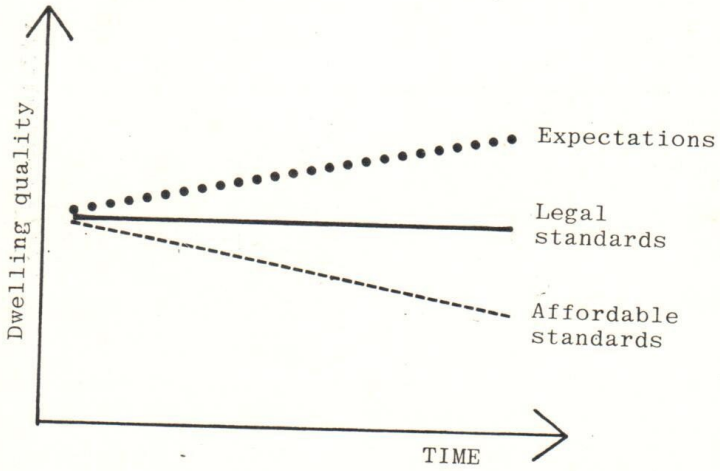


Fig. 7.2 CHANGING EXPECTATIONS OVER TIME

7.2 BUILDING CONTROL AND DEVELOPER BEHAVIOUR:

7.2.1 The influence of a building code on developer behaviour varies according to the market in which the developer operates. The builder of a high quality house is not likely to be bothered by the code. His standards are well above the legal minimum. It is in the middle and lower income sectors that meeting the legal standards creates a problem. In order to maximise his profit the developer will want to keep building costs as low as possible, since profit is the residual after deducting development and land costs from the sale value. A change in the building code downwards would thus assist the developer to maintain stable prices in the context of inflation, and also increase his profit. Only a portion of the cost reduction will be passed on to the purchaser.

7.2.2. Will the introduction of less expernsive standards result in more dwellings being built? Again the answer depends on who builds. The public sector will get more houses for their money, though not in the same proportion as the reduction in cost, since although public land is inexpensive the administrative overheads are much higher in public than in private development. On some NHC projects, administrative overheads have been quite substantial. Even if we assume that construction accounts for 60% of the total cost, a 10% reduction in building cost will result in 6.38% more housing. It is obvious that for maximum effect byelaws changes must be accompanied by reductions in other costs, especially land and administrative overheads.

7.2.3. In the private sector changes byelaw will make as we have already seen, individual houses slightly cheaper and more accessible to the lower income families, but a massive increase in the supply of housing is not likely since private developers operate as uncoordinated individuals and companies and are more interested in specific projects to satisfy specific demands. Thus unless effective demand for approved housing is increased as a result of byelaw changes the private sectore will not respond with an enhanced supply. In fact in this sector of the market the supply is more likely to be influenced by factors other then legal standards, e.g land availability and the possible financing arrangements. As far as dwelling quality is concerned the aim ought to be that a revised code should not adversely affect housing quality. The achievement of this objective is however not, an easy task. For example there is little scope for lowering the existing space standards without seriously affecting family welfare and comfort.

7.2.4 The scope for structural changes is limited by safety considerations, while sanitary requirements are tied to health considerations. So changes are not worth while unless the resulting cost reductions are large enough to justify increased risks. If one can define the risk level it will be easy to identify the cut off point as far as standards are concerned. This point is discussed in greater detail in the Discussion Paper DP 2 (Environmental Health) as well as in the other technical papers in this series. It is not possible to quantify the resulting trade-offs at this early stage.

7.3 INITIAL COSTS:

7.3.1 The cost of providing a new dwelling consists of the following:

- land
- Services/infrastructure

- construction cost i.e. materials, labour and contractors, overheads and profit if contractor built.
- landscaping
- professional fees
- survey fees
- interest on capital during construction
- developers administrative costs/or profit
- land taxes during construction
- marketing costs.

7.3.2 In addition the occupant will have to pay connection charges and deposit for the various services as well as legal costs and stamp duty. In the above list by far the largest and most important item is construction cost. If reductions were to be made here by a private developer building for speculative purposes who, let us suppose, is not constrained by a building code, where would he seek to effect reductions? He would first opt for the most economical design in terms of layout, both internal and external, and site conditions. He would then seek to effect economies as shown in Table 7.1.

7.3.3 New byelaws should attempt to accommodate the builder in his efforts to reduce costs. We have concentrated above on the areas in which byelaws could make a contribution. Thus the use of self-help methods or more efficient labour, though very pertinent as far as cost reduction is concerned, is not a legal requirement. Nonetheless byelaws must promote a more efficient use of labour by being simple, clear, and easily understood.

7.3.4 When a professional designer is involved, he will endeavour to utilise each cost-reducing tactic to the maximum while at the same time bearing in mind the possible secondary effects on other building elements.

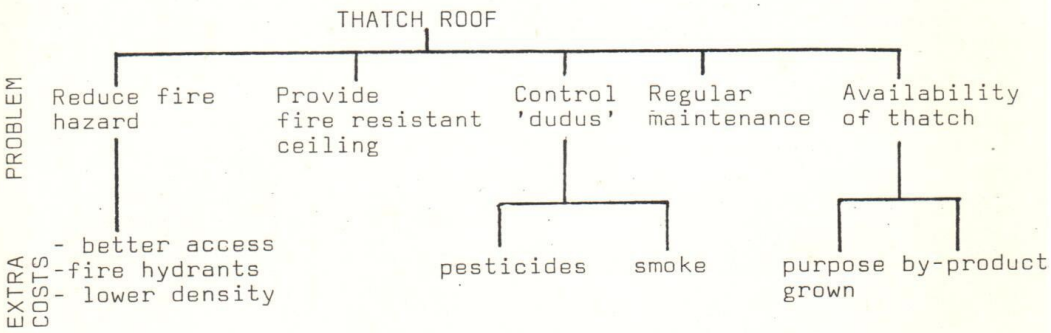
TABLE 7.1

HOW THE DEVELOPER ATTEMPTS TO REDUCE CONSTRUCTION COSTS

COST-SAVING DEVICE	POTENTIAL FOR CHANGE IN BYELAW REVISION	EXAMPLE
Reduce dimensions	High	Thinner walls, floor and partitions; light weight roof trusses; small dia. rwp.; thinner plaster or screed
Reduce space requirements	Low	Smaller rooms; lower ceilings
Reduce plot dimensions, side yards, etc.	Medium; $100m^2$ plots already in use	Small plots in sitse & services schemes; narrow frontages
Use inexpensive materials + recycled and secondhand materials	High	Local materials e.g. Walls: Mud/wattle coral & other locally available stones, soil-cement blocks, mud bricks, used concrete blocks, timber, sisal poles; roofs: g.c.i. sheets, makuti & thatch

COST-SAVING DEVICE	POTENTIAL IN BYELAW REVISION	EXAMPLE
Use labour-saving detailing & technology	High	Pre-manufactured elements and components; on-site machine for making blocks; mud bricks; efficient kilns
Cut down on finishes	High	No ceilings, plstering, skirtings, architraves, etc.
Use cheaper site	Medium ('cheap') sites are normally expensive to develop	Peri-urban sites on government land; land acquired at agricultural prices
Share elements and components	High	Shared water tanks, drains, manholes, road frontages; back-to-back houses; party walls; stand-pipe; shared septic tanks.

Here is an example showing the possible effects of using a thatch (say makuti) roof.



7.4. OPERATING COSTS:

7.4.1 The effect of byelaw changes needs to be examined in the context of total dwelling costs, that is capital as well as recurrent costs. If the resulting total costs (i.e. operating costs) were higher the change would in theory not be worth-while. However in practice other considerations may be paramount, e.g. the fact that only a limited amount of money is available now to build a house and future maintenance and other expenses though relatively high, can be met from other sources as and when needed. Such irrational, but necessary, considerations make it almost unrealistic to argue in terms of operating costs. To a low-income household it is more important to get the house built than to worry aboutfuture maintenance costs, rates and so on. Moreover not only do all costs rise anyway through inflation, but rising maintenance costs can be met from additional income from subletting.

7.4.2 Operating costs in this context are seen as including:

- amortisation of the initial investment over the life of the building; for renters it would be the rent
- maintenance
- rates
- insurance
- management expenses
- water charges

Electricity consumption would be much less responsive to byelaw changes and does therefore not warrant discussion here. It is also convenient to exclude depreciation, since at the prevailing interest rates, if a building can last fifty or sixty years, it is as good as an ever-lasting asset.

7.4.3 Amortisation: This aspect can be approached from three directions. First there is the mortgage repayment, which is a real and tangible household expenditure. The amount would depend on the loan period and interest rates plus any additional fees like insurance charges. We have already disccussed the possible effects of any changes in the byelaws on mortgage repayments. The second way is to take the rent payable by either real or hypothetical tenants, although in this case the demand of land and location would be included. The rent value is almost higher than the mortgage repayments. Thirdly, an annual equivalent of the initial investment could be calculated on the basis of a suitable interest rate taking into account the opportunity cost of capital and risks involved. Whichever method is used the amortisation on lower quality dwelling - say mud and wattle as opposed to concrete block- would be proportionately higher than for a superior dwelling. This is because of the shorter working life and higher risks involved.

7.4.4 The rent for a house built of mud or wattle would be lower than for a concrete block house but not in the same proportion as the capital costs. For instance whereas a tenant of a room in a permanent low-cost house at Likoni, Mombasa, may pay shs.100/- per month, his colleague in a mud and wattle and mabati roofed house may well pay shs.75/- per month, although the cost of the latter house may be about half of the permanent one. That is owners will benefit more from byelaw changes than renters. Even in Nairobi one finds that the difference in rent between say Mathare Valley and Dandora are in no way related to differences in construction costs and residential quality.

7.4.5 Maintenance: There is very little available information on maintenance costs outside the public sector. Even in the public sector estimates and actual expenditures are usually rendered for the whole town by Government Department. Widely varying figures of maintenance expenditure should be expected since there are so many factors which

influence the amount of expenditure. These include:-

- type of construction
- design
- age
- occupancy and use
- climate
- site conditions
- changing family preferences
- management capabilities.

7.4.6 The relevant point is that standards that allow inferior materials will result in higher expenditure on maintenance. A study of investment in Swahili housing in Mombasa, carried out in 1970, showed that investment in repairs and improvements accounted for two-fifths of the total investment in "temporary" construction, with non-new work (i.e. repair work) being heavily concentrated in the older neighbour hoods. 1/ Another study of Nairobi City Council maintenance expenditure on three housing estates showed that 2.64%, 3.90% and 23.20% of rental income from Mariakani, Kariakor and Ziwani Estate respectively was spent on maintenance. The amazingly high figure for Ziwani is explained by the age of the estate and the very low rents charged, varying from shs. 26/- to 91/- per month.

7.4.7 That particular study recommends a figure of 7½% to 10½% of revenue as being an appropriate allocation for maintenance in local government housing. 2/ However, the HRDU reports that in 1974 Nairobi and Mombasa spent respectively 17.00% and 11.55% of rental collections on maintenance. 3/

1/ S. Yahya Tradition and Modernity in Residential Investment. Dept. of Land Development, University of Nairobi, 1971.

2/ D.M. Mugaa "The Economics of Maintenance" KIPIMO Vol. 1 no. 1. March 1976

3/ Local Authority Housing in Kenya, HRDU, University of Nairobi, 1978

The HRDU report also gives the following average figures of maintenance and insurance expenditure for 1974 in five municipalities.

	Maintenance		Insurance	
	per unit shs.	% of revenue	per unit shs.	% of revenue
Kisumu	73/50	3.02	30/10	1.25
Nakuru	48/70	6.50	NA	-
Thika	451/10	54.10	4/10	0.50
Eldoret	35/30	4.00	2/80	0.30
Kitale	77/70	5.65	13/20	1.00

7.4.8 The Ministry of Local Government recommends a figure of 1%% to 2% of capital value. A recent study of University of Nairobi maintenance costs shows that the University spends 0.06% of the valuation on maintenance, but this figure is for all buildings, not just housing. 4/

7.4.9 It must be noted that maintenance demand and expenditure occur in "lumps" with large investments at intervals for the purpose of renewals and renovations, and relatively low expenditure in the intervening years. This is especially the case where traditional materials, such as mud and wattle and makuti roofs, are used. A suitable financing plan has yet to be devised for this kind of expenditure.

4/R.M. Njihia, Maintenance of University of Nairobi Estates Unpublished Student Project, Department of Land Development, University of Nairobi, 1979.

Class 1 Construction - Brick, stone and other permanent materials.
Class 2 " - Wood and iron
Class 3 " - Basic types e.g. farm buildings.

Premiums range from shs. 5/- to shs. 8/- per £100 of replacement cost. Reductions are possible where owners get together and ensure a whole estate.

7.4.13 Management: This expense is only relevant where the owner has a number of houses which he lets out and has to employ a managing agent or incurs expenses in rent collection, voids (i.e. vacancies); advertising for tenants and preparing leases. In the context of low income housing the cost are minimal, apart from the mental and emotional stresses of living and dealing with subtenants. For owner-occupiers there is the inconvenience of attending to different types of official notices and requirements. For instance the difference between land rent and rates is not easy to recognise for the non-initiated, while landlords are not always aware of their rights and obligations under rent restriction legislation. Revised byelaws are not likely to affect management costs to any significant extent.

7.4.14 Water is paid for separately as a user charge and is an expenditure not directly affected by building standards.

7.5 CONCLUSION:

7.5.1 This chapter has endeavoured to identify those areas where byelaw changes would be most profitable. The actual initial cost reductions are fairly easy to calculate once the changes have been decided upon and proto-type designs developed. That is a purely technical function. The long-term effects are however more difficult to forecast because of uncertainties regarding obsolenscence, maintenance technology and costs in the future. Not only is there a dearth of essential data, but the relevant methodological tools are quite weak. It is difficult to answer the question often asked by the layman: are the

inexpensive dwellings we are trying to develop going to be the slums and shanties of the future? It is a question which designers should assist to solve in a positive manner.

7.5.2 It is essential that a Housing Statistics Project be designed and launched to monitor and publish all the relevant financial and economic indicators discussed in this and preceeding chapters on a regular basis.

CHAPTER 8

RESOURCE USE

8.1 This section of the discussion paper deals with the following aspects of building control:-

- Relevance of housing types, standards and technology;
- Materials, local and imported;
- Labour, i.e. manpower, skills and management
- Equipment and capital
- Energy.

8.2 HOUSING TYPES, STANDARDS AND TECHNOLOGY:

8.2.1 The efficient utilization of such resources as building materials, labour, equipment, capital and energy (amongst others) is directly related to the house type designs, standards and technology. These resources are basic to the production of housing for all types of income groups, i.e. low, middle and high income groups. The wasteful utilization of these resources for the production of housing units for the high income groups directly and indirectly effects the production of housing units for the other income groups, especially the low income groups in the urban areas, and vice versa. It is, therefore critical that the utilization of the resources for any type of housing development project be a matter of concern at the planning and building design stages.

8.2.2. Table 8.1 shows a comparative cost analysis of various public housing estates in Nairobi for the low, middle and high income groups. This brief comparative analysis shows that the site-and-services scheme in Dandora is very competitive in terms of public investment per dwelling, as compared to other publicly completed housing programmes in Nairobi. The cost of services per plot in Dandora is the lowest despite the fact that in all the cases there is a provision of water-borne sewerage, individual water - supply, roads and street lighting. The main difference, however, is that Dandora is a high density area using some of the

TABLE 8.1: COMPARATIVE COST ANALYSIS OF DANDORA & OTHE R PUBLIC HOUSING ESTATES IN NAIROBI

HOUSING AREAS	Plots per Ha	Plot Size M^2	Covered Area M^2	Cost of Building K.Shs	Cost of Services K.Shs	Sale Price K.Shs	Monthly Payment K.Shs	Affording Income K.Shs p.m
1. DANDORA	50	120	60	9,600	3,200	12,800	115	575
2. BIAFRA (PUMWANI)	40	102	36	27,600	4,900	32,500	290	1,400
3. UMOJA	45	126	42	28,000	5,000	33,500	290	1,400
4. HURUMA	45	105	35	49,500	6,500	56,000	500	2,500
5. BURUBURU	38	167	67	54,900	11,500	66,400	600	3,000
6. KIMATHI	22	210	70	70,000	8,000	78,000	700	3,500
7. MADARAKA	N/A	N/A	90	77,000	7,000	84,000	750	3,700
8. HARAMBEE	26	270	70	80,000	6,400	86,400	760	3,800
9. KIBERA	38	150	110	91,000	18,000	109,000	980	4,900
10. JAMHURI	21	108	62	139,400	11,100	150,500	1,350	6,700
11. NGEI	10	700	130	130,000	30,000	160,000	1,440	7,200
12. LORESHO	36	2,500	200	219,000	23,000	242,000	2,100	10,500

Grade II Building byelaws and the others are medium and low density areas using Grade I byelaws. Table 8.1 also shows that the cost of services and buildings is directly related to the affordability of housing by the various income groups. The planned income group in Dandora (site-and-services scheme) is that earning upto K.shs.575 per month, while in the Ngei Estate (completed housing scheme) it is the higher income group earning upto about K.shs.7,200/- per month. Furthermore it shows that for the total cost of one housing unit in a high income, high cost housing project (e.g. Loresho at K.shs. 242,000/- each) almost 20 housing units in a low income/low cost housing project (e.g. Dandora at K.shs.12,800/- each) could be provided using public funds and resources.

8.3 HOUSING TYPES:

8.3.1 Within the low cost housing programmes implemented by the National Housing Corporation (NHC) or the Local Authorities (such as the First and Second Urban Projects implemented by the Housing Development Departments in Nairobi, Mombasa and Kisumu) house type plans with stipulated building standards and specifications have been provided in the past. These type plans have not always been followed by the plot holders in the site-and-services schemes nor have they always been enforced by the Local Authorities. According to the Housing Research and Development Unit (HRDU) study on the evaluation of the site and services programme in Kenya several examples of non-compliance with type plans were found in various schemes in the country. In most of these cases of non-compliance the plotholders built more rooms than was permitted, i.e. more than 50% of the plot coverage. Several houses were built on the plot boundary, leaving a space of less than two metres to the next house. In one case a house

was built partly over the sewer. In one of the project towns, the Town Engineer stated that type plans, and for that matter even byelaws, are difficult to enforce.

8.3.2 The HRDU study further points out that by and large the house type plans have improved in Kenya during the past 10 years since the first HRDU Site-and-Services (S&S) Analysis and Report prepared in 1970. Many of the recommendations made at that time are common knowledge. These include, interalia:

(i) The need for independant access to all habitable rooms in order to facilitate subletting;

(ii) The use of 4 - 6 rooms per service unit;

(iii) The need for room dimensions suitable to accommodate commonly used furnishings;

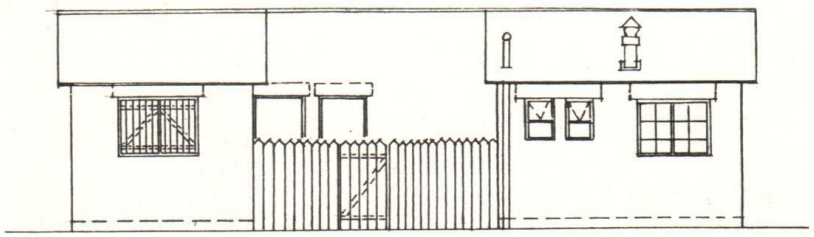
(iv) The need for simple construction methods which respond to the varying skills of local fundis' (craftsmen); and

(v) The principle of the Swahili house as a feasible low-income house-type based upon private outdoor space and security.

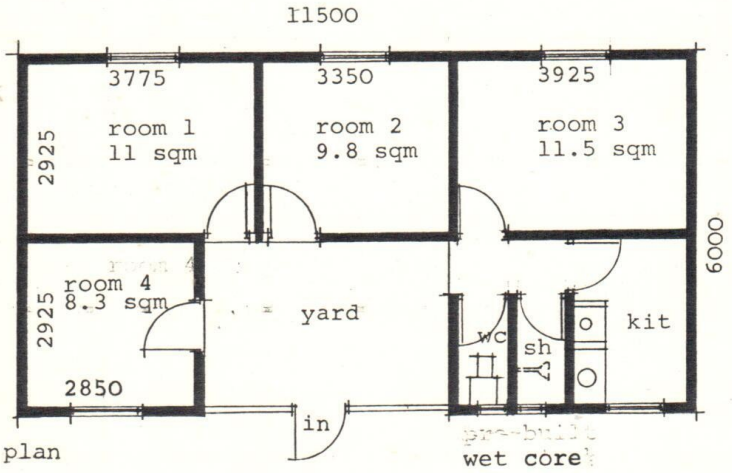
8.3.4 The NHC has adopted a range of housetypes based on the principle of the Swahili house and that of the conventional corridor house-types, which have been improved over time. However, a number of house type plans are not suitable for progressive development as mentioned in the HRDU S&S evaluation report.

8.3.5 Two examples from Webuye and Kakamega have been described in the report. (See Type Plan 8.1). This problem of one stage development as against progressive development is related to the detached house types being used presently. It is, therefore essential to control the use of type plans which cannot be developed in a progressive manner with relation to the income of the household and thus affordability. The detached houses built in one stage have often resulted in

TYPE PLAN 8.1 AN EXAMPLE OF AN NHC TYPE PLAN
(Webuye Town Council: Site & Service 2)

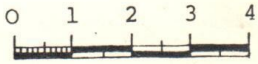


elevation



plan

plinth area 55.4 sqm



financial hardships and incompleted houses. Furthermore, the use of temporary shelters at the house consolidation stage in the S&S schemes needs to be officially permitted for reasonable time periods and controlled by the relevant implementation agency. The HRDU has recently prepared a report on "Low Income House Types for Kenya" in July 1979 in response to the need for appropriate and affordable house types for different parts of the country. These house types can provide useful guidelines for future low-cost house types in urban housing development projects. (See Type Plan 8.2).

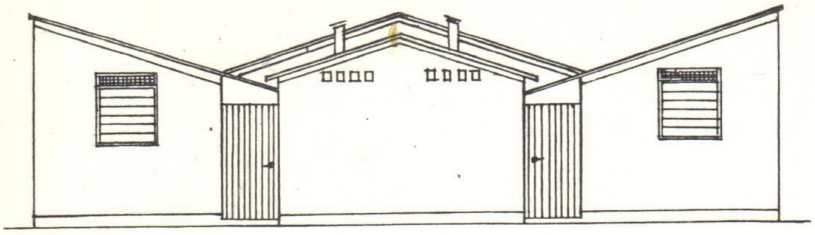
8.4 STANDARDS:

8.4.1 A detailed analysis and review of standards of construction for the house and the plot will be presented in Discussion Paper No.5 on Technical and Design Aspects. However, a summary of the major issues related to the standards for low-cost houses from the point of building control are outlined below:-

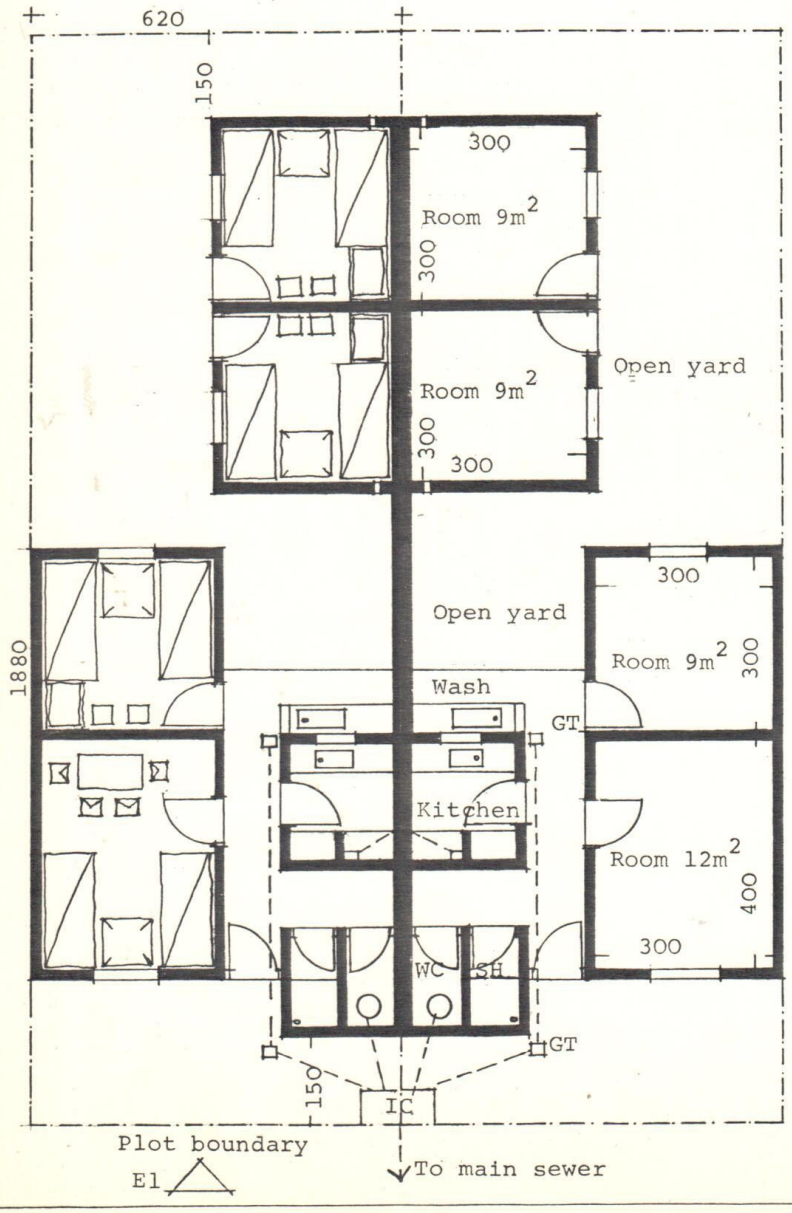
(i) The presently used Grade II building Codes as outlined in the Building Code of 1968 are inadequate and lack specific requirements especially when applied to low-cost/low-income high density housing development projects in urban areas.

Example:
Grade II Building Code No. 6 state:
"No building shall be sited on a plot otherwise than in accordance with the approval of the Council." Such a byelaw leaves tremendous amount of personal interpretation when approving a building plan for a low-cost house. Delays in the implementation of low-cost housing development projects have often occured in the past due to such vagueness and

TYPE PLAN 8.2 AN EXAMPLE OF AN HRDU TYPE PLAN



Elevation E1



personal interpretation of byelaws. The annoyance and inconvenience caused by the claimed arbitrary application of personal interpretation of the vague clauses in the legislation is aggravated by the lack of any authority to which aggrieved applicants can be appeal. In many cases, the decisions of the local authority officers, even if considered to be incorrect, is final.

(ii) The Grade II Building Code stipulate insufficient and inappropriate standards which do not respond to the changing conditions in the urban areas. For example, Grade II Building Byelaws Nos. 8, 12 and 23, which deal with Bathrooms and Latrines are insufficient and depend upon the Public Health Act for further information, especially when water-borne sanitation is provided in a low-cost housing project. Similarly, no clearly defined standards for roads, car parking and community facilities are available, except for the decisions of the Local Authorities, which are amended from time to time. There is, therefore, a need for a unified set of standards in one document.

(iii) Inappropriate standards have hindered the planning and implementation of low-cost housing development projects in the past especially with regard to the infrastructure requirements and building materials permitted. One example of such a project has been the Dandora Community Development Project. The levels of services and the expected planning and design standards as stipulated in the Building Code and the Public Health Act have a direct effect upon the cost of services and buildings. The cost in turn is related to the target income groups for the projects. One of the significant experiences of Phase I of the Dandora Project has been the issue of the

TABLE 8.2:CHANGES TO DESIGN STANDARDS & COST IMPLICATIONS FOR PHASE II OF DANDORA

COMMENTS (SOURCE)	RECOMMENDATIONS (SOURCE)	IMPLICATIONS
1. SEWER CONNECTIONS: The connection to the sewer passing through another plot is unacceptable (M.O.H.:C.P.O.:C.E)	To locate the sewer within a wayleave located in private plots and allow for separate sewer connection to each plot (C.F.)	i. Redesign: ii. Additional design fee and construction cost Approx. £20,000. iii. Higher costs per plot. Approx. £50
2. SEWER WAYLEAVE: No development to be allowed within a 3 meter sewer wayleave (C.A.E.)	Same as number one	Same as number one
3. SEWER SIZE: Sewer lines of 150 mm (6") will increase the incidence of blockages (C.A.E.)	Minimum sewer size should be 225 mm (9") diameter (C.A,E.)	i. Redesign; ii. Additional design fee and construction cost Approx. £30,000; iii. Higher costs per plot, Approx. £6;

COMMENTS (SOURCE)	RECOMMENDATIONS (SOURCE)	IMPLICATIONS
7. ROAD FRONTAGE: Approx.6% of the plots have no road frontage and are not within 75 m of parking lot (C.E.A. - E. & D)	All plots to have road frontage G.A.E. - E & D	i. Redesign; ii. Additional land. iii. Additional design fee Approx. £30,000. iv Higher costs per plot Approx. £6
8. CAR PARKING: A car parking space for every plot with no vehicular access (C.A.E. - E.& D)	Car parking ratio of 1:1 (C.A.E. - E.& D.)	i. Redesign ii. Additional land iii. Additional design fee and construction cost Approx. £50,000 iv. Higher costs per plot Approx. £10.
9. COMMUNITY FACILITIES: The Community facilities do not meet the minimum land requirements (C.P.O.) A planning concept of a central spine is wrong.	Modify and redesign land requirements for all facilities	i. Redesign 6 months ii. Additional design fee and construction costs Approx. £60,000

COMMENTS (SOURCE)	RECOMMENDATIONS (SOURCE)	IMPLICATIONS
10. HOUSE TYPE PLANS: The WC/shower/kitchen facilities should be integrated with the house plan (C.E.)	Submit house type layout plans showing the integrated (C.E.)	i. Redesign; ii. Additional design fee Approx. £20,000.
11. BACK-TO-BACK DWELLINGS: Back-to-back dwellings make is impossible for efficient through or cross ventilation (M.O.H; C.A.E.-E.S.D.)	Operate building for cross ventilation (M.O.H)	i. Redesign ii. Additional design fee and construction costs Approx. £120,000 iii Higher costs per plot Approx.

Source: Wanjohi & Chana "Strategies for Housing the Lower Income Groups in the Dandora Community Development Project, Nairobi."
(HRDU May 1977)

applicability of the existing Byelaws and the Public Health rules in relation to the minimum requirements for site and services projects Table 8.2 shows the cost implications of the comments on the Phase II plans and design of the Project and the recommended changes in the design standards. A more detail review of such implications will be discussed in the Discussion Paper No. 5 of this Study.

8.5 MATERIALS, LOCAL AND IMPORTED:

8.5.1 The following is a summary of the building materials specified for different elements in Grade II Byelaws:-

TABLE 8.3:

MATERIALS PERMISSIBLE UNDER GRADE II BYELAWS:

Building element	Byelaw No.	Specified Minimum Standard
1. Foundations	18	Adequate to support the load to the satisfaction of the Council
2. Floors	20	Compacted earth, or concrete or other approved material; min. 6" (152mm) above ground level
3. Walls	19	Mud and wattle capable of carrying roof; sealed, smooth finished and decorated externally and internally; but Council may require other materials
4. Roofs	21	Corrugated iron, aluminium or other permanent material or shingles; Council may require painting of C.I. or aluminium sheets; Council may set aside areas where grass or similar material may be permitted; pitch to conform with Council requirements.

8.5.3 Table 8.3 above reaffirms the earlier observation that the Council or the Local Authority officers have discretionary powers leaving room for personal interpretation by the use of phrases such as "to the satisfaction of the Council";"or other approved material";"the Council may specify the materials to be used."; "the Council may set aside areas where grass or similar material may be permitted"; "to conform with the Council's requirements", etc.

8.5.4 Apart from the issue of personal interpretation of the possible type of building materials for low-cost houses, there is a conflict in the use of different materials between the individual developer (e.g. in the site and services schemes) and the Local Authorities, even though the Grade II Byelaws permit the use of local semi-permanent building materials, such as mud and wattle, several local Authorities have expressed the view that structures built of semi-permanent materials 'downgrade' an area as a whole and devalue the efforts of the developer using permanent material. In addition, this view was further re-inforced by the point that there was little reason for allowing semi-permanent materials if plots in the S&S schemes were to be developed only by rich people, either through misallocation or through unauthorised transfers.

8.5.5 The above observation, according to the HRDU S&S Draft Evaluation Report, is further confirmed by the field survey findings which showed that 86% of the allottees (developers) used, or intended to use permanent materials, such as concrete blocks or stones for walls. Only 5.5% had re-used materials from older buildings. Apart from the S&S schemes in Mombasa where traditional local building techniques and materials are widely and advantageously used, only

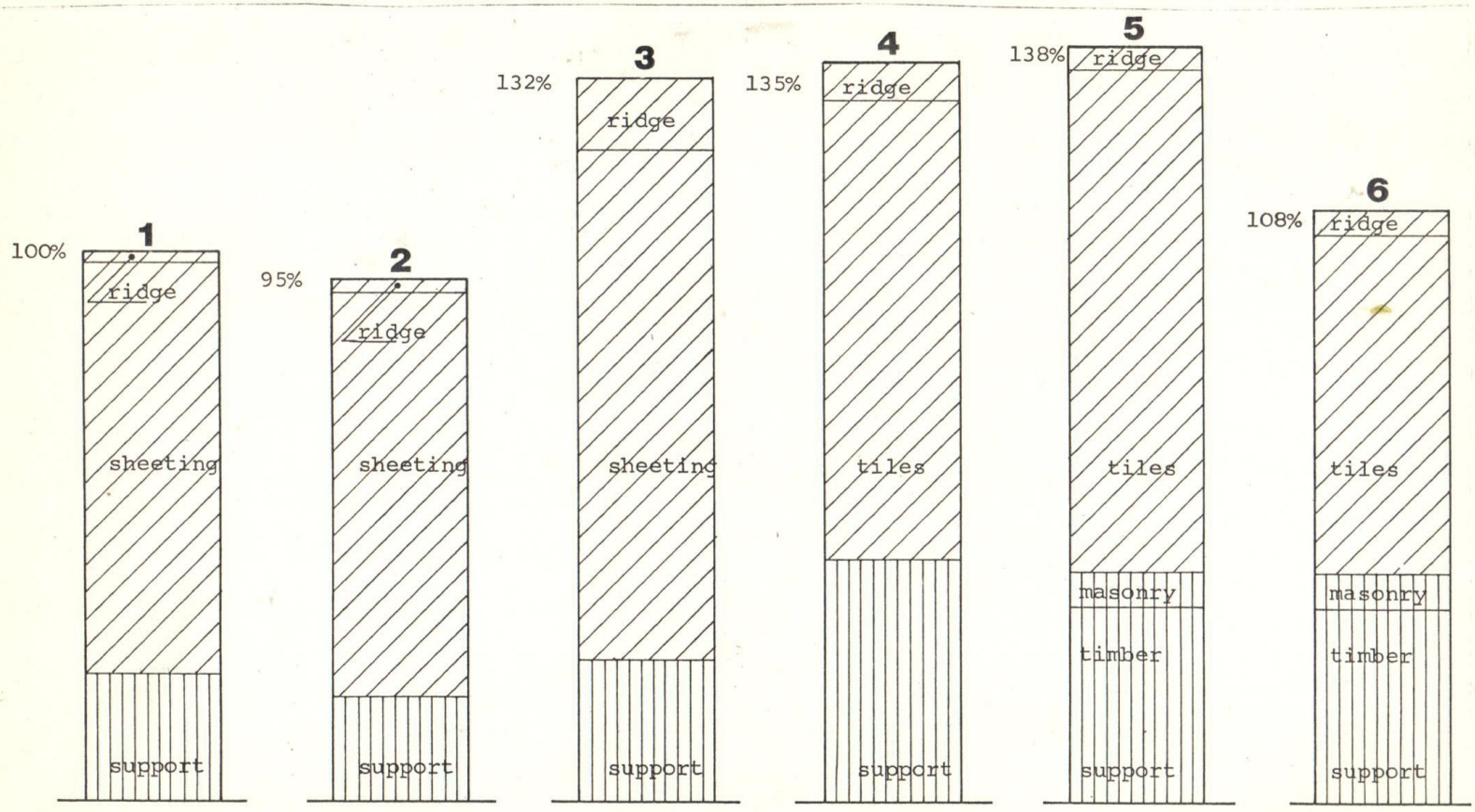
the Kitale S&S scheme showed a significant proportion of mud-and-wattle buildings. (Kitale may also be one of the schemes where plot allocation has been most fair, shown by the prevalence of the designated low-income target population groups).

8.5.6 In the case of major urban centres, especially Nairobi, temporary structures built in semi-permanent materials (e.g. in Dandora) in the earlier stages of house consolidation stage were considered by the Local Authority officials as contributing towards the the creation of slums and that they were not to be permitted. The monitoring and evaluation study reports of the Dandora project have shown that these structures contributed to the fast rate of housing consolidation especially in the cases of the plots occupied by the low-income groups; and that these temporary structures have eventually been replaced by more permanent structures over time.

8.5.7 The content of imported building materials is higher in the materials for civil works, especially street lighting, electricity, plumbing and drainage as compared to the materials used for house building, especially for single-storey low-cost housing. The major imported materials for house building are steel for corrugated galvanized iron sheets and asbestos for asbestos-cement sheets for roofing; and plumbing and sanitary fixtures for W.C.'s, showers and kitchens. (See cost comparisions for different roofing materials prepared by the HRDU - Table 8.4)

8.5.8 The availability of building materials in various parts of the country also has a direct impact on the success and/or failure of any housing programme and especially for the low-cost housing projects, including the S&S schemes. The annual reports of the NHC in the past have underlined the impact of both the high rate of inflation of the building material cost and the limited supplies of building materials

TABLE 8.4 ROOF STRUCTURES FOR LOW-COST HOUSING
Cost comparisons for various roofing materials.



especially cement and steel. In the past few years, especially since the energy crisis in 1973, the cost of building materials has been rising at very high rates. This continuous rise in building costs, has significantly contributed towards raising house prices above the reach of the low and medium income families, who have been particularly affected by shortages of adequate housing in the urban areas. Furthermore, the potential of locally available traditional materials and improved traditional construction techniques has not been fully realized. Special consideration needs to be given to pilot projects from the point of view of building control when such improved and/or innovative construction techniques and materials are proposed in future pilot housing projects, i.e. relaxation of byelaws (Grade II byelaw No. 17).

8.6 LABOUR:

8.6.1 From the point of view of labour in terms of manpower requirements, skills and management for effective building control there is a tremendous shortage of professional and para-professional staff within the Local Authorities. Apart from the major urban centres such as Nairobi, Mombasa and Kisumu where limited staff is available for the purpose of building control, most of the Local Authorities are very inadequately staffed to competently execute the various responsibilities.

8.6.2 According to the HRDU S&S Evaluation Study Draft Report there is a lack of sufficient building foremen and supervisors for approvals and technical assistance to the self-help builders in S&S schemes after the construction has commenced. Most of the Local Authorities in the smaller urban centres rely upon the field supervisors of the NHC. However, a

majority of these field supervisors do not have adequate resources, such as transport to visit sites thus causing delays in the production of low-cost housing. In the First Urban Project (and now also the Second Urban Project) there is provision for building foremen, clerks of works and resident engineers to ensure effective and efficient implementation of low-cost housing development projects.

8.6.3 Both the NHC and the Local Authorities continue to face the problem of lack of adequate and skilled professional and para-professional staff, which has had a severe negative impact upon the planning, programming, approval and implementation of low-cost housing projects, especially the S&S schemes. Many of the Local Authorities, interviewed by the study team, have expressed a desire for additional professional manpower in terms of architects, planners and engineers to improve the project preparation from the beginning to the end of the scheme. Some of these aspects will be discussed in further details in Discussion Paper No. 4/1 on Political, Administrative and Community Participation aspects.

8.6.4 The needs for labour within the building industry, in terms of manpower requirements, skills and management, does not present such a serious problem. Fortunately, the building industry in Kenya, as compared to other developing countries, is relatively more developed and organised, having evolved over the last 50 - 70 years. According to the International Labour Organization (ILO) study of 1972, the total employment in the construction industry in 1972 was estimated at at least 60,000 man-years, and could be upto 70,000 - 80,000 man-years if the casual workers were included. The structure of this industry showed a three-tier pattern,

with a few large European contractors dominating the large civil engineering projects, (and large non-residential building contracts to a lesser extent); the Asian firms mostly in medium scale and large residential building projects; and the African contractors ranging from the large contracting firms to the one-man self-employed 'fundi'. In spite of the commendable efforts of the National Construction Corporation, the participation of Africans in housing (especially medium income housing projects and large scale civil engineering projects) and construction activity remains limited.

8.6.5 At the lower end of the scale, the self-employed 'fundi' (craftsmen) are actively involved in the house building process in many S&S schemes in the country, especially since many of the plot allottees (developers) in these schems are either wage-employed or self-employed. This has had a significant impact in generating employment opportunities for these small-scale contractors and fundis. In other cases especially in the Dandora project, the plot allottees have pooled their labour and financial resources to form building groups to construct their houses (see also Chapter 6 of this Discussion Paper - on the Dandora Case Study) while others have built their houses on self-help basis with the technical and community development assistance provided by the implementation agency (i.e. the Housing Development Department of the Nairobi City Council). The experience gained from the Dandora Project could be effectively utilized in other low-cost housing projects in order to increase the production of such housing.

8.7 EQUIPMENT AND CAPITAL:

8.7.1 The provision of resources, such as equipment and capital, to the low-income groups,(who are intended to be beneficaries of the public low-cost housing projects), remains a major issue in the delivery of housing services. The individual self-help builder or the 'fundi' does not have easy access to capital to purchase equipment for the construction of houses in the S&S schemes.

8.7.2. The plot allottees (developers) in the S&S schemes have been provided with the materials loan needed to cover the cost of materials (permanent) and simple tools and equipment to build a minimum of a two-roomed structure, including the wetcore (shower, WC) and the kitchen. This amounts to an average of about K.shs. 7,000/- per serviced plot. The HRDU study on the S&S evaluation has pointed out that this amount is insufficient and needs to be reviewed. The study further recommends that the amount for the materials loan has to be proportional to the prevailing costs of building materials in the specific urban centres at the time the allottee takes possession of the plot and that adequate provision for price escalation for the materials loan component needs to be made at the project preparation and planning stage.

8.7.3 In most of the S&S schemes implemented by the NHC (e.g. in Kitale, Kakamega and Bungoma) simple hand-operated block- making machines have been provided to the Local Authorities to enable the plot allottees to make their own concrete/ cement blocks to build their houses. Such appropriate technology equipment needs to be provided and encouraged in future low-cost housing projects.

8.7.4 Furthermore, the HRDU study team observed that apart from the construction guidelines provided to the plot allottees in Kitale and Dandora, no construction manual showing simple techniques and the use of different equipment was being used by either the NHC field staff or the local Authorities to assist the allottees in the construction of their houses. For those allottees who build their own houses and for the fundis, an illustrated simple construction manual with the bills of quantities for the different building stages in both English and Kiswahili is desirable. The HRDU has recently embarked on the preparation of such a manual.

8.8 ENERGY:

8.8.1 Petroleum and petroleum products constitue about 80% of Kenya's total energy requirements. With the dramatic increases in the price of crude oil in 1973, the cost of living and cost of construction in the large cities and towns has also risen dramatically. There is therefore, the need to seriously review the utilization of this resource, which is available as commercial or non-commercial energy.

8.8.2 In terms of commercial energy, Kenya uses about 49% fossil fuels and 6% thermo-and hydro-electric power. The energy resources which constitute the remaining 45% are wood fuels in the form of firewood and charcoal (i.e. the non-commercial energy).

8.8.3 There seems to be no existing coherent policy on energy at the national level. Fundamental data on non-commercial energy supply and demand, patterns of energy use at the house-hold and commercial consumer level, the structure of the charcoal industry, and the impacts of energy consumption on resource depletion in the short and long term,

- The various cost implications of changes in the planning and design standards at the approval of building plans must be recognized.
- The use of available local building materials and construction techniques for low-cost housing must be emphasised and promoted.
- The use of temporary structures for reasonable time period during the house consolidation stage must be approved.
- Byelaws must be relaxed for pilot low-cost housing projects which aim to develop appropriate and innovate construction techniques and materials.
- Adequate professional and para-professional staff must be provided to local authorities to improve the building control procedures.
- The budget for materials loans should be proportional to the prevailing building costs.
- The use of appropriate technology using simple equipment for house construction must be encouraged.
- Further research and development must be undertaken on alternative sources of energy, especially solar energy and biogas.
- Excessive energy consumption must be reduced through controls and incentives to industrial, commercial and domestic users.

CHAPTER 9

LAND AND INFRASTRUCTURE

9.1.1 There is a case for discussing land together with infrastructure. The laying of infrastructure services is one step forward towards preparing land for development. That is the developer is interested not so much in the land itself but in the services and amenities it offers; he is interested in its potential for accommodating a liveable dwelling. To that extent then, it is necessary that dwelling standards must include land suitability standards as well as infrastructure standards. The suitability of the land for development ought in normal circumstances to be determined by the town planning mechanism. That is land suitable for low-income housing, or any housing for that matter, will have been inspected and carefully evaluated by the town planners before preparing the municipal development plan. A second screening process occurs when the developer files an application for town planning and building approval. And in public projects the designer should inspect and analyse the site before the decision to build on that particular site is taken. In spite of all these available safeguards disasters do happen. The Sites and Services Evaluation Study sites several cases where the wrong choice of a site or inadequate investigations resulted in very costly adjustments to the design and tender figure.[1] In Isiolo a sites and services project on black cotton soil had to be abandoned during construction. The project has been delayed for four years while a suitable site is being sought. In Nyeri 46% of the total plots designed had to be abandoned because the site was later found to be in the flood plain. In Bungoma a sewer was discovered after communual septic tanks had been built. In Kericho the USAID/NHC tenant purchase project was sited on steep land several kilometers out of town, resulting in complex problems of stormwater drainage, site preparation, and accessibility.

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[1] Personal interviews with HRDU Staff

9.1.2 In formulating suitable standards of land acceptability the following considerations are relevant:-

- clear title to the land
- zoning
- plot sizes
- grade or slope
- land quality
- location

9.1.3 Title: This is not a direct concern of building control as such, except that it saves a lot of subsequent expense and confusion if the local authority makes sure that the person applying for a building permit is legally authorised to build on that plot, or that he is not encroaching on his neighbour's or public land. For instance the County Clerk of Lamu has informed us that several cases have occured where permission to develop was given, only for the Council to find out later that the structure encroaches on someone else's land or on the road reserve. Lamu, however, is a special case since it has to send all plans for permanent buildings to Mombasa for approval. Many local authorities insist that their plans be approved by the Town Planning Department or Provincial Physical Planning Officer, as well as the Commissioner of Lands. Nairobi and Mombasa have their own estates officers who can ensure that land title and boundary complications will not arise. Where a building spans two plots belonging to the same owner, the City Council insists that the plots be consolidated into one title, although there is nothing in law that requires this. These complications can better be avoided through administrative procedures in scruitinising plans before approval than through specific legal provision in the building code. 2/ Morever, competent and regular inspections are absolutely necessary.

2/ Bye-law 42 requires the developer merely to prove the boundaries of the plot, not its ownership.

9.1.4 Zoning: Before land can be used for housing, whether by a public or private developer, it must be zoned for that particular category i.e. low, medium or high density and so on, in the town development plan. Where a development plan does not exist, or where the plan needs amendment, the Director of Physical Planning prepares a part development plan. The procedure for preparing a draft part development plan and getting it approved, before land can be made available to a public developer, is quite lengthy. 3/ Once land is earmarked for a certain grade of housing it is implicit that the land meets the minimum acceptable technical and environmental standards. It is therefore necessary that planning methodology should be more analytical and precise in designating land for housing, especially low cost housing. There is also a strong case for zoning land not only in terms of density or cost levels, but also to specify the type of building code that should apply i.e. whether grade I, II or any other code that may be relevant at the time. We will discuss this point further in the Discussion Paper on Political and Administrative Aspects.

9.1.5 Plot sizes: Again the prescription of plot sizes is the joint responsibility of town planning and building control. The latter is however more concerned with open space around and between buildings and distances between pit latrines or septic tanks and habitable rooms. Apart from health considerations, another major determinant of plot size should be the cost of infrastructure. It must be remembered however that although plot sizes are important, efficiency in actual layout design can go a long way towards reducing infrastructure costs e.g. through varying

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3/ The procedure is set out in a circular letter dated 10.12.77 from the Director of Physical Planning; the letter lists 13 steps from site indentification to commencement of development. It refers specifically to NHC projects.

accessibility standards, plot shapes, location of the wet-core, e.t.c. These approaches will be discussed in greater detail in the paper on Environment and Site Planning.

9.1.6 Recent sites and services projects in Kenya have created plots as large as $100m^2$. By international standards this is still a large plot. A survey of 80 sites and services projects in 27 countries carried out by the World Bank shows that 41% of the total plots are less than $100m^2$ and 62% not bigger than $200m^2$. The smaller plots are found in Latin America and Asia and the bigger generally in Africa. Only about a quarter of the plots are over $300m^2$, and these are all to be found in African countries. 4/ While it is premature to specify an optimum range of plot sizes, it does seem as if $100m^2$ is pushing the limits dangerously on the low side. This concern is further justified by the fact that the land is almost as important as the shelter in the African scheme of values; the plot is valued in its own right. It may be significant that a recent survey by the Dandora Monitoring and Evaluation Team has shown that the proportion of residents growing vegetables on the plot is actually declining. Only 15% grow vegetables, 11% keep chickens and 2% keep goats, these figures being roughly half of what was observed in March, 1978. 5/ The cash obtained from these activities was reported to be negligible. This is in sharp constrast to observations made a few years ago in a Kibera low-cost housing scheme where plots were larger and residents were vigorously cultivating their plots.

The HRDU has recently completed a study of plot sizes and space requirements for low-cost housing schemes. Its findings will be evaluated in greater detail in the relevant Discussion Paper; however, one could note here that although design guidelines and space standards are necessary, the

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4/ Praful Patel Sites and Services Projects: Survey and analysis of Urbanisation Standards and On-Site Infrastructure, Washington: IBRD 1974.

5/ Senga, Ndeti & Associates MEDIS, No March, 1979.

question of plot sizes is in many cases decided on political grounds and new regulations must attempt to make it easy for local promoters to get schemes accepted by the beneficiaries and local leaders.

9.1.7 Grade: The maximum acceptable slope is not regulated by the Building Code. In fact it may be difficult and undesirable to do so. Nonetheless some type of guideline or code of practice is needed because as good land becomes scarce and expensive there is an increasing tendency to move to the more maginal sites, which are expensive to develop. In some towns such as Embu, Kitui and Kericho itis difficult to get a sizeable piece of flat land. Extra attention has to be given to the foundations, retaining walls, and surface water drainage. Cost differentials will vary from site to site and according to the type of development; nonetheless it would be wise to avoid grades steeper than 10%.

9.1.8 Land Quality: This is a blanket term meant to include such physical parameters as soil types, vegetation surface water drainage, view and so on. The Code has placed certain restrictions on building on black contton soil-"black cotton soil shall be deemed to have no bearing capacity" (Byelaw 44 (2)) - and has specified the maximum permissible bearing capacity for various types of soils. The subsoil is merely required to be "effectually drained" (Byelaw 38 (1)). The maximum permissible bearing capacity of other types of soils is specified by Byelaw 44.

9.1.9 There are no standards regarding the preservation of existing vegetation. As a result existing trees on building sites are indiscrimnately felled, whereas a little more thought on the part of desgners could save many trees. For instance building sites in

Mombasa, especially in Likoni and on the West Mainland are normally endowed with beautiful mature mango trees, baobab and coconut palms. It is necessary that new housing layouts attempt to preserve as many of these trees as possible.

9.1.10 Location: We have already examined this topic from a variaty of angles. The point at issue here is that a mixture or wider range of locational possibilities for low-income families is difficult to achieve. The market has a major role to play in selecting sites for specific income levels. The result is that the redistribution of locational opportunities, if desired as a social goal, has to be done as a deliberate planning and land allocation measure.

9.1.11 The problem of land assembly for low cost housing is beyond the scope of this study; nonetheless it is a question which cannot escape notice, especially as the subject has come up time and again in our interviews with local authority and Government officials. In fact in many cases building approval is taken for granted once one has been allocated a plot. For instance in sites and services schemes approval is almost automatic. The recent Sites and Services Evaluation Study recommends the establishment of a Land Acquisition Committee to coordinate land acquisition and to create land banks for the sites and services programme. There is much to be said for this recommendation, especially if the Committee were a small ad hoc committee while the actual responsibility vested in the relevant officers i.e. the Commissioner of Lands, the Chief Housing Officer and the General Manager of N.H.C. The /needs to have its own land experts who could /NHC identify and purchase suitable sites. At the same time it should find sufficient funds to assist local

authorities in land purchase.

9.1.12 A more ambitious proposal is that made by the National Urban Development Strategy for Kenya which suggests a Land Development Corporation to acquire, develop and sell land at market prices to the rich and at cost to the poor, the latter being cross-subsidized. This suggestion calls for such major institutional changes that it does not warrant further consideration in this study. 6/

9.2 INFRASTRUCTURE:

9.2.1 The types of services that need to be provided in a residential area are taken for granted. They are well known. However as soon as an attempt is made to reduce costs so as to provide the lowest acceptable standards doubts begin to arise and questions are asked as to whether say the roads should be tarred or not, whether public sewers are necessary or pit latrines are adequate, whether individual water connections are extravagant as opposed to communual standpipes. Decisions have thus to be made on what to provide and what to omit. Within this framework, further refinements have to be devised regarding the quality of what is provided as well as leaving options open for reintroducing what has been omitted at a later date. In this difficult task planners and designers are often guided by attitudinal surveys. Many such surveys have shown that after security of tenure and shelter the most desired amenities are water, an acceptable toilet, and personal security. This order of priority will vary from place to place. In most cases the respondents will emphasise those facilities which they do not already have.

6/ National Urban Development Strategy for Kenya,(Draft) Kenya Government/World Bank, December 1977.

Table 9.1: - Estimated Infrastructure Cost per Plot on Second Urban Project Sites (Kshs)

	MANYATTA KISUMU		MIGOSI KISUMU		MIKINDANI MOMBASA		CHAANI MOMBASA		MATHARE VALLEY NAIROBI		KAYOLE-VILLAFRANCA NAIROBI	
Site Preparation	cost per plot	%	cost per plot	%	cost per plot	%	cost per plot	%	cost per plot	%	cost per plot	%
Clearing and grading	92.4	1.2	92.4	1.2	92.4	1.2	92.4	1.4	178.	2.9	92.4	1.3
Topography & Soil survey	37.4	0.5	37.4	0.5	99.0	1.3	99.0	1.4	71.	1.2	37.4	0.5
Lot demarcation	550.0	7.0	220.0	3.0	550.0	7.0	550.0	8.1	224.	3.7	220.0	3.2
Sub-total	679.8	8.7	349.8	4.7	741.4	9.5	741.4	10.9	473.	7.8	349.8	5.0
On-site Infrastructure												
Roads and Drainage	3507.9	44.7	3477.1	46.6	3325.5	42.3	2413.4	35.6	1676.	27.7	2695.0	38.7
Patho and Drainage	144.7	1.8	392.7	5.3	182.0	2.3	451.0	6.7	156.	2.6	301.4	4.4
Water reticulation	677.6	8.6	566.5	11.9	638.0	8.1	424.6	6.3	478.	7.9	811.8	11.
Sewage reticulation	2196.7	28.0	1988.8	26.7	2323.2	29.6	2095.5	30.9	2571.	42.4	2142.8	30.
Security lighting	312.4	4.0	353.1	4.7	312.4	4.0	321.8	4.7	337.	5.6	330.0	4.
Refuse collection	330.0	4.2	330.0	4.4	330.0	4.2	330.0	4.9	337.	5.6	330.0	4.
Others (Filling)	-		-		-		-		31.	0.5	-	
Sub- Total	7169.3	91.3	7108.2	95.3	7110.9	90.5	6036.3	89.1	5586.	92.2	6611	95.
TOTAL	7849.1	100.0	7458.0	100.0	7852.3	100.0	6777.7	100.0	6059.	100	6960.8	100

Source: Adapted from the Second Urban Project. Appraisal Report

The Sites and Services Evaluation Study shows that first priority among allottees was given, by order of the number of respondents, to dispensary, electricity, street lighting, nursery school, and improved roads. Among tenants the order was electricity, dispensary, police post, street lighting and nursery school. These responses are characteristic of sites and services project residents who already enjoy basic services such as running water and water-borne sanitation. The responses have to be counter-balanced against preceived needs in the interests of community health, safety and social advancement.

9.2.2 The bulk of infrastructure costs is attributable to roads, sewerage and water, with roads being normally the most expensive item, depending on specification. Table 9.1 shows the estimated servicing costs per plot on the Second Urban Project Sites. It is too early to start comparing the estimates with actual tender prices. Nonetheless the figures do show that excluding Mathare Valley, roads and surface water drainage account for 35% to 45% of the total plot costs. Sewerage reticulation accounts for between 27% and 42%, water from 6% to 12%. Table 9.2 shows plot costs for two NCC sites and services schemes in Mathare. If building work, representing the wet cores, and preliminaries were excluded the next largest item would be foul sewers followed by roads/footpaths/ surface drainage. Again water costs constitute a very small proportion. An analysis of recent tenant purchase schemes built by NHC with USAID finance (Table 9.3), in which total figures have been adjusted to exclude superstructure costs, shows that sewerage is by far the largest item followed,(except in Thika) by roads/footpaths/surface drainage. Again water here is a fairly minor item. That is, it costs much

TABLE 9.2- SERVICING COSTS PER PLOT ON SITE & SERVICING SCHEME AT MATHARE

	MATHARE S & S PHASE 1		MATHARE PHASE 1 COMMUNAL S & S	
	K.Shs. Elemental Cost	%	K.shs. Elemental Cost	%
Preliminaries	187,500	12.5	41,600	14.3
Building work	600,000	40.0	104,000	35.7
Road ways	75,000	5.0	20,800	7.1
Foot path	37,500	2.5	10,400	3.6
Foul sewers	300,000	20.0	41,600	14.3
Surface sewers	75,000	5.0	20,800	7.1
Water Mains	75,000	5.0	10,400	3.6
Electrical mains, street lighting and security lighting	75,000	5.0	20,800	7.1
Land scaping	37,500	2.5	10,400	3.6
Contingencies	37,500	2.5	10,400	3.6
Special purpose Item	-	-	-	-
Total Cost	1,500,000	100	291,200	1000

much more to get rid of spent water than to obtain fresh.

9.2.3 There is a remarkable uniformity in infrastructure costs per m^2 of plot area. In the second urban project plot sizes will vary but if we take an average of $120m^2$ we get a figure of shs. 60/= to shs.70/= per m^2 of net plot area. The USAID/NHC figures show a range of between shs. 71/= and shs. 80/= per m^2. Lower unit costs are however evident from Table 9.4, which is based on data collected by the HRDU. The Dandora figure of shs. 66/= per m^2 seems to be consistent with the analyses in the preceding tables.

9.2.4 Although all the schemes discussed exhibit more or less similar infrastructure standards i.e. sewered sanitation or communal septic tanks, individual water connections and murram estate roads (there are some with tarmac roads) variations in unit costs are to be expected, since there are so many factors that can influence the ultimate cost per plot or cost per m^2 including:

- site characteristics i.e. soil type, slope e.t.c.
- density
- plot sizes
- design standards
- construction techniques and materials used
- layout efficiency
- size of project
- developer's overheads

The method used in allocating the cost of trunk infrastructure and remote auxillary works e.g. sewage or water treatment will also influence plot costs.

9.2.5 The question of design standards will be discussed in greater detail in the relevant Discussion Paper. It is worth noting that on the basis of recent and current projects some feasible

Table 9.4-NHC Sites and Services Schemes - Project costs based on Tender Price (Kshs)

Site & Services Schemes	DANDORA		KITALE		BUNGOMA		NAKURU - NAIVASHA		EMBU	
	Total Project	Per Plot	Total Project	Per Plot	Total Project	Per Plot	Total Project	Per Plot	Total Project	Per Plot
Site investigation	260,280	-	10,000	182	-	-	248,700	1115	90,000	484
Sewerage	1,327,960	-	92,300	1678	34,200	1140	860,000	3856	646,000	3441
Roads and drainage	2,116,980	-	156,240	2841	24,200	807	816,600	3662	623,600	3353
Water supply	309,300	-	128,240	2332	10,600	353	804,500	3608	198,560	1068
Street lightings	312,180	-	25,000	455	-	-	-	-	-	-
Professional fee & supervision	3,966,980	-	26,400	480	(15,100 (3,660	503 123	257,880 76,680	1156 344	166,300 56,780	894 305
Interest on finance	-	-	4,000	73	19,900	663	153,580	689	44,780	241
Contingency (exclude in the total cost)	(1,632,620)		(36,000)	(654)	(47,460	1582)	(485,060	2175)	(233,920	1258)
Total	8,294,000	7998	442,180	8041	107,660	3589	3,703,000	16605	966,400	11043
Total number of plots	1,037 (Phase I)		35		30		223(?)		186(?)	
Plot dimensions	120m^2		187m^2		169m^2		293m^2		293m^2	
Service costs per m^2 (Kshs)	Shs.66.65		Shs.43/=		Shs.21.25		Shs.56.65		Shs.37.70	

solutions used elsewhere would seem to be unacceptable to the Kenya people and authorities, hence their examination will be of academic interest only. Our discussions with local authority officials have for example shown an official dislike for the use of pit latrines and communual standpipes. For the purpose of formulating standards however, it is necessary that all the available low-cost options be thoroughly examined. The ideal and most expensive solution in all cases is unrestricted individual access to a publicly run and ma maintained facility, while the other extreme is no facility at all. Permutations are available within the following framework:

ROADS &	Track
SURFACE WATER	stabilised earth
DRAINAGE	murram
	tarmac
	no vehicular access
	limited " "
	direct " "
	no drainage
	ditches
	open drains unlined
	" " lined
	covered drains
SEWERS	pit off-site
	" on-site
	conservancy tank
	improved pit/aqua privy
	septic
	public sewers
WATER	communual stand pipe
	single outlet on site
	multiple outlets on site

ELECTRICITY	no connection
	lighting only
	lighting & other uses
STREET LIGHTING	none
	at essential points
	at intervals.

9.2.6 All the situations listed above actually exist in Kenyan towns. Planners could easily devise a simple way of measuring infrastructure quality by using the above list in conjunction with a points system. A cut-off level arrived at on policy criteria would then form the minimum acceptable environment. The device can also be used to compare the cost-effectiveness of alternative design solutions.

9.3 UPGRADING AREAS:

9.3.1 In the upgrading areas infrastructure design is constrained within the limits of what is already existing in the form of wayleaves; existing buildings; demolitions and compensation; existing service lines and connections, e.g. electricity; topography; local adaptations and habits which may hinder the acceptance of innovations. Yet shilling for shilling, investment in upgrading yields a lot more benefits than in sites and services. There are two reasons for this. First, in spite of demolitions and an irrational layout the cost per plot is lower because of the sparse infrastructure density. Secondly, the provision of infrastructure almost always results in:

(a) ramarkable improvements in individual dwelling structures;
(b) the opening of shops along the newly created roads;
(c) improved access to most dwellings for private cars, taxis, ambulances, the fire brigade, police and other vehicles;
(d) improved delivery of social services; more electricity and water connections, with obvious advantages to

family welfare;

(e) improved personal security resulting from street lighting and the opening up of the neighbourhood;

(f) increased involvement of house owners in the urban economy through a revised tenure system;

(g) an enhanced tax base, and

(h) a more manageable urban environment with a reduced threat to the established administrative and political systems.

These are observations which we have made in the course of working on upgrading projects elsewhere in East Africa. Benefits in the fields of nutrition and health are more difficult to isolate and identify, especially as public health monitoring is a lengthy and expensive process.

9.4 MAINTENANCE:

9.4.1 Legislation governing the maintenance of public services is contained in the Local Government Act as well as in the various enabling Acts for the utilities. However, the actual maintenance standards are governed by whether or not the consumer pays a user charge. Thus electricity and water facilities enjoy a high standard of maintenance, such as one would expect from a commercial undertaking; on the other hand roads, drains, sewers, and refuse collection tend to suffer especially in a low-cost residential area. The reason is largely the poor state of local authority finances. For instance a survey of USAID tenant purchase schemes at Umoja, Nairobi, and in other towns has shown that it does not take long before a new estate begins to show signs of neglect in the form of damaged roads, clogged drains, litter and overgrown open spaces. The Sites and Services

Evaluation Study laments that "in general maintenance of public utilities is poor. Roads in older schemes are not well-maintained and severe erosion has occured in several places" 7/ The same study showed a high degree of satisfaction in the wet-cores and the sewerage system both among allottees and tenants; however 58% of the allottee expressed disatisfaction with the refuse collection system while 76.9% of the allottees and 81.3% of the tenants were not satisfied with the estate roads. The latter finding is corraborated by our own discussion with various town clerks and town engineers, many of whom are of the opinion that tarmac roads are in the long run cheaper because of the lower maintenance costs. The question of maintenance is closely related to local government finances and technical capabilities; not much progress should be expected until local authority revenue and capital sources are improved.

9.5 INFRASTRUCTURE FINANCING:

9.5.1 While electricity and water undertakings are operating at a profit and can afford to finance part of their capital requirements from revenue, the other services have to operate under severe handicaps. The Local Government Loans Authority has not been effective in raising the required capital finance, partly due to poor organisation and to restriction imposed by the Treasury.

7/ Evaluation of the Sites and Services Programme in Kenya (Draft), HRDU, University of Nairobi, 1979

Only Nairobi has managed to raise money in the market by issueing stocks. A recent study by HRDU suggests different ways in which more capital finance could be made available to local authorities. 8/ But even with a vastly improved financial situation infrastructure standards will still have to be relatively low since such additional money as becomes available will be needed to provide for additional numbers and for those who now have to do without.

9.6 CONCLUSIONS AND RECOMMENDATIONS:

The formulation of standards for housing sites is in some respects more difficult than for the superstructure. Quite apart from physical criteria, the plot's performance must be judged against acceptable standards relating to tenure, location and town planning. The site in fact consists of serviced land. Therefore, the type and quality of infrastructure available to and on the site are a measure of land suitability for building. Whereas no legal standards may be necessary for this aspect of development process it is essential that some practical guidelines be formulated for professionals and lay builders. We therefore, RECOMMEND as follows:-

- Devote more attention and professional expertize to site selection for public projects and sites and services schemes.

8/ J.D. Hagger Finance for Housing Infrastructure Nairobi HRDU, 1979

- Develop standards or guidelines on land suitability for housing purposes.
- Intergrate building control with the land use zoning system.
- Widen the locational opportunities of the low-income households.
- Restrict the felling of trees on building sites.
- Assist the National Housing Corporation to draw up a land acquisition programme and to create a land bank.
- Seek further reductions in roads and sewerage standards and costs.
- Promote non-waterborne sanitation and mobilize support for its use in appropriate circumstances.
- Develop and test suitable techniques for measuring site quality.
- Devise appropriate infrastructure standards for upgrading areas.
- Improve the capabilities of local authorities in the management and budgetting of infrastructure maintenance.

CHAPTER 10

CONCLUSIONS

The rate at which new households are being formed makes it unrealistic to expect all of them to be housed in conventional housing that meets acceptable legal standards. Even the Sites and Services programme does not fully address the issue. It seems as if more emphasis needs to be put on the upgrading of the existing housing stock and providing sufficient plots serviced to the minimum standard.

10.2 While the beneficiaries of such a strategy are easily identifiable, in that they are or should be households in the lowest income brackets, policy measures aimed at raising these standards are confounded by moral issues relating to the proprietry of subsidising the non-poor. Hence the preoccupation with defining low cost housing, which is an irrelevant task. What is relevant and possible is a set of criteria for identifying the main target area - be it people, structures or locations - and the shady or marginal zones surrounding it. That is we would then be talking of a primary target, secondary target and so on. This approach, coupled with more reliable statistics on relevant variables such as incomes, rents, household budgets and construction costs should make the low cost/high cost argument less acrimonious. This approach is reinforced by the fact that housing costs have by and large remained fairly stable in real terms.

10.3 The substandard structures that poor people live in are not dangerous or hazardous in themselves. Rather it is the family life-style which creates dangerous situations. For example the method of food preparation is a potential fire hazard. Site planning and house design can only achieve so much. Investment in education, policing and control needs also to be increased.

10.4 The reduction of fire hazard at reasonable cost and the preservation of structural durability are the pre-conditions for extending conventional credit facilities to minimum standard housing. The problem of devising acceptable titles can easily be solved. There is a large and profitable market here for finance institutions and insurance companies, both of which stand to benefit from more imaginative design and administrative methods. But the Government must be prepared to offer the necessary encouragement and incentives.

10.5 Individual builders too need encouragement and guidance. They find it difficult to help themselves otherwise. The design of projects based on self-build methods still need further refinement in terms of technical support, appropriate documentation and methods of instilling the confidence to build. Self-build has in fact been forced by the realities of urban life to evolve towards self-management. The allotee combines the role of the inventor/developer/project manager/builder/fundi; now let the experts design the costume and write the script to go with the role.

10.6 And what is the outcome of all these efforts? Will the builder spend less and the renter have more to spend on other necessities such as food? Will taxes and other expenses rise or fall? It is quite clear that any reductions in cost that could be made have already been made, but they have been made in the wrong, or illegal sector, and new legislation would have the effect of legalising these innovations. No dramatic reductions in cost should therefore be expected. Progress will be incremental; nonetheless the acceptable housing stock will be enhanced, both in quantity and quality.

10.7 The value of the housing stock, and its contribution to the national economy, will to a large extent be determined by the rate at which housing inputs are consumed. Materials, energy and equipment are becoming scarcer. Insufficient effort is directed towards research in these areas. More needs to be done than exhortations on the use of local materials. A dramatic increase in materials and energy prices will completely cancel any gains made through byelaw revisions. Even the one resource we would appear to have plenty of, that is land, is being priced out of the poor man's reach. The relationship between land and services needs to be re-examined so that the largest possible plots and open spaces are made available to the low-income household.

SECOND WORLD BANK/GOVERNMENT OF KENYA URBAN PROJECT

KENYA LOW-COST HOUSING BY-LAW STUDY

DISCUSSION PAPER
DP 5

TECHNICAL AND DESIGN ASPECTS

DECEMBER 1979

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FOREWORD

The Discussion Papers are prepared to enable members of the Steering Committee to fully contribute in the preparation of this Study. Therefore they are not final reports, but evolving stages in the process of preparing the Manual/ Handbook and the Draft Final Report. As such, it is intended that their contents should receive the fullest attention of the members of the Working Parties and, subsequently, all members of the Steering Committee.

This Discussion Paper examines the technical and design aspects of the plot and the dwelling contained in it. Thus this paper examines the legislation presently applied against the actual needs of the plot, the dwelling, the elements of the dwelling (living room, kitchen, choo, shower etc.), the materials to be used and methods of construction, the services required on the plot, the fire regulations and the variations required by different climatic conditions in Kenya.

Following this research and analysis we draw conclusions and make recommendations for revised legislation, its application and preliminary recommendations for its technical content including variations to accommodate climatic conditions.

The recommendations made are defined as preliminary because, as we have explained, some of the technical aspects will be affected by the re-actions to Discussion Paper DP2 - ENVIRONMENTAL HEALTH and the findings of and reactions to the final Discussion Paper DP6 - ENVIRONMENTAL AND SITE PLANNING.

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CHAPTER 1

INTRODUCTION

1.1 In examining the technical and design aspects of the plot and the building it contains we are very conscious of the fact that a well laid-out plot and properly designed house cannot be achieved solely by legislation. Unless the regulations and legislation are so complex (and therefore by implication difficult to apply) that they dictate the design to be achieved then the quality of the final layout and design of the building is the result of the abilities of the designer - whether he be a professional, local builder or the plot owner.

1.2 The hypothetical example mentioned previously (i.e complex and extensive regulations) would, in any case, create an unsatisfactory situation in that:

a. the regulations would, because of their complexity and attempts to cover every aspect of the design and construction of the building, be extremely difficult to apply and administer.
b. the designer of the building would have only a minor design input
c. individuality in both design, methods of construction materials and rate of construction would be curtailed.
d. the end result would be a mass of identical dwellings laid out in an identical form.

1.3 In low-cost housing and particularly in the site-and-service, squatter upgrading and settlement plots concepts one essential feature is that the plot owner erects his own dwelling. Whilst, as explained in Discussion Paper DP1, this form of self-help takes many forms from true self-build to being a member of building group whatever form self-help takes the plot holder is the basic implementor.

1.4 Again, in theory, the plot owner would design the house and obtain approval, under the regulations. In practice the need for the technical knowledge to enable one to prepare proper drawings and complete the application forms necessitates the use of technical/professional expertise with the resultant extra costs. To overcome this problem within the existing framework of building control legislation and administration many of the developers of low-cost housing schemes (NHC, Nairobi HDD and Mombasa HDD) have prepared a series of approved type plans. These are of inestimable assistance in allowing the low-income population to erect legal houses and, where properly designed, allow the owner to construct a house more compatable with his or her financial situation. However, type plans, unless infinite in their variety, do tend to restrict the variations in the types of houses built. Even at Dandora Phase 1 (Nairobi) where there are 16 various types (including variations for 'different sizes of plots) the visual effect is of sameness.

1.5 Therefore we believe that the objective of building legislation should be to define and ensure the application of minimum standards of building compatable with the basic needs of the plot owner and the public at large. If a developer (either the plot owner or commercial house builder) wishes to build above these minimum standards either initially or at a later date he should be encouraged to do so. But building to the minimum standards should create no dangers either for the individual or the public.

1.6 The concepts of low-cost housing as defined in DP1 (THE ECONOMICS OF BUILDING CONTROL) and in Government Policy are predominently three main types of development:

a. site and service projects
b. settlement plots
c. squatter upgrading schemes

1.7 In Site and Service Projects the development agency (NHC and/or the local authority) prepare overall plans for the development of the area including the sub-division of the area into plots, the provision of infrastructure, wet-cores (a w.c., shower and often a kitchen) and sites for public facilities. The plot allottee is then responsible for the erection of his own house on the plot in conformity with the by-laws imposed by the local authority.

1.8 In Settlement Schemes the area would be planned, basic infrastructure would be provided (often excluding sewerage) but no wet cores would be constructed.

1.9 In Squatter Upgrading Schemes an existing (originally often illegal) settlement is to be rehabilitated by the minimal re-organisation of the plots, the provision of public services and facilities and the encouragement of the plot owners/occupiers to upgrade their dwellings.

1.10 Within the scope of this paper, we shall be concerned with the controls over the development of the plot and its contents. The development of the environment around the plot and the provision of services to it will be covered by Discussion Paper DP3 (INFRASTRUCTURE) and DP6 (ENVIRONMENTAL AND SITE PLANNING). Therefore within the context of the development of the plot this paper is concerned with the development controls exercised over:

a. the development agency: plot size
wet core/kitchen requirements
supply of water
sewer connections/human waste disposal
electricity supply

b. the plot developer: house design and layout
room sizes
materials and construction standards
lighting and ventilation
provision, if necessary, of extra washing/toilet facilities.

N.B. It must be remembered that many sites and service scheme developers produce approved type plans for the guidance of the plot owner. Thus the above aspects may affect either the private plot developer or the development agency or both.

1.11 Therefore this Discussion Paper will examine each of the elements (the plot, the dwelling, the outside space around the dwelling, its construction and its services) in a chronologial order (comensurate with the stages of the development of plot) and summarise the interdependent elements of each stage in its conclusions. Finally specific technical recommendations will be made.

1.12 However it must be accepted that the conclusions and recommendations may have to be modified by the investigation of the local development of a housing area which will be investigated in Discussion Paper DP6. As was stated in the Inception Report "The preparation of a series of Discussion Papers dealing with specific aspects - whilst allowing in-depth studies of these subjects, can easily lead to an overlapping; of studies and especially recommendations" 1/
The major coordination of the findings of each of the Discussion Papers will be presented in the Draft Final Report which will be prepared after all the Discussion Papers have been completed and discussed by Working Parties and the Steering Committee.

1/ Inception Report (Chapter 7) Kenya Low-Cost Housing By-Law Study September, 1979

CHAPTER 2

CURRENT LEGISLATION - GENERAL

2.1 The current legislation affecting the development of the plot and its contents are:

Local Government (Adoptive By-laws) (Building) Order 1968.
" " " " (Grade II Building) Order 1968.
The Public Health Act Chapter 242. 1972. (Particularly Part IX - SANITATION AND HOUSING and THE PUBLIC HEALTH (DRAINAGE AND LATRINE) RULES

2.2 The relevant clauses of each piece of legislation will be discussed at the begining of each of the subject chapters. However it is important at this stage to consider the general relevance of each of the pieces of legislation to the subject of this Discussion Paper.

2.3 The Building Code of Kenya: This booklet was a first attempt at a national building code for the whole country. Its purpose is stated as:

The By-laws set out in this Order shall be the adoptive building by-laws which any municipal or county council may adopt.

Thus there is no definition that all the relevant local authorities must adopt, and therefore apply, them. The requirement is that they MAY adopt, and therefore apply, them. In fact discussions with various authorities throughout Kenya have shown that whilst all authorities we have visited have adopted the Building Code they only apply a part often of it (i.e. Grade I By-laws).

CHAPTER 3

PLOT SIZES

3.1 Within the context of this paper the size of the plot is solely governed by the needs of accommodating a dwelling house together with its services, suitable for the needs of the inhabitants and within the financial capabilities of the constructor/plot allottee (or owner). The effects of proposed housing densities will be dealt with in Discussion Paper DP6.

3.2 The existing Grade II By-laws (By-law 7(1)) require a minimum plot area of 2800 sq.ft. (260.12m^2),'except where otherwise approved by the Commissioner of Lands'. From existing examples in urban areas this exception has clearly been allowed viz:

NAIROBI	(DANDORA)	96m^2 - 160m^2
MOMBASA		216m^2
KISUMU		192m^2 (NB. 216m^2 has also been described as suitable)1/

3.3 The very basic determinant of the minimum plot size is its capability of accommodating a dwelling house of the basic size. Such a dwelling is defined under the Grade II By-laws as 'at least one habitable room in addition to a kitchen, ablution and privy accommodation' (clause 9 Part I). Subsequently the By-laws define certain minimum sizes (clause 10 & 11) viz:-

Habitable room:		minimum of 75 ft. (6.97m^2)
Kitchen	:	" " 25 sq.ft. (2.3m^2)
Toilet	:	undefined - assume 11.25 sq.ft. (special area by-laws) = (1.05m^2)
Shower	:	minimum 11.25 sq.ft. (1.05m^2).

Therefore, excluding the thickness of walls and access ways a minimum dwelling would consist of 11.37m^2. Add 25% for wall thickness, verandahs + courtyards then the total built/covered area would be approx. 14.2m^2.

1/ Low-cost housing and squatter upgrading study, Waweru & Associates, Final Report, January, 1978.

The Grade II By-laws however determine that not more than 25% of the plot shall be built upon i.e. a 25% plot coverage On the above very basic assumptions therefore a minimum plot should be not less than 57m^2. There is therefore, an apparent incompatability between the requirements of By-law 7(1) and the application of subsequent by-laws.

3.4 One of the reasons for this incompatability is to be found in By-law 8 where it is clear that the Grade II By-laws envisage that human wastes shall be disposed of on the plot by means of pit latrines with the added control that they 'shall not be nearer than 30 ft. (9.144m^2) from any habitable room, or room used for the preparation, cooking or storage of food' (although the by-laws allow the MOH to permit the pit latrine to be constructed within 30 ft. from a habitable room).

3.5 From this resumé and the acceptance by the Nairobi City Council and other local authorities of smaller plots within urban areas it is clear that it is now generally accepted that smaller plots can be permitted where mains sewerage is available to serve the plots (see Table 3.1).

3.6 However, in determining the minimum size of plot it is also necessary to establish the optimum size of the building necessary in low-cost housing. It is now accepted that sub-letting some of the accommodation constructed is an intergral (and necessary) part of the method of self-financing the construction and retention of the building. The number of rooms to be sub-let varies between 1 and 5 rooms 2/. In a few cases the whole dwelling is sub-let although there are many arguments against this as an ideal - i.e. (a) it is often contrary to the agreement signed upon being allocated a plot and
(b) it reduces the control over the use of the plot and therefore its condition.

2/ MEDIS REPORT NO.4 August 1978, Senga, Ndeti & Associates.

TABLE 3.1: PLOT SIZES AND SERVICES

ESTATE	DEVELOPER	PLOT SIZE/S	PLOT % COVERAGE	SEWERAGE CONNECTION
DANDORA PHASE I	N.C.C.	$99.25m^2$-$120m^2$	50%	YES
KISUMU 2	KISUMU M.C.	$212m^2$	50%	YES
WEBUYE 1&2		$225m^2$	25%	YES
KITALE	KITALE M.C.	$187m^2$ & $315m^2$	45%&27%	YES
BUNGOMA	N.H.C.	$169m^2$	?	YES
NAIVASHA III		$293m^2$	?	YES
MOMBASA-LIKONI	MOMBASA M.C	$251m^2$	46%	YES?
" KISAUNI	" "	$325m^2$	22%	YES,COMMON SEPTIC TANKS
THIKA	THIKA M.C.	?	?	YES
NANYUKI I	N.H.C.	$297m^2$ & $464m^2$	30%&22%	YES
" II	?	$293m^2$		YES
KAKAMEGA I	N.H.C.	$195m^2$	39%	YES
" II	N.H.C.	$293m^2$	?	YES
NYERI I	N.H.C.	$288m^2$	N.K	YES
EMBU PHASE I	?	$293m^2$	N.K	YES

Abbreviations:
N.C.C. - NAIROBI CITY COUNCIL
N.H.C. - NATIONAL HOUSING CORPORATION
M.C. - MUNICIPAL COUNCIL
? & N.K - NOT KNOWN

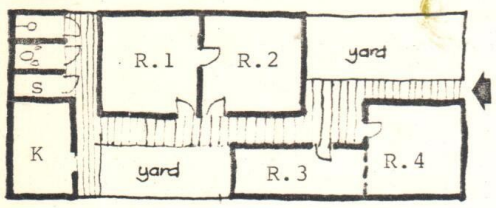
Source: EVALUATION OF THE SITE AND SERVICE PROGRAMME IN KENYA
H.R.D.U., University of Nairobi - Draft Report July 1979.

Personal observations at Dandora Phase I clearly indicate that the condition of the plot is directly related to the presence of the owner/allottee living on the plot. Accepting that the necessity of sub-letting results in more than the By-law allowed minimum number of rooms being constructed, hen one can anticipate that a minimum of 4 rooms plus kitchen plus shower/wc would be required. This is confirmed by the type plans for Nairobi, Dandora Phase I (N.C.C.) Webuye, 1 & 2 (WTC) and Mombasa, Kisauni (MMC) (Figure 3.1) whilst a three room unit has been proposed for Nanyuki 1 (NTC) it is clear from an examination of the type plan (Figure 3.2) that the dwelling is NOT designed for sub-letting.

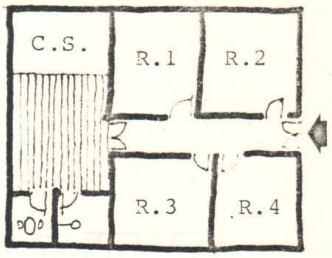
3.7 Thus assuming that a minimum dwelling in terms of the allottee's needs consists of 4 rooms, the minimum plot size required in a scheme served by water borne sewerage is; according to the Grade II By-laws:

1 habitable room of 120 sq-ft. (11.15m^2)	-	11.15m^2
3 " rooms each of 74sq.ft (6.97m^2)	-	20.91m^2
1 kitchen of 25 sq-ft. (2.3m^2)	-	2.30m^2
1 toilet of assume 25sq.ft. (2.3m^2)	-	2.30m^2
1 shower of minimum 11.25sq.ft (1.05m^2)	-	1.05m^2
Total		37.71m^2
For calculation purposes say		40m^2
Add 25% for wall thickness, verandahs etc.		10m^2
		50m^2
With a plot coverage of 50% total plot area =		100m^2

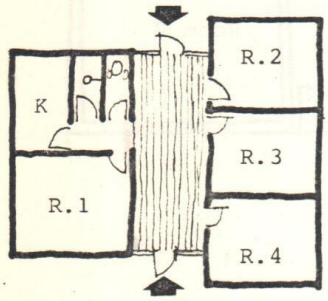
3.8 For the accommodation of pit latrines it will be necessary to allow only 25% plot coverage. Therefore the plot would need to have a minimum area of 200m^2. However, if the requirement that the pit latrine be no closer than 30 ft. (9.15m^2) is applied then the shape and development of the plot will be important. See Figure 3.3.

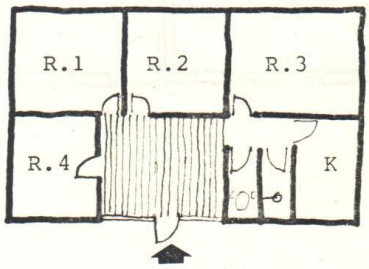


NAIROBI : DANDORA PHASE I



MOMBASA : KISAUNI





WEBUYE : 1 & 2

KEY

R.1 Room
K Kitchen
C.S. Covered cooking space
S Store
Choo
Shower
Yard

SCALE 1 2 3 4 5 6m

FIG. 3.1. TYPICAL SKETCH PLANS OF HOUSE TYPES

Source: Evaluation of the site and services programme in Kenya. HRDU (Draft) July 1979

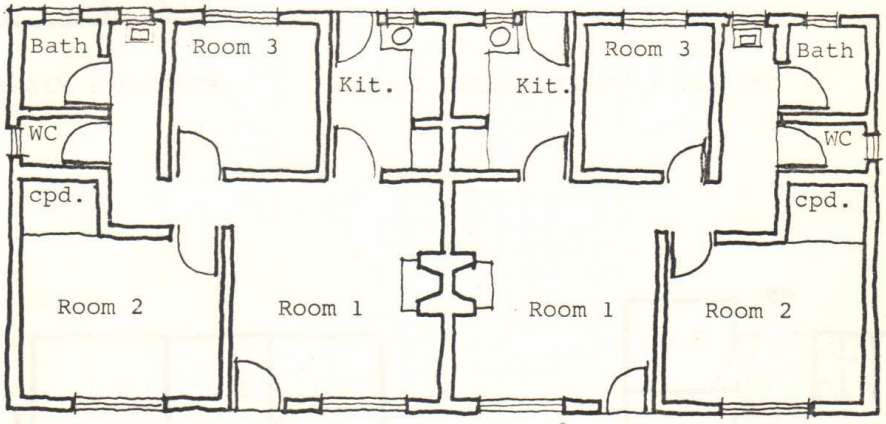


FIG. 3.2. TYPE PLAN FOR NANYUKI SITE AND SERVICES I

Source: Evaluation of the site and services programme in Kenya. HRDU (Draft) July 1979

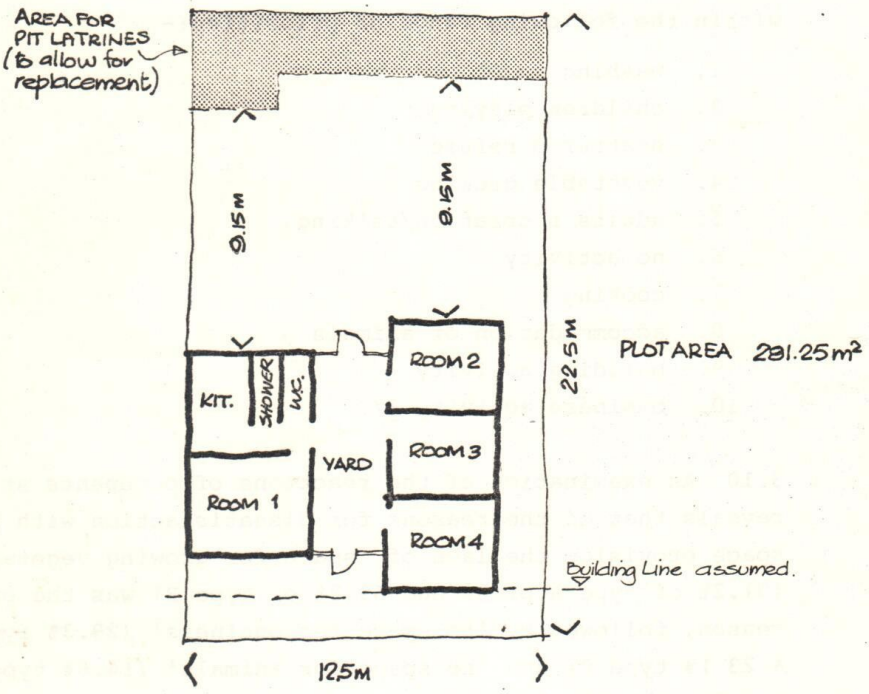


FIG.3.3. ACCOMMODATION OF A PIT LATRINE ON A PLOT

3.9 One other factor affecting the minimum plot size to be permitted relates to the use of the site not covered by buildings. With a normal 50% plot coverage (which appears to be essential with plots below $200m^2$) in order to satisfactorily accommodate the required building area) one is left with the minimum space for outside activities. Such activities generally fall within the following range of priorities:-

1. washing
2. children playing
3. scattered refuse
4. vegetable growing
5. adults recreation/talking
6. no activity
7. cooking
8. accommodation of animals
9. building activity
10. business activity 3/

3.10 An examination of the reactions of occupants at Dandora reveals that of the reasons for dissatisfaction with the open space provision the lack of 'space for growing vegetables' (51.2% of type A plots and 69.2% of type B) was the primary reason, followed by 'no space for business' (29.3% type A & 23.1% type B) and 'no space for animals' (14.6% type A & 7.7% type B). 4/

3.11 A critical examination of the Type A plots, ($100m^2$) shows that only a total area of some $20m^2$ is available (ie. is not covered by building or pathways) and this is diveded into two areas in the normal house types. The need for access to the sub-let rooms together with the higher occupation rates of partially sub-let plots decreases the availability of space in small sites for open space activities. It is intersting to note that in Dandora Phase I the NCCK is developing a vegetable growing area adjacent to the river and that allottees (and/or tenants) have developed their own vegetable plots along the river.

4/ ibid

3.12 The use of the plot for business is discouraged in Dandora although at present, prior to the market being developed, kiosks are allowed. These, because of the limited space within the plot and the controls excercised by HDD, are located on the road reserve in front of the plot (where the plot owners are the businessmen) or on the truncation areas at the corners of the road where more extensive kiosks have been developed.

3.13 The climatic variations found in Kenya should have a critical effect upon an examination of the minimum permitted plot size. The HRDU in their examination of the effects of climate upon building form defined six different climatic zones: 5/

i) Coast
ii) Semi-desert
iii) Savanah
iv) Lake
v) Highlands
vi) Upper highlands.

It has been suggested that these six zones be reduced to three and for the ease of applying building regulations (i.e. the numbers of variations and their applicability to local authorities) we concur with this reduction. 6/ viz:

i) Temperate (Highland & Upper Highlands)
ii) Hot-humid (Coast & Lake)
iii) Hot-dry (semi-desert & Savanah)

The co-relation between these two aspects is seen in Figure 6.1. (Chapter 6)

5/ 'Design for climate' Charles Hooper, HRDU 1975

6/ 'Space Standards for residential development in Kenya' Guid & A. Ast. HRDU : September 1979

3.14 The effects of climatic variations upon the plot size will be the result of:

i) the need to gain the maximum benefit from breezes in hot-humid climates

ii) the benefits of shade in hot-dry climates

iii) the need for maximum use of outdoor space, within the plot, in hot-humid and hot-dry climates

Therefore on these basic premises it can be assumed, subject to further detailed examination in this paper (see Chapter 6), that in hot-humid climates plots should be larger than in the temperate and hot-dry climates with, perhaps, a smaller percentage plot coverage. In hot-dry climates plots could be smaller and/or the plot coverage could be increased to create smaller sheltered courtyards rather then gardens.

3.15 The minimum acceptable size of the plot is affected by a number of other factors and we shall therefore return to this subect at the end of the paper. Even then the subject will not be exhausted for additional aspects will affect the issue such as building lines, truncations, overall planning densities etc. and these aspects will be dealt with in Discussion Paper DP6. ENVIRONMENTAL AND SITE PLANNING ASPECTS.

CHAPTER 4

THE DWELLING

4.1 In determining the basic requirements for a low-cost house it is first necessary to define the basic needs of its inhabitants i.e. what do they require of it. These needs can be classified as:

a. shelter from the elements for sleeping, eating and living
b. a private place for personal cleansing (external and internal)
c. a place where private possessions can be stored safely
d. a place where children can be raised and a base for their education
e. a means of increasing income by sub-letting a room or rooms
f. a place which has sufficient space within the plot for children to play, washing to be dried and, hopefully, vegetables to be grown.
g. a place to which friends can be invited.

4.2 With the exception of (e) all these criteria will apply to housing for all income groups. In the higher income groups whole dwellings will be created to provide an income, but the concept of sub-letting part of the total dwelling is primarily a low-income population requirement.

4.3 The present building legislation allows all these criteria to be satisfied with the exception of criteria (e).

4.3.1 For example a minimum dwelling shall consist of:
Grade I Building Bylaws:
'dwelling' means a part of a building lawfully used or constructed, adapted or designed to be used as a residence for one family and includes /as such out-buildings/ are ancillary thereto (Page 10). There are no specific requirements with regard to room sizes.

4.3.2 However for scheduled special areas and special buildings these regulations are to apply to low-cost urban housing for it states (By-law 215). 'In high density or low-cost residential areas, where approved by the Council, the requirements of By-laws 216 and 227 of these By-laws shall prevail, where they conflict with any other of these By-laws' (By-law 215 - emphasis added).

4.3.3 By-law 216 requires that every habitable room shall have a superficial area of not less than 75 sq.ft. ($6.97m^2$) within a minimum width of 6 ft. 6 in ($1.981m^2$) and shall contain a minimum area of 40 sq.ft. ($3.72m^2$). In addition at least one habitable room shall have a superficial floor area of not less than 120 sq.ft. ($11.15m^2$).

4.3.4 The rest of the requirements of a dwelling may be summarised as:

i) Each dwelling shall contain a latrine and an ablution

ii) For each family or group not exceeding six persons shall be provided with a latrine and ablution.

iii) Sufficient properly designed cooking areas shall be provided - numbers or ratios are unspecified.

iv) Facilities for washing clothes shall be provided as slabs or splash areas at the rate of one per six persons. Sizes 3 ft. ($0.914m^2$) x 2ft. ($0.61m^2$) for slabs and 3ft. ($0.914m^2$) x 3ft.($0.914m^2$) for splash areas. For additional persons these areas shall be increased by 1sq.ft ($0.09m^2$) for each additional person.

4.3.5 The Grade II Bylaws are very specific in defining the accommodation to be provided in a dwelling house viz:

i) Every dwelling house shall consist of at least one habitable room in addition to a kitchen, ablution and privy accommodation for the exclusive use of the occupants of the house (By-law 9 - definition of a dwelling house)

NB. The definition of a dwelling house is:

a building designed for use exclusively as one self-contained residence, together with such out-buildings as one ancilliary thereof.

ii) Every habitable room shall have a superficial area of not less then 75 sq.ft. ($6.97m^2$) with a minimum width of 6 ft.6in ($1.981m^2$) and shall contain a minimum area of 40 sq.ft. ($3.72m^2$) for each person accommodated therein. Provided that in every dwelling of two or more habitable rooms there shall be constructed one habitable room having a superficial floor area of at least 120 sq.ft. ($11.15m^2$) (By-law 9(2)).

iii) The area of the kitchen shall not be less than 25sq.ft. ($2.33m^2$) (By-law 11)

iv) Whilst the area of the bathroom is not defined the minimum dimensions are. Thus the By-law requires that the internal dimensions be not less than 2ft 6ins ($0.762m^2$) by 4ft.6in ($1.372m^2$). This gives a minimum area of 11.25sq.ft. ($1.05m^2$) (By-law 12).

4.4 Before determining what is required in a low-cost dwelling it is important to examine in more detail how the basic needs of the dwelling (see para. 4.1) can and are converted into a specific building. To achieve this it is necessary to examine each element individually.

CHAPTER 5

THE ELEMENTS OF THE DWELLING

5.1 THE LIVING ROOM

The title is used to describe a multi-function room and not the middle/high cost housing concept which normally serves only limited number of functions:

i) relaxing
ii) entertaining
iii) house work (sewing etc.)
iv) reading and studying
v) eating (if combined with a dining area)

For low-income housing the pressure for sub-letting often results in both the plot owner and the tenant each living in one room only. Therefore to the above list must be added:

vi) sleeping
vii) accommodating sick people
viii) food preparation and cooking
ix) dressing and changing clothes
x) feeding changing and washing babies and young children
xi) storage of food, cooking materials, clothes and other personal possessions.

Thus the room, in low-cost housing, serves a multitude of functions - many of which are often incompatible (i.e entertaining v. changing clothes etc.) Often, to permit such incompatible functions, some form of screening is used to define areas of different uses and to provide a degree of privacy for personal actions.

Therefore the principal objectives of creating a living room in a low-cost housing should be to create the maximum area compatible with the multitude of functions that it has to accommodate. However, this objective is often limited by two factors:

a) the building costs
b) the, hopefully, temporary nature of the multitude of uses. It is often a basic assumption in many low-cost housing schemes that the desire and need to sub-let will reduce as the house-hold of the building owner increases

its total income from sources other than sub-letting and can therefore reduce the need to sub-let. As a result, it is anticipated that the household will be able to expand into the other existing rooms. Unfortunately it is too early in the life of recent site-and-service schemes to determine whether this WILL happen in all cases. However accepting these qualifications it is considered that the user requirements should be paramount.

5.1.1 The varying sizes of such rooms provided in recent low-cost housing projects in Kenya are shown in Table 5.1.

TABLE 5.1 LIVING ROOM SIZES IN VARIOUS LOW COST HOUSING SCHEMES.

SCHEME	MINIMUM INTERNAL DIMENSIONS	ROOM SIZES m^2
NAIROBI: DANDORA PHASE I	1.88m av.2.28-3.0m	6.8,8.3,9.0,10.2 11.3,12.3, & 14.3
KISUMU: S. & S. I	3.045m	10.2
WEBUYE: S.& S. I & II II	2.8m 2.85m	9.2 & 11.5 8.3,9.8,11 & 11.15
KITALE: S.& S. I	3.0m	12.2
MOMBASA: LIKONI : KISAUNI	2.74m 3.0m	11.3 & 16.7 9.3 & 11.3
THIKA: SITE & SERVICE 6	3.0m	8.9,9,10.8,11.0, 12.3 & 12.9
NANYUKI: S.& S. I*	2.15m	6, 9.7 & 14.1
" : S. & S. II	3.1m	12, 12.4 & 16.0
KAKAMEGA: S.& S. I*	2.74m	7.5,8.8,11.1,& 11.
NHC TYPE PLANS	2.0m	8,9,12,12.4,15.4 & 16

Notes: i)* These type plans are clearly not designed for efficient sub-letting.

ii) All these areas refer to type plans - rooms actually constructed may vary slightly in size.

Source: Evaluation of site and services programme in Kenya Draft HRDU July 1979.

5.1.2 The HRDU has undertaken considerable research into rooms sizes related to their use 1/. As a result of their studies which related use to the average sizes of furniture to be accommodated they recommended a minimum internal dimension of 2.1m although most of their examples had a minimum of 3.0m. In addition it was recommended that whilst $7m^2$ (75sq.ft) can accommodate the beds it will not satisfy the present requirement of $3.72m^2$ (40sq.ft) per person. They therefore suggest that the space per person be changed to $3.50m^2$ (38sq.ft).

5.1.3 It must be noted that these recommendations have, by the title of the report, been made for the temperate highland climate where temperatures range between $8^{o}C$ and $26^{o}C$. The HRDU report on climate 2/ makes no specific recommendations regarding room sizes for different climatic areas. One could assume that more indoor space is required in hot-humid and hot-dry climates yet in fact the greater use made of outdoor space would contradict this. However if people choose to sleep indoors (especially in hot-humid climates) then it is necessary to have well ventilated and mosquito proof rooms.

1/ Guidelines for room types in low-cost housing (with reference to the highland climatic region) HRDU April 1977.

2/ Design for Climate HRDU January 1975

5.1.4 A re-examination of Table 5.1 shows that in towns in hot-humid climates (Mombasa & Kisumu) minimum room sizes vary between 9.3m^2 and 16.7m^2, in temperate climates from 6.8m^2 to 16.0m^2, but there are, as yet, no examples from hot-dry climate areas.

5.1.5 From reading of publications and discussions with officers in the local authorities it would appear that in the hotter climatic areas the minimum volume of space is more important than the minimum floor area. However, even this conclusion is subject to modification in that a g.c.i. roof without a ceiling under a very hot sun will create most uncomfortable internal conditions irrespective of the volume of space likely to be found in low-cost housing. This aspect will be discussed further in connection with room heights,construction methods and materials.

5.2 THE KITCHEN

5.2.1 The kitchen in low-cost housing normally provides space for the following functions:

a) preparing and cooking food
b) storage of food and cooking materials
c) where the pressures to sub-let are severe it is often used for sleeping purposes.

5.2.2 The current legislation requires:

Grade I Bylaws: every kitchen shall have an area of not less than 60sq.ft. (5.58m^2) and a minimum internal dimension of 6 ft (1.83m^2).

Scheduled special areas: kitchens shall have an area of not less than 25sq ft. (2.33m^2) and a minimum dimension of not less than 4ft 6in (1.37m^2). In addition the by-laws for these special (low-cost residential areas also permit cooking areas, as opposed to a specific room (i.e. a kitchen). Such an area, if in the form of a covered recess of verandah, shall have an area of not less than 24sq ft. (2.23m^2) with a minimum dimension of 3ft 6in (1.07m). The by-laws also accept that cooking may take place in a habitable room, but in such a case require that the area of room be calculated on the basis of 50sq ft (4.65m^2) per person rather than 40sq ft (3.72m^2) per person.

Grade II Bylaws: require that kitchens shall be not less than 25sq ft. (2.32m^2) with proper outlets for fumes and smoke, properly lit and ventilated.

5.2.3 An assessment of areas of kitchens, in site-and-service is given in Table 5.2

TABLE 5.2: AREAS OF KITCHENS IN SITE-AND-SERVICE PROJECTS

SCHEME	AREA OF KITCHEN m^2	NO. OF ROOMS SERVED	COMMENTS
NAIROBI: DANDORA PHASE I	7.81	4	
KISUMU: S.& S. I	3.6	3	NB 2no.kitchens for 6 rooms
WEBUYE: S.& S.I&II	5.4	4	
KITALE: S.& S. I	5.4	5	Very badly designed but has store directly off
MOMBASA: LIKONI	5.55	4	Long (3.7m) & narro (1.5m)
KISAUNI	4.5	4	Roofed cooking spac
THIKA: S.& S. 6	-	8	No specific kitchen/ cooking space provi d - use of yard
NANYUKI: S.& S. I	5	3	Not designed for sub letting
II	7.25 & 10	6	Store ($2.25m^2$) off
KAKAMEGA: S.& S I	4.65	5	Store ($1.7m^2$) off Not designed for sub letting.
NHC: TYPE PLANS	4.6 4.8 5 5.8 8.32	6 6 6 6 6	with store ($2m^2$) off

Source: Evaluation of the Site & Services Programme in Kenya, HRDU Draft: July 1979.

5.2.4 Thus, whilst the Special Scheduled Areas By-laws and the Grade II By-laws require a minimum area of 2.32m^2 for a kitchen, the examples shown in Table 5.2 are all above this area. In fact, with the exception of the kitchen in the Kisumu Site-and-Service Scheme, the areas provided are all greater than the minimum area of 4m^2 recommended by the HRDU. However, even in the Kisumu example there are in fact two kitchens giving a total area of 7.2m^2. The basis of the HRDU recommendation was that in low-cost housing ideally a kitchen to serve more than one household (ie. to accommodate the needs of tenant's families) should be at least 6.3m^2.

5.2.5 However it is our opinion that the provision of an overlarge kitchen is unnecessary and not necessarily ideal in low-cost housing because:

i) if the plot allottee's family is living on the plot there will be a natural desire for the plot allottee's wife to consider the kitchen as her own domain and prohibit its use by the families of tenants because of security of food and utensils and normal human reactions.

ii) assuming that i) is correct an overly large kitchen would therefore be an unnecessary extra expense.

iii) the provision of an over-large kitchen is an encouragement to sub-let this expensive space as a habited room.

5.2.6. It is therefore suggested that in low-cost housing where rooms are sub-let then only one kitchen of a minimum of 4m^2 should be provided, but that sub-tenants either cook in their rooms or a covered cooking space is provided on the plot. In both cases provision is already made for such arrangements in the Grade I By-laws (By-law 218(1) - (4)).

5.2.7 With the traditional use of charcoal burning jikos and the more recent popularity of kerosene burning cookers the provision of adequate disposal of fumes is of paramount importance, as is the safety of the appliance. Whether cooking is done in a specific room (i.e a kitchen) or in the living room, a proper flue must be provided and should be situated over the area for cooking. Such a cooking area is normally defined by the provision of a concrete slab (HRDU recommended size 0.5m x 0.9m at a height of 0.5 - 0.6m above the floor) built into the walls and supported by a block wall. Such a provision will both define the area of cooking and increase the security of the heat source from accidents (see Figure 5.1)

5.2.8 However is a kitchen (i.e. a specified enclosed space) necessary? We have been informed by local officials in the hot-humid climatic areas (i.e Mombasa) that from their observations the families living in low-cost housing prefer to cook in open air. It is interesting to note from Table 5.2 that the Kisauni Scheme in Mombasa provides only a covered space within the yard. Clearly such a provision accommodates the problems of fume disposal and, in hot climates, allows the cook to stay cooler. The main problem of such a provision in multi-occupied dwellings lies in the security of the utensils and food when not in use. However these objects can, and often are, accommodated in the rooms without creating any major additional demands upon the design of the living room.

5.2.9 In the colder (temperate) and the hot-dry climatic areas of Kenya there <u>is</u> a need for a specific enclosed space for cooking (i.e. a kitchen) to retain some warmth in the case of the former and to provide the coolness both by shade and the insulation value of the walls in the latter. In both cases efficient ventilation is very important. To accommodate the sub-tenants cooking needs in these cases provision should be made as outlined in paragraph 5.2.6.

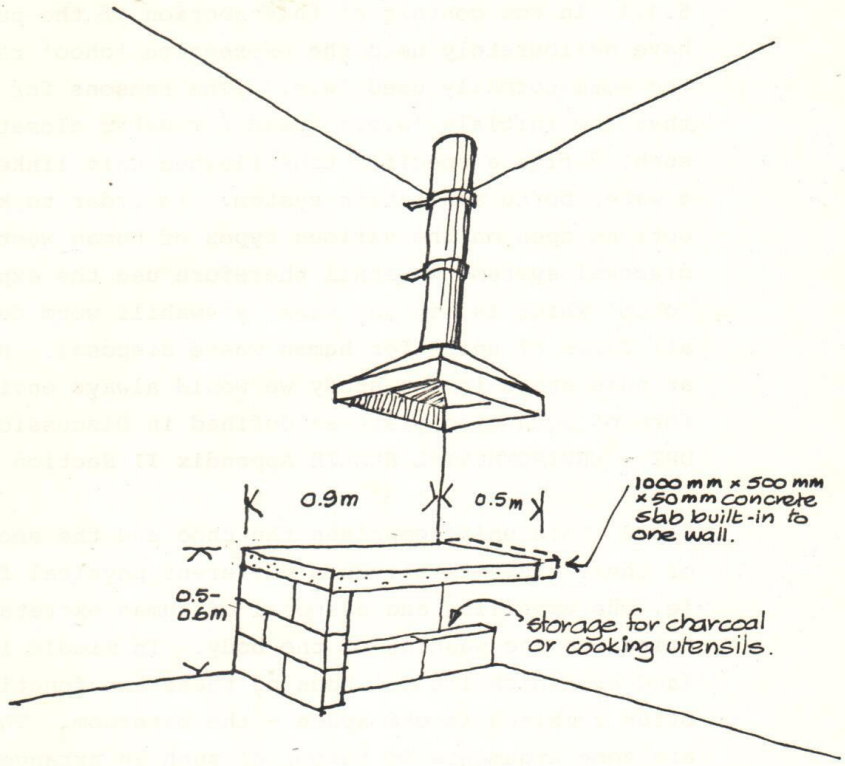


FIG. 5.1. SKETCH OF COOKING SLAB FOR USE IN KITCHENS, COOKING SPACES OR IN HABITABLE ROOMS

5.3 THE SANITARY UNIT.

5.3.1 In the context of this section of the paper we have deliberately used the expression 'choo' rather than the more normally used 'w.c.' The reasons for this are that the initials 'w.c.' stand for water closet and, as such, define a specific tank flushed unit linked with a water borne sanitation system. In order to keep our options open on the various types of human waste disposal systems we shall therefore use the expression 'choo' which is, in any case, a swahili word describing all forms of units for human waste disposal. However at this stage in the study we would always envisage some form of squatting plate as defined in Discussion Paper DP2 - ENVIRONMENTAL HEALTH Appendix II Section 1.9.

5.3.2 This unit comprises the choo and the shower. Each of these elements serves a different physical function ie. the expelling and disposal of human excreta and/or urine and the washing of the body. In middle income (and even high income) housing these two functions are often combined in one space - the bathroom. There are some arguments in favour of such an arrangement. Discussion Paper DP2 - ENVIRONMENTAL HEALTH has underlined the need for adequate hand-washing to inhibit the spread of excreta - related diseases. Thus one can assume that the immediate availability of clean water (ie. a tap or a shower) in the same room as the choo would encourage this necessary hygiene function.

5.3.3 However in examining recent examples of type plans for site and service projects no examples of combined showers and vyoo have been found. To discover some examples it is necessary to go back to:
Nairobi City Council: African housing Types A,E,F & G 1959
East African Railways & Harbours: Class V (cool climate) 1959.

Ministry of Works, Grade 9, double 1961
(Source: Dwelling units in public low-cost housing: Vol.2 recordings HRDU October 1970)

5.3.4 Even in 1970 HRDU reported that from social surveys they had received strong complaints against both combined showers and yyoo and against arrangements where one entered one unit through the other. The reasons for this, as stated, were:

i) the capacity of the installations was reduced
ii) the shower room is often used for the washing of clothes and the proximity of a w.c.p an is unpleasant and it could also mean the loss of small items of clothing!

In addition DP2 draws attention to the problems of use of the shower and, particularly, the choo in the mornings when rooms on the plot are sub-let. An example was given of a plot containing 6 rooms with a potential of over 18 people living on the plot. With only one choo and allowing 2-3 minutes/person then others would have to wait for 30-60 minutes. With only one combined choo and shower, clearly the morning waiting time would be longer as the occupation time of the unit by an individual could be anything up to 15 minutes. Therefore the present practice of providing separate choo and shower units is a good one.

5.3.5 The existing regulations related to sanitary accommodation and equipment are:

Grade I Bylaws:* Every building shall be provided with a bathroom of not less than 25sq ft. ($2.33m^2$) with a minimum dimension of 3ft 6in (1.07m).

The floors, where a floor trap is used, shall be constructed of cement concrete of at least 4in (10mm) thickness, be impervious to moisture and be finished with a smooth and readily cleansed hard wearing surface.

The walls to a height of 2 ft (0.61m) shall also be finished with a smooth and readily cleansed hard-wearing surface.

---

*NOTE: The actual design of the sanitary accommodation, the specifications of the equipment to be provided and the manner in which it is to be fitted is covered in some detail in By-laws 185, 186, 187, 188 and 190.

Grade I Special Scheduled Areas (By-law 217):

i) Both a latrine ('cho') and an abulation (shower and/or wash basin) shall be provided either in separate compartments (minimum dimensions for each compartment 4ft 6in (1.37m) x 2ft 6in (0.76m)) or in a combined compartment with a minimum area of 18sq ft (1.67m^2).

2) Where the units are combined in one compartment then separate provision shall be made for washing utensils.

3) The walls of the compartment/s shall have a smooth and readily cleansed surface to a height of not less than 4ft 6in (1.37m) above the floor. Floors shall be laid to fall and similarly finished, and at the junction with the walls have a smooth finished cement core of a radius of not less than 1½in (3.8mm).

4) One latrine and one ablution (or one combined ablution/water closet) shall be provided for each family or group not exceeding six persons.

5) Each ablution shall be fitted with a shower and operated by a self-closing valve.

6) The floor of both the ablution and the latrine compartments (or a combined compartment) shall have a cement concrete floor of not less than 2in (5.1mm) thickness and where the pan is sunk into the floor the thickness shall be not less than 3in (7.6mm).

Grade II Bylaws: (By-law 8) A pit latrine shall be provided with a roof (minimum of 6ft 6in (1.98m) from floor to underside of roof or ceiling).

(By-law 12) A bathroom shall be at least 2ft 6in (0.76m) by 4ft 6in (1.37m) with a minimum internal height of 6 ft 6 in (1.98m).

5.3.6 Thus the Grade I By-laws (including those for Scheduled Special Areas) specify in some detail both the sizes of compartments, construction of the floors and finishes for floors and part of the walls. The Grade II By-laws define only the minimum of space requirements with no definition of construction or finishes.

5.3.7 An examination of current type plans for site and service schemes shows the following:-

TABLE 5.3: SIZES AND PROVISION OF SANITARY ACCOMMODATION

SCHEME	MIN. SIZE m^2		NO.OF UNITIS	NO.OF ROOMS SERVED	COMMENTS
	CHO O	SHOWER			
NAIROBI:DANDORA PHASE I	1.35	1.35	1 of each	4	+ wash slab
KISUMU: S.&S. I	1.54	1.54	2 of each	6	
WEBUYE: S.&S. I	1.26	1.26	1 of each	4	
II	1.44	1.44	"	4	
KITALE: S.&S. I	1.76	1.76	"	5	
MOMBASA: LIKONI	1.95	1.95	"	5	
: KISAUNI	1.35	1.95	"	4	
THIKA: S.&S. 6	1.575	1.575	2 of each	8	+ wash slab
	1.8	1.8	"	8	" "
NANYUKI: S.&S. I*	1.52	2.85	1 of each	3	+ wash hand basin
	1.3	1.3	2 of each	6	
	1.13	1.13	1 of each	6	
KAKAMEGA: S.&S. I*	1.28	1.28	1 of each	5	+ wash hand basin
NHC: TYPE PLANS	1.44	1.44	"	6	
	1.35	1.35	"	6	
	1.785	1.665	"	6	
	1.5	1.89	"	6	

* Not designed for sub-letting

Source: Evaluation of the Site and Services Programme in Kenya HRDU Draft July 1979.

5.3.8 All these examples have separate w.c. and shower compartments and each compartment satisfies the minimum area for the Special Scheduled Areas and Grade II Bylaws. (minimum 1.04m^2) and appear to accommodate the minimum internal dimensions specified.

5.3.9 However it is also necessary to compare the amount of these facilities related to the demands likely to be made upon them.. For the basis of calculation it is assumed that there are 8.4 persons per plot (c.f. Dandora Phase I: 4 rooms)and an average of 2.2 persons per room. 8/ We consider this is a low figure bearing in mind that Dandora Phase I is still in an early stage of its full development. Therefore for calculation purposes it is proposed that an average of 3 persons per room will be used. The application of this population projection to the examples already reviewed is shown in Table 5.4.

TABLE 5.4: POTENTIAL POPULATION RELATION TO PROVISION OF SANITARY ACCOMMODATION

SCHEME	NO.OF ROOMS	POTENTIAL POPULATION	NO. OF VYOO	NO. OF SHOWERS	REQUIRED BY BYLAWS	SUFFICIENT
NAIROBI: DANDORA I	4	12	1	1	2 of each	NO
KISUMU: S&S I	6	18	2	2	3 of each	NO
WEBUYE: S&S I&II	4	12	1	1	2 of each	NO
KITALE: S&S I	5	15	1	1	3 of each	NO
MOMBASA: LIKONI	5	15	1	1	3 of each	NO
: KISAUNI	4	12	1	1	2 of each	NO
THIKA : S&S 6	8	24	2	2	4 of each	NO
NANYUKI: S&S I	6	18	2	2	3 of each	NO
II	6	18	1	1	3 of each	NO
NHC: TYPE PLANS	6	18	1	1	3 of each	NO

Notes: 1. The type plans for Nanyuki and Kakamega which are clearly not designed for subletting have been excluded.

2. On the basis of 3 persons per room

3. Application of Bylaw 214(4).

8/ MEDIS Report No. 7 March 1979, Senga, Ndeti & Associates.

Thus none of the recently constructed site-and-service type plans conform to the Scheduled Special Area Bylaws.

5.3.10 However we believe that the provision of sufficient sanitary accommodation is a valuable contribution to good public health. Yet again we are concsious of the need to balance this need against the possibility of pricing housing beyond the financial abilities of the target population.

5.3.11 The problem of a high plot population is directly related to the accepted concept of sub-letting in self-built low-cost housing. The acceptance of this concept has developed from the following reasons:

a) it will happen anyway
b) the target low-income population require the additional income from sub-letting to:
   - enable the family to be better fed, clothed and educated
   - enable the plot to be developed
c) over time it is anticipated that the family will no longer need to sub-let for financial reasons and will therefore be able to use the existing accommodation for its own use. Thereby improving its own accommodation standards.

All these reasons are worthy ones, but we believe that experience has shown that in Kenya a minority of the plot allottees sub-let for other reasons viz:

a) the plot has been mis-allocated and is therefore developed solely as a commercial development with the owner resident elsewhere.
b) it is possible that a number of allottees will, when their financial situation improves move to other parts of the urban area (considered to be more compatable with their new socio/economic status) and retain their plot as a continuous source of income. 9/

9/ Discussions with officers involved in low-cost housing developments by the Study Team

5.3.12 Therefore we have on the one hand a situation where a higher provision of sanitary accommodation to occupants initially could impose heavy financial demands upon the developers, yet such provision may not be necessary in the longer term. On the other hand the solely commercial aspect of the development of the plot and its continued use in this manner necessitates concern for the proper provision of facilities for the inhabitants of the plot.

5.3.13 We would therefore suggest that a standard of one choo compartment and one shower compartment should be provided for every 10 people on the plot.

5.3.14 The effects of such a recommendation upon the sufficiency or otherwise of the sanitary accommodation from the examples given in Table 5.4 is:

Sufficient

Nairobi: Dandora Phase I
Kisumu: Site & Service I
Mombasa: Kisauni
Webuye: Site & Service I & II
Nanyuki: Site & Service II (one example with 2 vyoo and 2 showers)

Insufficient

Thika: Site & Service 6
N.H.C. Type Plans
Nanyuki: Site & Service II (one example)

Borderline

Kitale: Site & Service I
Mombasa: Likoni

The 'borderline' cases i.e. one choo and one shower to serve a possible population of 15 people illustrates the problem of applying any standards of persons/provision which is likely to create a mid-point

provision i.e half way between one provision and the next. The 'safest' (in the interests of the applying authority) way is to demand an over provision rather than an under provision - however such an attitude could saddle the developer with unecessary extra costs. This aspect of the application of the recommended standards will be discussed in more detail in Chapter 11.

5.4 STORAGE SPACE

5.4.1 The multiple and intensive use of rooms in low cost housing makes the availability of storage space a severe problem. The multi-household use of the plot (as a result of sub-letting) creates an increase in the number of objects to be stored agravated by the need for extra safety of storage. In a one-family occupied plot some objects could be safely stored outside the building, but within the walls of the plot. In a multi-occupied plot such arrangements could lead to losses and therefore considerable arguement and disagreements amongst the occupiers.

5.4.2 None of the existing building legislation defines any specific requirements for storage other than the vague need for 'suitable provision for the storage of food' (Bylaw 218(1)) Scheduled Special Areas: Cooking areas. Clearly the legislation assumes that this provision is at the discretion of the designer/ constructor of the house. However, from observation there is a need for safe storage and where it is not specifically provided then a number of lean-to accretions are provided within the plot.

5.4.3 The examples previous considered show the following data:-

TABLE 5.5: PROVISION OF STORAGE SPACE

SCHEME	NO. OF ROOMS	NO. OF PEOPLE	STORAGE SPACE m^2	COMMENTS
NAIROBI: DANDORA PHASE I	4	12	1.20	
KISUMU: S.& S. I	6	18	$2.0m^2x2$	
WEBUYE: S.& S. I&II	4	12	-	
II	4	12	-	
KITALE: S.& S. I	5	15	1.50	Off kitchen
MOMBASA: LIKONI	5	15	1.35	
KISAUNI	4	12	-	
THIKA: S.& S. 6	8	12	-	
NANYUKI: S.& S. I*2	3	4	-	Built in cpds
II	6	18	2.25	Off kitchen
II	6	18	2.70	
KAKAMEGA: S.& S. I*2	5	8	1.7	Store off kitche
NHC: TYPE PLANS	6	18	2.2	
	6	18	2.5	Long & Narrow
	6	18	2.7	
	6	18	2.0	Off kitchen
	6	18	2.1	

Notes: 1. On the basis of 3 persons per room

2. Not designed for subletting - number of people based upon 2 per bedroom.

5.4.4 From the above table it appears that the amount of separate storage, when provided, is at the ratio of 0.1 to 0.2m^2 per person in the house types specifically designed for sub-letting. The HRDU recommend that an area of at least 1m^2 with a minimum dimension of 1m^2 shall be provided for food storage and an additional store provided for bicycles charcoal etc. Clearly such a store, to accommodate a bicycle, will need to be at least 2 m long.

5.4.5 The provision of secure storage space is a necessity in low-cost housing, especially as a result of sub-letting. However whilst approximately 1m^2 per family should be provided for each family unit we would emphasise that the total requirement must <u>not</u> be provided in one large room, especially where such a room so created is 4m^2 or more. If such a provision is made then the tenants will not have access to their <u>own</u> stores (the space is likely to be monopolized by the plot owner) and, more likely, the room will be seen as an additional source of income and therefore sub-let.

5.4.6 We therefore recommend that the provision of storage at the rate of 1m^2 per room be provided in separate units, and that such a provision should be included in the revised Bylaws.

5.5 EXTERNAL SPACES WITHIN THE PLOT

5.5.1 In the climate of Kenya the spaces around the building are almost as important as the space within the building. We have already referred to the uses that take place within this space (paragraph 3.9. Chapter 3). To satisfactorily accommodate these activities within the limited space of a 100m^2 plot (less the area of the building) requires careful plot planning and layout.

5.5.2 However it is also important to achieve a degree of privacy in these spaces plus, where such areas are used for storage, security. Both factors are normally achieved by the erection of a boundary fence or wall. However the isolation of the plot and its building also has a disadvantage in that it separates the inhabitants from the passerby and thereby isolates them from the life of the community and opportunities of chatting to passerby.

5.5.3 The traditional 'swahili' house, as can be observed in many majengo areas achieves both objectives (see Figure 5.2).The courtyard at the rear provides the privacy and the security controlled by the central passage whilst the facade, on the front of plot and immediately adjacent to the street,provides an opportunity to meet people. In the hot-humid climate areas the roof is often extended from the front of the building to provide a sheltered verandah, which when equipped with a simple seat (or seats) becomes a place where people can 'drop by' for a chat.

5.5.4 It is interesting to note that in majengo areas in the higher temperate climate areas the same basic concept is used, although the covered space so created is often used as a canopy to the shop or as a space for informal activities i.e. bicycle repair, small scale itinerant traders etc. 10/

5.5.5 Such a concept is however impossible to achieve if building lines are applied to the plot. The validity or otherwise of applying building lines in low-cost housing areas and especially in squatter-upgrading schemes will be discussed in detail in Discussion Paper DP6- Environmental and Site Planning.

10/ The future planning of a majengo swahili village - Masuku:HRDU March 1976.

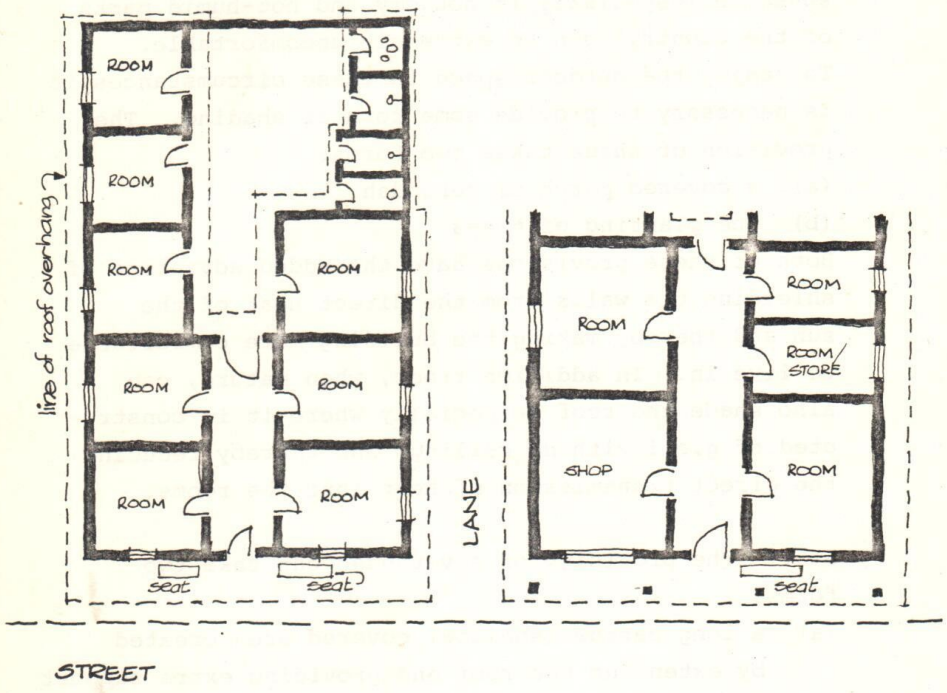


FIG. 5.2 TYPICAL 'SWAHILI' TYPE PLANS

Source: Adapted from: The future planning of a majengo swahili village - Masuku. HRDU

5.5.6 Whilst the tropical climate of Kenya encourages the use of outdoor space, the effects of strong sunshine (especially in hot-dry and hot-humid parts of the country) can be extremely uncomfortable. To enjoy the outdoor space in these circumstances it is necessary to provide some form of shading. The provision of shade takes two forms:

(a) a covered porch or verandah

(b) the planting of trees.

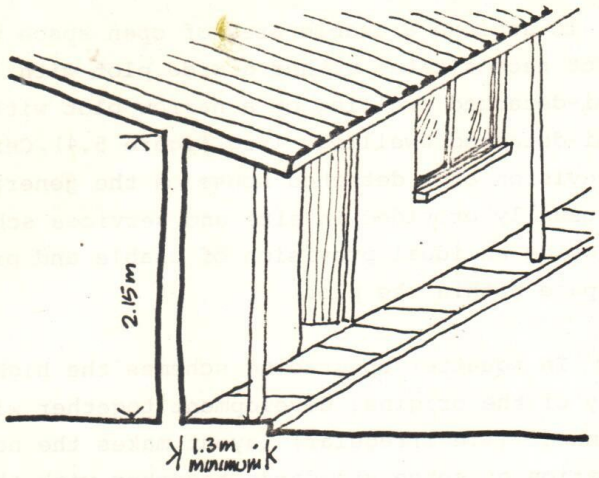
Both of these provisions have the added advantage of shielding the walls from the direct heat of the sun and thereby making the building more ccmfortable to live in. In addition trees, when mature, can also shade the roof (especially where it is constructed of g.c.i with no ceiling) and thereby reducing the direct transmission of heat into the rooms.

5.5.7 The provision of a verandah can take two forms:

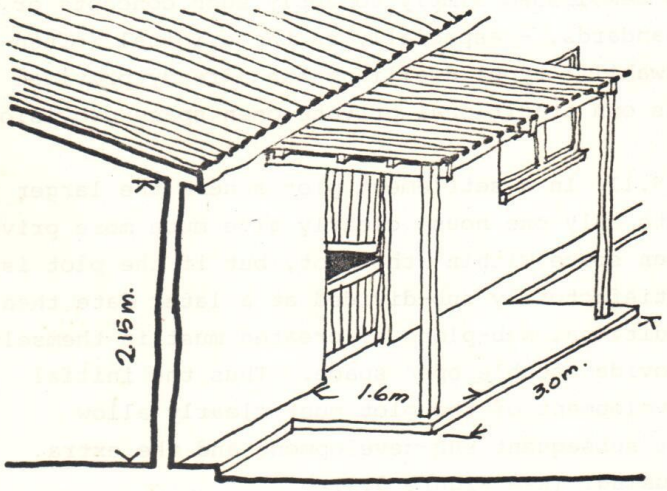
(a) a long narrow (shallow) covered area created by extending the roof and providing extra support in the form of timber poles to support the eaves. To be effective it should be at least 1.3m deep.

(b) A specific covered area of 1.6m x 3.0m. infront of the entrance to the house or the sub-let room. Unless the height of external wall at the eaves is very high such an area will require an extra roof and cannot be accommodated by extending the roof of the house (see Figure 5.3).

5.5.8 There are no specific requirements in any of the Bylaws related to the provision of verandahs or for the need to plant trees and shrubs. Clearly these are considered to be personal decisions which do not impose any public dangers-although there <u>are</u> public dangers from falling dead trees!



MINIMUM VERANDAH



COVERED AREA WITH INDEPENDENT ROOF

FIG. 5.3. VERANDAHS AND COVERED AREAS

5.5.9 To achieve a usable area of open space within the plot necessitates either a wide plot with a detached or semi-detached dwelling or a narrow plot with attached or semi-detached dwellings (see Figure 5.4). Certainly the provision of a detached house on the generally small plots, usually provided in site and services schemes, does not provide an ideal provision of usable and private open space within the plot.

5.5.10 In squatter up-grading schemes the high density of the original development together with the 'unplanned' (i.e irregular) layout makes the normal application of space standards together with the most effective provision of private open space difficult to achieve. Certainly no houses should be demolished simply to apply such concepts or standards, - especially as the original (often 'swahili' type) dwellings has already provided its own traditional private open space provision.

5.5.11 In a settlement plot scheme the larger plots with only one house clearly give much more private open space within the plot, but if the plot is to be satisfactorily sub-divided at a later date then additional sub-plots so created must in themselves provide useable open space. Thus the initial development of the plot must clearly allow for subsequent sub-development and the extra housing. (see Figure 5.5)

5.5.12 The Grade II By-laws do not contain any specific requirements for the provision of private open space within the plot other than the vague requirement (By-law 6) No building shall be sited on a plot otherwise than in accordance with the approval of the council.

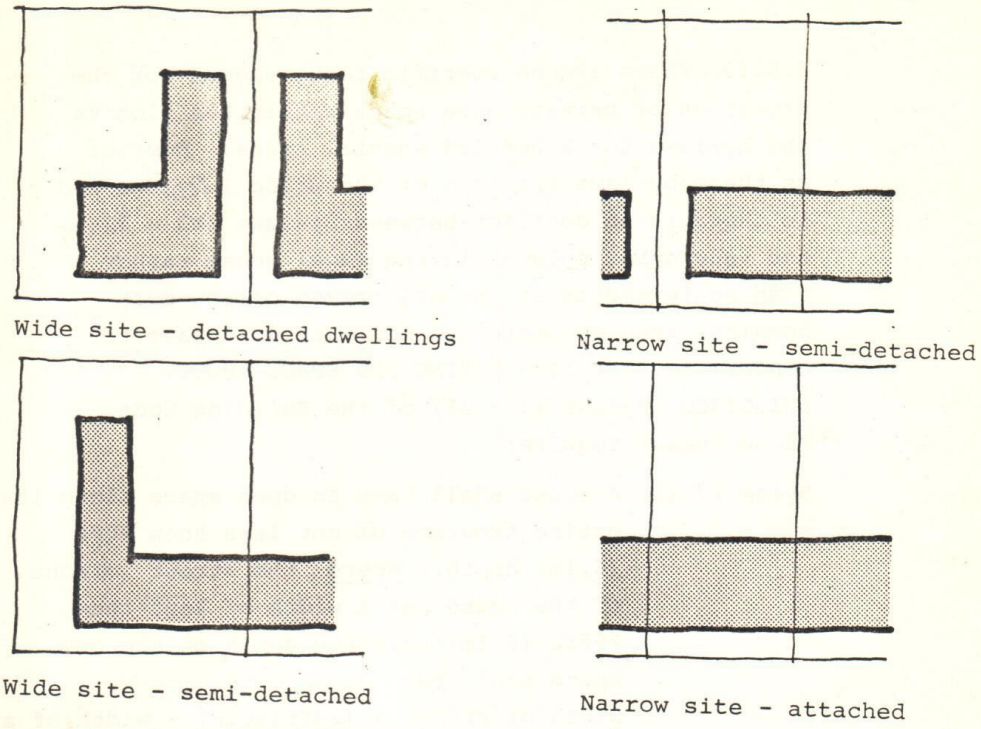


FIG. 5.4. FORMS OF SITE DEVELOPMENT

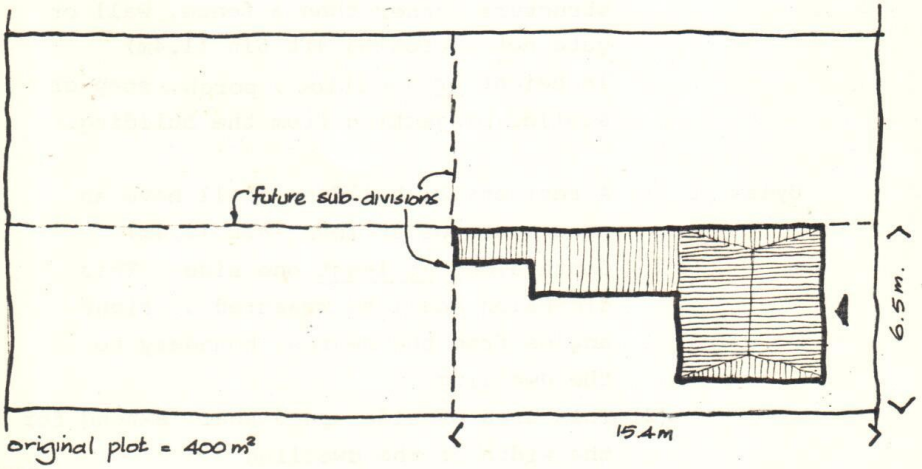


FIG. 5.5. INITIAL DEVELOPMENT OF A SETTLEMENT PLOT

5.5.13 There are no specific requirements for the provision of private open space within the plot in the by-laws for Scheduled Special Areas. However as these by-laws are part of the Grade I Bylaws and as there is no conflict between By-laws 215 - 227 and any other by-laws (in the legal sense rather than achievements of the objectives of low-cost housing) then at present a designer will have to conform to Part II - SITING AND SPACE ABOUT BUILDINGS (By-laws 17 - 31) of the Building Code. These by-laws require:

By-law 17 (1) A house shall have an open space along its entire frontage of not less than 20ft (6.1m) depth. Where the street infront of the house has a width of less then 20ft. (6.1m) then the depth of the open space shall be:

$$\text{width of street} + \frac{(20\text{ft}(6.1\text{m}) - \text{width of street})}{2}$$

(2) The open space lying within the plot shall not contain any buildings or structure other than a fence, wall or gate not exceeding 4ft 6in (1.4m) in height or a portico , porch, step or similar projection from the building.

By-law 18 (1) A residential building shall have an open space of at least 8ft (2.4m) depth along at least one side. This dimension shall be measured at right angles from the nearest boundary to the dwelling.

(2) This area of side space shall extend for the width of the dwelling

(3) A council may allow no side space (i.e. semi-detached or terraced dwellings) or the council may allow the erection of a garage or other out-buildings in the side space.

Bylaw 19 Where a building contains more then one dwelling and is designed to have an internal courtyard or open space then such an open space shall have a minimum areas of 350sqft ($35.5m^2$) with a minimum dimension of 15ft (4.57m)

Bylaw 23 (1) The council may prescribe building lines

(2) No one shall erect any structure within that area of the plot lying between the building line and the edge of the plot other than a boundary wall
fence
gate
portico
step
or other projection;

Bylaw 24 All new buildings shall be sited to ensure hygenic and sanitary conditions and to avoid, as far as is possible any annoyance to the occupants of neighbouring properties.

Bylaw 26 Unless otherwise agreed by the council no building shall have a principal frontage onto a street of less than 30 ft. (9.15m) width.
The theoretical application of these bylaws is illustrated in Figure 5.6.

5.5.14 It would appear that these requirements, with one exception, do not inhibit the provision of private open space. The one exception is the application of the building line. However it must be emphasised that according to the Building Code a local authority may require a building line - it doesen't have to! The relevance or otherwise of building lines will be examined in Discussion Paper DP6.

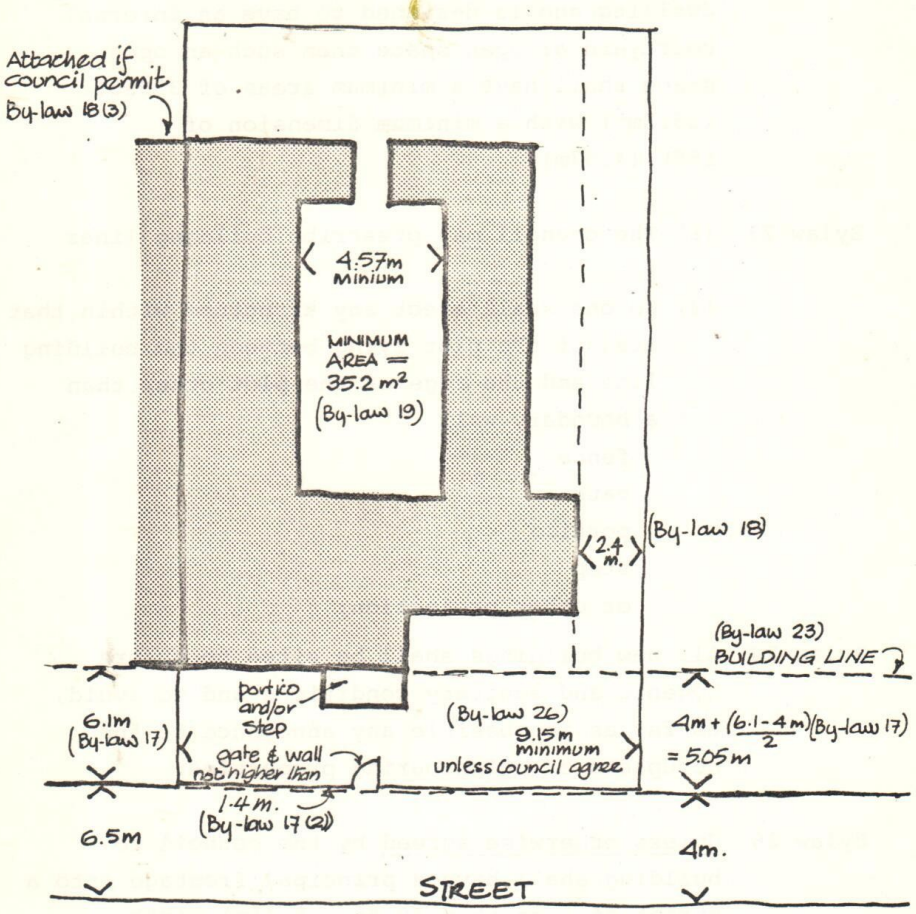


FIG. 5.6. ILLUSTRATION OF BY-LAWS 17,18,19,23,24 & 26.

CHAPTER 6

CLIMATIC VARIATIONS

6.1 Kenya has a varying climate ranging from the very hot areas to the cooler upper highlands areas where it can become cold at night. In order to examine the effects of such climatic variations upon building the Republic has been divided into six climatic zones. 1/

Coast
Semi-desert
Savannah
Lake
Highlands
Upper Highlands

However subsequent work on the relationship between climate and building enabled these size zones to be reduced to three 2/ viz:

TEMPERATE	-	tropical highlands
HOT-HUMID	-	tropical lowlands with high rainfall
HOT-DRY	-	tropical lowlands with low rainfall

The co-relation with the original size zones proposed by HRDU is:

TEMPERATE	-	Highlands and Upper Highlands
HOT-HUMID	-	Coast and Lake
HOT-DRY	-	Semi-desert and Savannah

The geographical distributions of these three zones and their relationship to the principal urban areas in Kenya is shown on Figure 6.1.

6.2 The principal factors affecting the design of housing in each zone are outlined below together with the requirements to accommodate them. Comment has already been made upon specific aspects in Chapter 5 and others will be made in other Chapters.

1/ Design for Climate Charles B Hooper B.Arch, HRDU January, 1975

2/ Space Standards for Residential Development, Guido A. Ast, HRDU September 1979

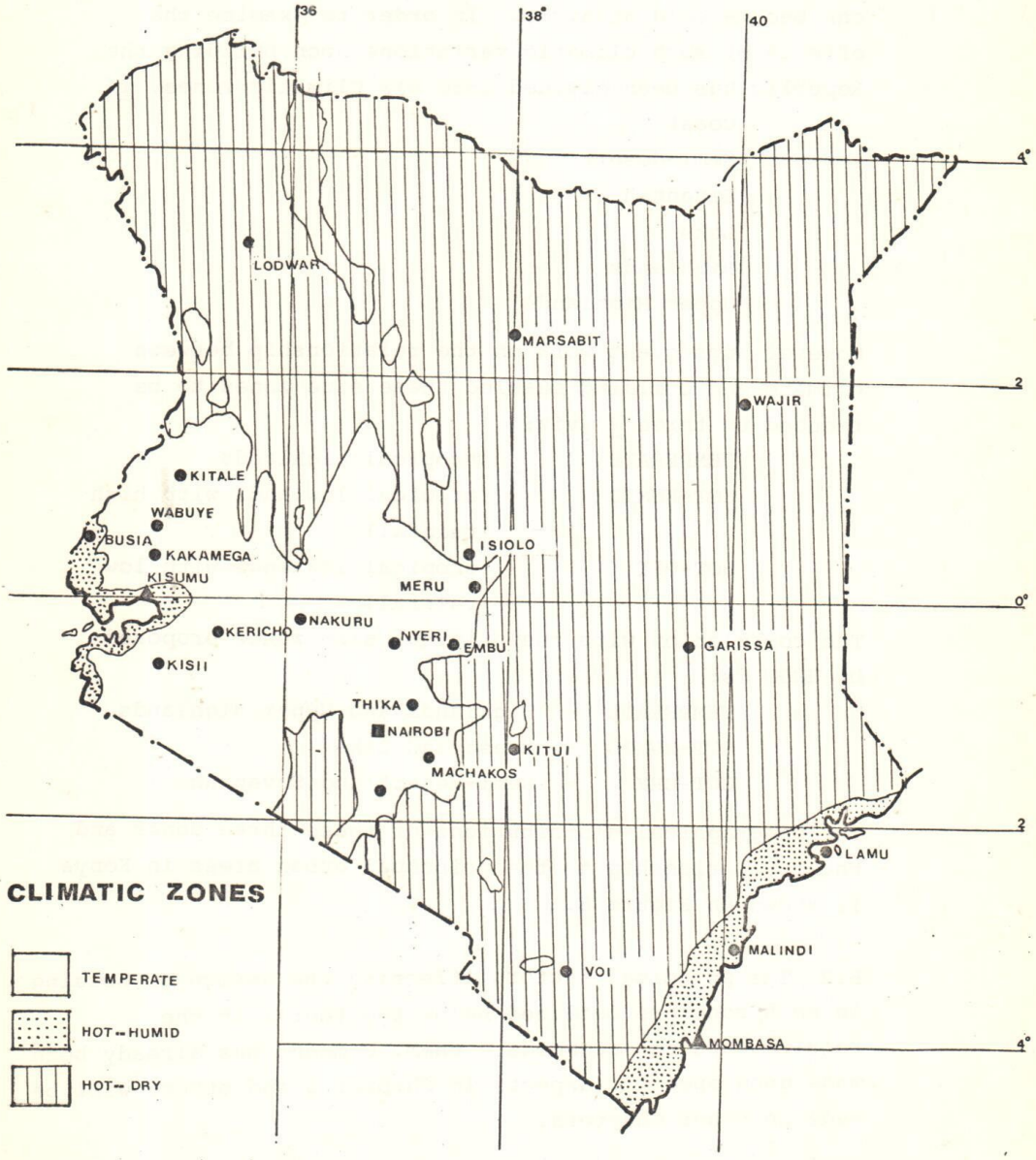


FIG. 6.1. CLIMATIC ZONES OF KENYA FOR BUILDING DESIGN

Much of the information used in this Chapter has been obtained from the excellent report 'Design for Climate,' (Guidelines for the Design of Low Cost Houses for the Climates of Kenya) written by Charles Hooper B.Arch. in January 1975 and published by the HRDU, University of Nairobi, to which due acknowledgement is given.

6.3 TEMPERATE CLIMATES:

6.3.1 These climates are found between the altitudes of 1,250m. and 2,750m although the majority of the people live between 1,250m and 2,500m altitude. Daytime temperatures range from 18.3°C (Equator) to 25.6°C (Nakuru) with minimum hight temperatures ranging from 8.0°C (Equator) to 13.6°C (Nairobi). Relative humidities at 1500 hours and 0600 hours range from 46% to 94%.

6.3.2 The amount of rainfall received in this zone is variable both in amount and geographical distribution. The annual amount of rainfall varies between 739mm at Nanyuki to 1,450mm at Kericho. Generally the Western Highlands receive afternoon showers spread throughout the year whilst in the Eastern Highlands rainfall is mostly concentrated in the two wet seasons - mid-March to May ('long' rains) and November to mid-December (the 'short' rains). Whilst rainfall in the Eastern Highlands can be intense, it is seldom continuous.

6.3.3 Strong winds are not normally a problem and wind speeds rarely exceed 10m/sec. However strong gusts are associated with thunderstorms, especially in the Western Highlands and these gusts are often responsible for the reported loss of roofs.

6.3.4 Human comfort:

a. Internal The temperate regions (by their name) provide comfortable living conditions. Day time temperatures are never excessive although the mid-day level of solar radiation in the months of December and January can be high. The level

of humidity is never excessive. However above 2000m. altitude nights (especially in July and August) can be cold and for ideal levels of human comfort some form of internal heating is required, especially for young children, the old and the sick. To provide heat it is often advisable to provide fire places in all living rooms either for a fire or for siting the jiko (after its use for cooking) as a source of heat.

b. External The outdoor space is very popular especially during the hot seasons. Planting of trees is very useful to provide shaded sitting areas, but is not necessary to shade the building. At higher altitudes on exposed sites the planting of hedges or lines of trees will provide useful wind-breaks.

6.3.5 Compact houses with the minimum of external walls are valuable in conserving the daytime warmth and reducing the night-time loss of heat. Except in houses constructed with iron roofs and without ceilings cross-ventilation is not important for human comfort. Above 2000m altitude early mornings are often cool, dull and moist and therefore the sun when it does break through the clouds at about 11.00 a.m is very welcome. To achieve the maximum benefit of the sunshine an east facing living room is advantageous. A west facing sleeping room (presuming there are separate rooms) has the advantage of benefiting from the later afternoon warmth of the sun which heavy construction can then store for dissipation to the occupants during the night.

6.3.6 The main objectives of house construction in the temperate climatic zone is both to limit the heat admitted during periods of strong sunlight and to store that heat for the benefit of the inhabitants during cold nights. To achieve this roofs (especially where constructed of g.c.i) should be insulated to reduce heat transmission both inwards and outwards. The popularity of g.c.i. as a roofing material would necessitate the application of an insulating material or, more easily achieved, the addition of a ceiling of either plasterboard, softboard, hardboard,

timber boards or split bamboo. Walls should be of heavy construction i.e. stone, bricks, concrete blocks (idealy plastered both internally and externally) cement/murrum blocks or the traditional mud and wattle construction.

6.3.7 The ventilation of rooms is not necessary to compensate for uncomfortable climatic conditions in the temperate zone. It is however necessary to compensate for the build-up of heat within the rooms due to human activity and cooking. If the walls are of heavy construction and the roofs insulated (or provided with ceilings) the transmission of heat through the structure is minimal except during the hottest periods of the day in December and January. However in the temperate zone the value of ventilation is reflected in air changes and not air movement. Because of the necessity of maintaing security for the occupants, especially at night, some form of permanent ventilation is necessary - this is often provided by means of air bricks situated high in the walls.

6.3.8 Lighting of rooms, especially at higher altitudes, is important, due to the dull grey days that are experienced. Because of the low temperatures experienced at night during certain seasons of the year, windows should be glazed and should be well constructed to reduce draughts.

6.4 HOT-HUMID CLIMATES

6.4.1 Such climates are predominantly found in two areas of Kenya - along the coastal strip and along the shores of Lake Victoria. The coastal strip is approximately 50km. wide and includes the off-shore islands (i.e. Lamu). Temperatures range from a minimum of 17.1^{o}C (Kisumu) to a maximum of 30.3^{o}C (Mombasa). Rainfall at the coast has an annual

mean of 750 - 1500mm which is concentrated in the period from April to June, whilst around Lake Victoria rainfall is fairly evenly spread throughout the year although there are two peaks in March and May, and November and December. By the Lake the rainfall falls mainly in the late afternoon or early evening. The annual mean at Kisumu is 1280mm.

6.4.2 The primary factor in the climate of this zone is the high humidity which at the coast is from 86% to 93% at 0600 hours (66% to 75% at 1500 hours) and from 77% to 92% at 0600 hours (40% to 56% at 1500 hours) at the Lake.

6.4.3 At the coast the wind pattern is affected by the sea which modifies the North-East and South-East Monsoon pattern. From about 1000 hours a sea-land breeze (of about 4 to 8 metres/second) developes to be replaced at night by a land-sea breeze (of between 1 to 2 metres/second). At Lake Victoria a similar pattern of lake-land and land-lake breeze developes, but without the monsoon winds. In addition strong and destructive gusts of wind often develope with thunderstorms.

6.4.4 Human Comfort

a. Internal A combination of high temperatures and high levels of humidity potentially make living conditions uncomfortable. During the day the life styles that have developed allow people to make maximum use of shaded outdoor spaces which also utilize the cooling effects of the breezes. At night conditions for sleeping indoors can be very uncomfortable especially at the coast. In particular when nights are still the cooling effects of the breeze are missing. In any case the high incidence of mosquitos makes sleeping both uncomfortable and unhealthy unless mosquito nets are used.

Around Lake Victoria, because of the average altitude of 1100m., nights are often cool. Even so in over-crowded, poorly ventilated rooms conditions can become oppressive. Again the high incidence of mosquitoes makes ventilation (unless well screened openings are provided) difficult to achieve.

b. External Some form of enclosed external space is essential in houses in both the coastal and lake areas. At the coast the historical muslim influences have developed the 'swahili' house form which enabled the female members of the family to enjoy the cooler open space whilst at the same time preserving privacy. Today these social influences are far less strong but the value of a shaded open space where cooking, relaxing and entertaining can take place is still appreciated. Certainly the development of low-cost housing should enable well shaded (both by planting and verandah)spaces to be provided which can cate the breezes. In the lake region there is not such a tradition of courtyards but when provided they are appreciated. Again the design of the private open space should enable the cooling effects of breezes to be maximised.

6.4.5 The house form should maximise the possibilities of cross ventilation. Main elevations should face north and south. Where double banked houses are constructed the internal walls should enable a good flow of air through the building. Well shaded and enclosed outside spaces should be provided. Verandahs are particularly valuable.
At the coast large roof overhangs should be provided especially on window walls.

6.4.6 Light weight construction is particularly valuable at the coast. The traditional building system of mangrove poles with an infill of small coral stones, mud, plaster and whitewash is ideal and, when well maintained with a lime wash, provides a good reflective external surface.

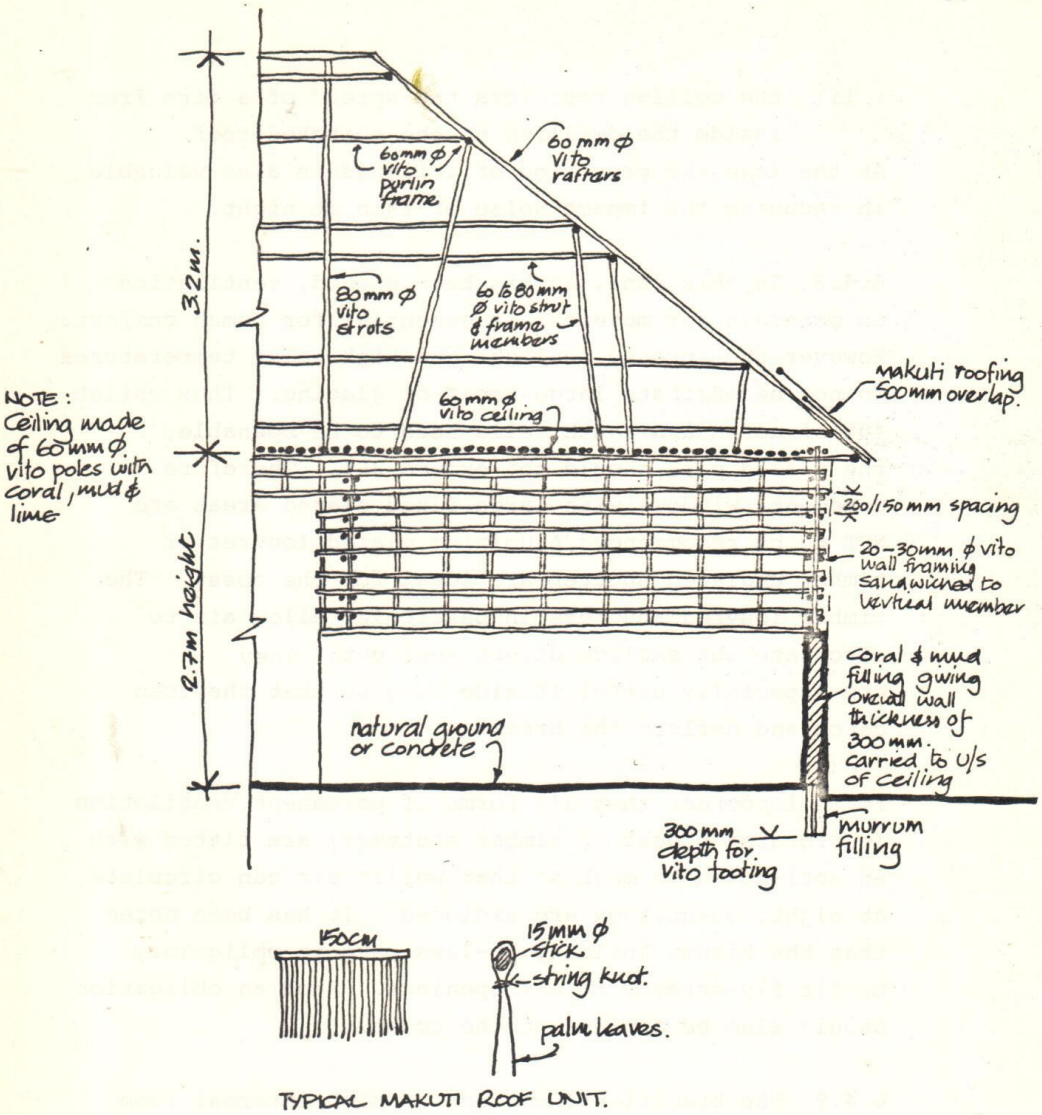
At the lake there is a greater variation between day and night temperatures and therefore lightweight walls are not so valuable. However where heavy wall construction is used in large compactly designed huoses it is ESSENTIAL to ensure that the houses are efficiently ventilated and that internal walls allow a good cross-ventilation. Lightweight construction with timber frames and infil panels, plastered externally and faced internally, are valuable on the lake plains where expansive black cotton soils are found as the frames, if properly constructed, can accept structural movement much more easily than heavy solid construction.

6.4.7 Roofs both at the coast and around Lake Victoria should be lightweight and <u>well insulated</u>. Sheet roofs (especially g.c.i.) without ceilings provide the worse possible conditions. At the coast g.c.i. suffers severely from corrosion thereby initially reducing its refelctive value and subsequently shortening its life.
The traditional roof of 'makuti' at the coast is ideal when used with a ceiling. However it is too often considered as a temporary form of construction by the authorities. Yet many of the prestigious tourist hotels recently created have made considerable use of makuti for roofing. As a material it has the advantages of:

a local material
a traditional form of construction
a lengthy knowledge of its use
a cool material allowing maximum ventilation of the roof space.
easily maintained.

Its main disadvantage is that it often allows mosquitoes to enter. However such problems can be avoided by the provision of a ceiling. Such ceilings could be of plasterboard or the traditional ceiling of mangrove poles, stones and lime plaster as found in Lamu (see Figure 6.2). Certainly such a form of construction is to be found in the low-income majengo areas of Lamu. Such a ceiling has the added advantages that:

i) should the makuti roof catch fire the occupants of the building have time to escape with their possessions.



TYPICAL MAKUTI ROOF UNIT.

FIG. 6.2. TYPICAL COAST (DIGO) CONSTRUCTION

Source: Study for Diani Tourism Study
Kenya Coast Planners Ltd., June 1974

ii) the ceiling restricts the spread of a fire from inside the dwelling to the thatched roof.

At the lake the provision of ceilings is also valuable in reducing the impact noise of rain at night.

6.4.8 In this zone, as has been stated, ventilation to maintain air movement is essential for human comfort. However the intense sunlight and high solar temperatures do not necessitate large areas of glazing. Thus whilst 40% of north and south walls need to be openable, the glazed part should not exceed 20%. Therefore casement windows with large fixed glazed areas are NOT to be recommended. Aluminium glazed louvres or timber unglazed shutters are ideal for the coast. The timber louvred shutters in particular allow air to circulate but exclude direct sunlight. They are especially useful if side hung so that they can catch and deflect the breeze.

It is important that all forms of permanent ventilation (perforated blocks or timber shutters) are fitted with an anti-mosquito mesh so that whilst air can circulate at night, mosquitoes are excluded. It has been noted that the Kisumu building by-laws make it obligatory to fit fly-screens to all openings. Such an obligation should also be applied at the coast.

6.4.9 The traditional concept of high internal room heights making a building cooler have been disproved especially where an uninsulated sheet roof is used. Internal discomfort can be increased by raising the height of the roof if, as a result, less shade is provided to the walls. It is far more important to reduce the penetration of solar heat through the roof either by:

a. an insulating layer
b. a ceiling with a ventilated space between the roof and the ceiling.

c. a non-heat absorbing roofing material (i.e. makuti)
See Figure 6.3

6.4.10 In the lake zone it is essential that roofs are strongly fixed to the walls and especially where overhangs are provided to shade the walls. It may be necessary to consider either the use of a perforated roof panel or temporary thatched materials for the overhangs so that the upward movement or the whole roof can be relieved.

6.5. HOT-DRY CLIMATES

6.5.1 This climatic area comprises the semi-desert zone of the Northern and Eastern parts of Kenya (including the area around Lake Magadi) and the rest of the Republic not included in the other two climatic classifications. Whilst the climate can be summarised as very hot (mean maximum temperature at Magadi is 35°C) with low humidities (35% at Lodwar and Magadi) and low rainfall (mean annual rainfall 165m at Lodwar) there are variations throughout this extensive zone. For example minimum temperatures at Makindu can be 16.5°C, humidity can be as high as 54% with a mean annual rainfall of 1031mm at Kitui. However the basic overall pattern in relation to the design of buildings is high temperature, low humidity and low rainfall.

6.5.2 Winds are generally light but strong local squalls can produce dust storms especially where there is little local vegetation.

6.5.3 Human comfort

a. Internal The days are very hot and nights often warm (frequently unpleasantly) but with lower humidities to those found in the hot-humid climatic zones a ventilated house provides comfort by its shade. However such a house should be of a construction that does not permit the solar beat to penetrate into the

interior and at night allows the heat so collected to escape to the air and not into the interior. In parts of this zone (for example, Voi, Kitui, Makindu and Isiolo) it should be noted that it can be chilly at night during July and August and after the rains. In addition, where areas of water exist, mosquitoes can prove troublesome as does dust.

b. External

The traditional life style of the inhabitants of the areas of towns such as Isiolo, Garissa, Wajir, Lodwar and Magadi is nomadic. However the needs for the education of children together with the temporary posting of government officials is creating a more settled population. In all areas much use is made of shaded outdoor spaces for cooking, eating, recreation and, traditionally, sleeping. However the frequent dust storms, insects and robbery has discouraged the tradition of sleeping outside. In the hottest areas private shaded courtyards are very valuable. In certain towns (for example Garissa and Wajir) lightweight screened shelters are traditionally constructed either on the roofs or the courtyards and are used both during the day and at night.
Only in the semi-desert areas (Magadi, Lodwar, Wajir and Garissa) are the small high-walled courtyards desired where they provide the maximum of shade in places where it is difficult to grow plants, provided a shelter from dust and also provide a degree of privacy.

6.5.4 In this climatic zone the two major requirements are:

a. compact house forms which limit the amount of external walling and therefore heat absorbtion
b. the maximum amount of shaded open spaces as for much of the day and year it is more comfortable to eat, work and sleep in the open
c. plan forms that provide the maximum of cross-ventilation

In high density low-cost housing layouts the courtyard form of housing satisfies these criteria. To achieve efficient cross ventilation it is suggested that the houses be detached with narrow lanes between the plots or semi-detached with spaces between each two plots (see Figure 6.4). Generally all major openings should be on the courtyards side of the dwelling and only high-level ventilation openings on the external walls. Such an arrangement increases the security aspects of the dwellings.

6.5.5 The buildings should be of heavy construction in order to modify and delay the impact of heat gain into the interiors. At night however, it is necessary to ensure that the heat so absorbed into the structure can be dissipated into the air, primarily by being able to ventilate the room. An alternative form of construction would be a lightweight well insulated structure. This is often difficult to achieve in these climatic zones due to the lack of local timber. However comments were made by a local government officer in Isiolo to the Study Team that such lightweight timber structures with screens and a roof of makuti would be attractive to the local inhabitants because of:

a. the climate
b. the traditional nomadic nature of the population.

He considered that the makuti could either be obtained locally or imported from the coast.

6.5.6 It has been suggested that, particularly in the semi-desert areas (such as Garissa, Wajir, Magadi and Isiolo) rooms used during the day could be constructed of heavy construction, with well shaded walls and a reflective external surface, and sleeping rooms constructed of a lightweight construction. Certainly the development of courtyard houses would enable these two methods of construction to be easily accommodated and security maintained.

6.5.7 As in all the climatic zones the use of unlined sheet roofs is to be avoided if internal human comfort is to be obtained. It has been stated that where nights are cool an unlined sheet roof over the sleeping areas only has the advantage of quicker dispersion of the heat absorbed during the day. However with the multiple use of rooms in low-cost housing in Kenya it is unlikely that such a differentiation could be obtained and therefore it is recommended that all sheet metal roofed rooms be provided with ceilings. Such ceilings do not have to be of expensive plasterboard- locally woven reed or grass mats are suitable.

In the semi-desert regions (as is found in the older towns of the coast) flat roofs of heavy construction are often used. This is a traditional form of construction and the extra floor so provided is often used for sleeping. Such roofs when constructed of non-metalic materials have by their development overtime overcome many of the problems created by the mis-use of modern materials.

6.5.8 The provision of ventilation in this climatic zone is more important than natural lighting. Often, infact, it is advantageous for the interiors of rooms to be kept dim and cool during the heat of the day. Activities required plenty of illumination are carried-out in the shaded external spaces. Thus the use of plenty of perforated block walls, timber screens or timber shutters is preferable to the use of glazed casement windows. Such forms of ventilation are not subject to breakages and restrict robbery. To prevent the entry of insects (especially mosquitoes and flying ants) and the activities of pole-fishers all such permanent ventilation openings must be effectively covered with a mesh.
In addition high level permanent ventilation should be provided just under the ceiling (or roof where no ceilings are provided) to reduce the build-up of heat created either by solar penetration through

the roof or from the inhabitants of the rooms. Generally 15% to 20% of the north and south facing walls of a house should be open or openable.

6.6 CONCLUSIONS

6.6.1 The division of Kenya into three climatic zones for the application of building legislation does produce minor variations within a zone (i.e. Lake Victoria area v. the Coastal area) but generally the design and construction requirements for each zone are similar throughout it. Certainly the application of variations for different administrative areas is much simpler to apply for three zones. As will be seen from Table 6.1. the majority of the 94 urban areas (including minor centres) lie within the temperate zone (69%). It is therefore suggested that the basic model by-laws are developed for this zone with modifications, as appendices to the model by-laws, for application to the urban areas in the other two climatic zones.

6.6.2 The principal variations in the requirements for building in the three climatic zones are given in Table 6.2.

TABLE 6.1: DISTRIBUTION OF URBAN AREAS WITHIN THE THREE CLIMATIC ZONES OF KENYA

TEMPERATE ZONE		HOT-HUMID ZONE	HOT-DRY ZONE
Nairobi		Mombasa	
Nakuru		Kisumu	Isiolo
Thika	Kandara	Malindi	Voi
Eldoret	Othaya	Lamu	Marsabit
Kitale	Rnyenjies	Homa Bay	Kitui
Nyeri	Siakago	Kinango	Hola
Kericho	Mwingi	Kigori	Garissa
Kakamega	Mutomo	Busia	Mandera
Nyahururu	Kilome	Maseno	Wajir
Naivasha	Mbooni	Mariakani	Lodwar
Embu	Makueni Boma	Kwale	
Machakos	Nkubu	Ahero	
Kisii	Chuka	Kendu Bay	
Meru	Chogoria	Ukwala	
Athi River	Maua	Yala	
Muranga	Karaka	Siaya	
Webuye	Manga	Butero	
Bungoma	Ogembo	Vihiga	
Mumias	Kabarnet	Khayego	
Molo	Iten	Kaimosi	
Wundanji	Sotik		
Njoro			
Londiani			
Maralal			
Karatina			
Narok			
Kapsabet			
Kiambu			
Ol Kalau			
Kapenguria			
Eldama Ravine			
Kerugoya			
Kajiado			
Kangundo			
Ruiru			
Ngong			
Limuru			
Maragua			
Nandi Hills			
Kikuyu			
Githunguri			
Sagana			
Wanguru			
Makuyu			
Kangena			

Source: Space Standards for Urban Low Cost Housing in Kenya HRDU Final Report September 1979.

TABLE 6.2: SUMMARY OF DESIGN AND CONSTRUCTION REQUIREMENTS FOR LOW-COST HOUSING IN DIFFERENT CLIMATIC ZONES

	ELEMENT / FACTOR	CLIMATIC ZONE		
		TEMPERATE	HOT-HUMID	HOT-DRY
CLIMATE	Temperature Humidity Rainfall	8°C - 25.6°C 46% - 94% 739mm - 1450mm	17.1°C -30.3°C 46% - 92% 750mm - 1500mm	35°C Max. 35% 165mm - 1031 mm
	Human comfort	Generally comfortable but nights can be cold (especially above 2000m.altitude)	High temperatures and high humidity make living and sleeping difficult in houses. Mosquitoes a problem.	Very high temperatures but low humidity makes internal day-time conditions uncomfortable. Insects and dust a problem.
	Plot Development	Compact development as detached, semi-detached or terraced Open space valuable but not essential.	Detached forms suitable to achieve benefits of breeze. Courtyards valuable especially where Islamic influence	Compact/or grouped development advantageous, but courtyards essential, as life-style/climate requires maximum use of external private space.
	House Design	No specific requirements but good ventilation necessary in houses with high occupancy. At higher altitudes maximum internal lighting required	Ventilation for human comfort essential. Walls and windows/ openings need to be shaded. Insect proofing essential.	Cross-ventilation essential but insect/ dust screening necessary. Well-shaded courtyards very valuable.
CONSTRUCTION	Walls	Heavy walls useful in concerving heat for use at night	Lightweight construction suitable with reflective external surfaces. In the Lake area heavier construction helps to conserve warmth at night.	Heavy construction for rooms used during the day but lightweight construction suitable for sleeping spaces. All walls should have reflective external surfaces.
	Roofs	Insulation necessary under sheeted roofs to reduce penetration of solar heat & retain warmth at night.	Insulation of roofs very important. G.c.i not recommended for coast due to comfort and corrosion. At the Lake roofs must be securely fixed & ceilings necessary.	Roofs must provide good insulation. Flat roofs valuable in semi-desert areas for sleeping. Roofs must have reflective surface.
	Openings	Maximum for light especially at high altitudes. Wirldows need to be glazed.	Maximum for ventilation but not for light Glass not necessary by fly screeing necessary.	Minimum openings for light but ventilation very necessary. Dust & fly screening necessary.

CHAPTER 7

BUILDING MATERIALS AND CONSTRUCTION

7.1 This chapter of the Discussion Paper will consider the range of building materials available, their suitability and requirements for use in low-cost housing and constructional techniques . To achieve these objectives we have visited a number of local authorities to discuss their attitudes to various building materials and construction methods, interviewed parastatal bodies, private developers and local manufacturers of building materials. In addition we studied research work currently available in Kenya and especially the research work of the Housing Research and Development Unit (HRDU) of the University of Nairobi.

7.2 Requirements of the current legislation

7.2.1 The current building legislation (ie. The Building Code of 1968) have the following requirements related to materials to be used (excluding fire-resistance - see Chapter 8):

GENERAL

The Building Code commences with general remarks about the materials to be permitted for building construction viz:

PART III - BUILDING MATERIALS

WALLS- All walls built of stone, bricks or blocks (material undefined) shall be hard, durable and suitable for the purpose for which they are used, and shall be of a resistance to crushing as laid down in rule 3 of the Third Schedule of these By-laws.

(By-law 52 - comment added).

Every external wall of a domestic, public or warehouse class building, including any parapet wall thereto shall adequately resist the penetration of rain (By-law 65).

FOUNDATIONS: - The foundation for a load bearing structure of a domestic building where constructed as strip foundations of plain concrete .....(By-law 44(1)).

- Hollow blocks and slabs shall not be used in substructure foundation walls (By-law 56).

CHIMNEYS - Hollow blocks shall not be used in the withes of chimney construction (By-law 57).

No wall, pier or column of a building to which by-law 65 of these By-laws applies, shall permit the passage of moisture from the ground to the inner surface of any storey of the building, or to any part of the building that would be harmfully affected by such moisture (By-law 66).

The by-laws relating to Scheduled Special Areas (ie. high density or low-cost housing) do not specify any special requirements (other than fire resistance requirements) and we can therefore assume that By-laws 52, 56, 57, 65 and 66 apply to building materials for walls.

The Grade II By-laws do not permit walls:

to be constructed to a lower specification than wattle or similar timber adequately framed together and filled and covered with mud (By-law 19).

There is, however, a very important proviso:

Provided that the council may specify the materials to be used in constructing and finishing the walls (By-law 19)

ROOFS

The roof of a building shall be weatherproof (By-law 96)

For roof coverings, the requirements of by-law 96 of these By-laws shall be satisfied if constructed in accordance with the relevant Rules specified in the Fifth Schedule* to these By-laws (By-law 97).

*Note this schedule details the requirements for pitched roofs covered in tiles or asbestos slates and for flat roofs covered with a bituminous felt or asphalt.

In addition By-law 94(3) gives a list of roofing materials which satisfy the fire protection requirements. These materials are:

a. natural slates,or slabs of stone
b. tiles or slabs of burnt clay or concrete
c. slates, tiles or sheets of asbestos cement
d. corrugated sheets of galvanised steel (g.c.i) or other suitable materials of an approved thickness
e. metal sheeting covered both sides with a bituminous material or other similar approved weather resistant coating
f. glass tiles or sheets, or glass bricks or blocks in concrete or metal frames.
g. lead, copper, zinc or aluminium of an approved thickness
h. asphalt mastic with a sanded or gravelled finish
i. asbestos based roofing felt to B.S. 747
j. organic based roofing felt laid on a non-combustible material.
k. organic based roofing felt covered with a non-combustible material.

Thus a whole range of materials is accepted with the exception of grass or makuti thatching. It must be also be noted that Nairobi City Council has town planning objections to the use of g.c.i in an untreated state in certain areas of the city's administration. These requirements would also apply to Scheduled Special Areas.

The Grade II By-laws require that roofs shall be constructed of:

"Corrugated iron, aluminium, asbestos or other permanent materials or shingles as may be required by the council" (By-law 21)

The Council on the advice of the Town Planning Advisor (now Director of Physical Planning) may set aside either the whole or part of a Grade II building area where roofs may be permitted to be constructed of grass or other similar material. (By-law 21 (ii) - amendment added)

FLOORS (Assume a ground floor only for single storey buildings)

The by-laws do not specify the materials to be used but do require that ground floors 'adequately resist the passage of moisture from the ground' (By-law 98) and that 'In a building, all structural parts, which are of timber, shall be properly protected against termites' (By-law 100).

There are no specific requirements for floors under the by-laws for Scheduled Special Areas. However under the Grade II By-laws:

A floor shall be constructed of concrete, compacted earth or such other materials as approved by the council (By-law 20)

The only additional aspect of low-cost housing construction where materials are specified is the construction of CHIMNEYS viz:

Every chimney, flue, pipe and stove, the back and jamb of every fireplace opening, and every hearth shall be constructed of suitable non-combustible materials (By-law 101).

Subsequent by-laws infer that the normally accepted materials for the construction of chimneys shall be bricks, blocks, concrete or stone (By-laws 108(1) and 110)

The by-laws applicable to Scheduled Special Areas do not specify that the materials to be used in chimneys other than 'A flue shall be provided in every internal cooking space. Unless other satisfactory provision is made, the flue shall be constructed ..... of suitable materials .....' (By-law 218(5)).

The Grade II By-laws only require that a kitchen 'shall have a satisfactory outlet for smoke and fumes..' (By-law 11).

7.2.2 Whilst the legislation does not specify what materials may or may not be used clearly the local councils do apply their powers to define what is and what is not 'a satisfactory building material' for low-cost housing, as shown in Table 7.1. This table also shows the acceptance or otherwise of the Grade II By-laws and the 'acceptability' of mud and wattle construction.

TABLE 7.1: COMMONLY USED MATERIALS IN DIFFERENT TOWNS

Town	Roof	Walls	Floors	Grade II By-Laws	Mud&Wattle Houses
GARISSA	G.c.i on timber trusses; Asbestos sheets on timber rafters. Thatch (in un-authorized developments)	Sand-cement blocks on strip concrete footings	Concrete screed	Acceptable	Allowed mainly in private developments
ISIOLO	Asbestos and g.c.i on timber on steel trusses Thatch in temporary houses	Concrete blocks; poles, strip concrete foundations for block walls	Concrete screed	Acceptable	Allowed if properly plastered and well maintained
KAJIADO	Asbestos and iron sheets on timber rafters thatch in areas outside town centre	Concrete blocks; strip footings in concrete	Concrete slabs	Not adopted by council but applied in some areas	Acceptable outside town centre
KAKAMEGA	G.c.i and Asbestos sheets on timber trusses	Concrete blocks on concrete footings	Concrete floor slabs	Applicable	Exist in the old parts of towns

Town	Roof	Walls	Floors	Grade II By-laws	Mud&Wattle Houses
KISUMU	G.c.i and asbestos sheets, concrete and burnt clay tiles, timber rafters and purlins	Concrete blocks, dressed natural stones, concrete strip foundations	Concrete floor slabs	Not adopted by council though applied in some areas	Exist in some areas; not acceptable in town centre
KITUI	G.c.i and asbestos sheets on timber trusses	Concrete, burnt clay bricks, concrete footings	Concrete floor slabs	Acceptable	Exist in some areas
LAMU	Mangrove battens and rafters, coral stones and lime, makuti thatch for protection	Cement-sand blocks; poles, battens coral stone, mud and plaster footings in concrete for block walls	Concrete floor slabs in some houses	Adopted by council	Exist
MACHAKOS	Concrete or clay tiles, g.c.i or asbestos sheets on timber trusses	Quarry stones, concrete blocks, burnt clay bricks (only those produced by approved firms) Concrete footings	Concrete floor slabs	Not adopted by council	Exist in some areas outside town centre

Town	Roof	Walls	Floors	Grade II By-Laws	Mud & Wattle Structures
NJORO (Jewatho Site & Service)	G.c.i sheets tin or straightened oil drums on timber trusses	Sawn timber, natural stones, concrete blocks, timber off-cuts, mud and wattle.	Concrete floor slab in some houses	Adopted	Exist
THIKA	G.c.i or asbestos sheets clay or concrete tiles; timber rafters	Natural stones, concrete blocks, burnt brick, concrete footings.	Concrete floor slabs	Not adopted	Exist in unauthorized developments
WEBUYE	Asbestos or g.c.i sheets timber trusses and battens flat R.C roofs	Concrete blocks, natural stones, earth bricks concrete strip foundations	Concrete floor slabs	Apply outside town centre	Exist outside town centre

7.3 Potential materials for low-cost housing construction

7.3.1 It is clear that a much wider range of building materials are, from a technical viewpoint, suitable for low-cost housing. Such a range is given in Table 7.2.

7.3.2 In determining the potential of such a range of materials it is necessary to determine the suitability on the following criteria:

- availability
- suitability for their purpose
- ease of and knowledge of their use
- life of material with or without maintenance
- cost.

7.3.3 In fact the cost of the material is often affected by all the criteria noted above. For example a material that is cheap in Nairobi may be expensive in another urban area to which it has to be transported from Nairobi. Another material (for example mud & wattle) is cheap initially but requires considerable (albeit cheap) maintenance. At the coast, for example, g.c.i roofing is cheap initially but rapidly corrodes in the maritime atmosphere and therefore requires constant treatment both to combat corrosion and to maintain its heat reflection characteristics.

7.3.4 In addition the method of purchasing of materials for low-cost self-built housing affects the costs considerably. For example a self-builder is likely (unless a member of a building group) to have to acquire materials in small lots - his costs per unit will therefore be much greater than for a large building contractor buying in bulk. At the same time the ability to shop around for materials is important. An example of such a method of material purchase has already been given in Discussion Paper DP1 (Chapter 6 Table 6.2).

TABLE 7.2: POTENTIAL PERMANENT MATERIALS FOR LOW-COST HOUSING

ROOF:

(i) Cladding:
- galvanized corrugated iron sheets
- corrugated asbestos cement sheets
- clay tiles
- concrete tiles
- others (makuti, glass/reeds, tins, shingles, felt & mastic asphalt)

(ii) Structural:
- sawn timber
- steel
- poles

WALLS:
- concrete blocks
- quarry stones
- burnt bricks
- sun-baked bricks
- sun-baked mud/cement blocks
- mud & wattle
- sawn timber
- timber off-cuts
- timber poles
- prefabricated panels
- reinforced concrete
- structural steel & steel products

FOUNDATIONS:
- reinforced concrete
- plain concrete
- stones
- murram

FLOORS:

- concrete screed
- cement screed
- concrete slabs
- bricks
- p.v.c. tiles
- timber

WINDOWS:

- metal
- timber
- glass

DOORS:

- flush panels
- steel doors
- timber doors

7.3.5 Our objective is therefore to expand the range of materials permitted as'permanent' under the building regulations as administered by local authorities. The concept of 'temporary' materials should only be used in relation to the currently defined temporary shelters erected during the development of the plot (in the case of site-and-service schemes) or for existing building in a squatter-upgrading area where it can be shown that such structures will have a temporary life of so many years compatable with the ability of the owner to erect a permanent building.

7.3.6 One example of a material which is eminently suitable for low-cost housing,but not permitted by local councils,are locally made bricks. These are produced in Machakos, Marakwet and Kakamega as well as other parts of Kenya. Discussions with the officers of one local authority in an area in which they are produced has revealed a resistance to their use as they do not have the specified compressive strength of factory made bricks (ie. over $14N/mm^2$) as defined in the Third Schedule of the Building Code Item 3(1). But does a low-cost house (predominently of single storey construction) need a material of such a great strenth? A wall 300mm wide, 400mm long and 6m high has a weight of approximately 15KN. The bottom bricks in such a wall are subjected to a compression of about $0.125N/mm^2$. Applying a safety factor of 10 to include the weight of the roof, wall and other dead and live loads) then the material of the wall should have a compressive strength of $1.25N/mm^2$. Locally made burnt clay bricks have a compressive strength of $7.10N/mm^2$ and are therefore quite suitable as far as structural stability is concerned.

7.3.7 In Chapter 6 of this Paper we have referred to the suitability of light weight timber framed structures in certain climatic areas. Additionally such structures are advantageous in:

- areas where there is an earthquake danger as it has been found in New Zealand, for example, that well constructed timber framed houses are very stable
- areas where there is a black-cotton subsoil as the frame can more easily accommodate ground movements than a stone or concrete block structure especially where expensive foundations are not used.

7.3.8 The Building Code specifically excludes the use of second-hand materials (By-law 33) except where the local council agrees to their use. The Grade II By-laws contain no such requirement. In Scheduled Special Areas no such requirement is made, but it must be assumed that in this case By-law 33 would apply in that nothing is stated to conflict with this By-law. (see By-law 215). We believe that the use of second-hand materials in low-cost housing should be specifically permitted. Thus whilst By-law 33 does permit their use, with the Council's permission, the by-law in relation to low-cost housing should be re-written viz:

Second-hand materials may be used except where the local council specifically prohibits their use on proven grounds of structural instability.

7.4 Structural requirements

The elements of the building which affect its structural stability are:

- the foundations
- the walls
- the roof structure

Foundations:

74.1 The required size of foundations is dependent upon, the type of subsoil they are constructed in, the materials used for foundations and size, type and weight of structure resting upon them.

7.4.2 Where no specific tests are made to determine the mechanical characteristics of the soil, individual judgement of the designer will be required. This will depend on the interpretation of the soils themselves as well as on experience. Table 7.3 below shows the safe bearing pressures on the ground of different soils. The table is a guide and should be read in conjunction with Table 1 of By-law 44 of the Building Code. The Metric equivalent of the Code's tables will be given in the proposed manual at a later stage.

TABLE 7.3: BEARING CAPACITY OF SUBSOILS

Type of Ground	Bearing Pressures in MN/m^2
Silt, alluvial earth etc.	0 - 0.08
Clay: soft or very soft	less than 0.08
sandy: firm	0.08 - 0.16
stiff	0.16 - 0.3
firm	0.08 - 0.16
stiff	0.16 - 0.32
hard shalley	0.32 - 0.65
very stiff (boulder)	0.32 - 0.65
Sand: Uniform: Loose	0.10 - 0.21
Compact	0.21 - 0.43
Well-graded: Loose	0.21 - 0.43
Compact	0.43 - 0.65
Gravel: Sandy: Loose	0.21 - 0.43
Compact	0.43 - 0.65
Clean: Loose	0.32
Compact	0.43 - 0.75
Rock: Soft	0.21
Moderately hard	0.53 - 1.07
Hard	1.29

- In case of rock filling the bearing pressure will depend on consolidation and should be determined by testing.

- As a guide, the permissible bearing capacity of a rock should not exceed 12½% of its crushing strength.
- The values given in the table for sand, gravel etc. are for dry materials. In case of saturated materials these values should be halved.
- The bearing capacity of earth filling, peat, ashes and black cotton soil is negligible as far as foundation are concerned.

7.4.3 The Building Code Bye-law 44 (2) Note (iv) also specifies that "for the purpose of this by-law, black cotton soil shall be deemed to have no load bearing capacity". It should be noted, however, that the Ministry of Works allows construction of dwelling houses even on black cotton soil but they specify that the footings should be in reinforced concrete and the minimum depth should be 600mm below the ground level. They have produced standard details and specifications for different types of houses and for various climatic zones. It is our opinion that building of low-cost houses in black cotton soil should be discouraged for the following reasons:

a) the control of the buildings is limited and design and construction of the buildings themselves is likely to be poor
b) although reinforcing of the footings may solve the problem from the technical point of view, it may prove very expensive for such type of houses.
c) the swelling and contracting characteristics of this soil makes it unsuitable,especially for light weight structures like the ones for low-cost houses since the loads involved may not be heavy enough to consolidate the soil itself.

7.4.4 Regarding ground floors on black cotton soil, Building Code by-law 99(1) states that:

Except as hereinafter provided in this bye-law, black cotton soil under and for the area of any solid floors, shall be entirely removed down to the rock or other approved level, and 99(3) states that: Where the depth of the black cotton soil does not exceed 6ft (1.8m) the requirement of this by-law shall be satisfied, if that soil is removed for 3ft (900mm) or its actual depth, and a site overlay 4in (100mm) thick of consolidated murram or 3in. (75mm) thick of concrete of not less strength than 1:4:8 is provided and the remaining excavation is filled with suitable hard core properly consolidated and blinded with fine materials to a level finish.

This specification again leads to an expensive structure taking into account the fact that the foundations to the external walls have to be on solid rock or approved material. An alternative solution would be to construct the ground floor suspended either on external walls or on reinforced concrete frame structure.

7.4.5 An investigation carried out on a site in Nairobi for three alternative foundations on black cotton soil gave results carried hereunder:
The foundation alternatives were:

Type A: strip footings/wall/hardcore/mass concrete ground floor slab.

Type B: Strip footings/wall/suspended reinforced concrete ground floor slab

Type C: Reinforced concrete column/beam/suspended reinforced concrete ground floor slab.

The results of the cost analysis was as follows:

i) Type A system was cheaper that both type B and C for black cotton layer of thickness up to approximately 1.9m.

ii) Type B system was cheaper than A and B for depths of black cotton soil between 1.9m and 2.2m. It was also observed that although the difference in cost between Type A and B was considerable, the difference between Type B and C was small in that depth range.

iii) Type C system proved to be cheaper than Type A and B systems for black cotton soil depths greater than 2.2m.

Note: a) this analysis was made in 1977

b) the costs were determined assuming that all black cotton soil was to be removed to the hard material depth and the excavated area filled with hard core.

c) It was also assumed that formwork for the suspended reinforced concrete slab was to be left.

d) the site investigated was to be developed with houses for middle and upper income people.

7.4.6 Widths of wall footings:

The minimum widths of the wall footings for different types of soils' bearing capacities and total vertical loads are given in Table 7.4 below. The table is the metric conversion of the Table 2 of Building By-law 44(2).

TABLE 7.4:WALL FOUNDATIONS

Bearing Capacity of the ground in MN/m^2	Minimum width in mm for total load in KN per linear Meter of not more than								
	15	25	30	40	45	60	75	90	12
35	450	600	900	1200	1500	1800	-	-	-
50	450	600	600	750	900	1200	1500	1800	-
80	300	300	450	500	600	800	1000	1200	-
110	230	300	300	400	450	600	750	900	120
150	230	300	300	300	300	450	500	600	80
220	230	230	230	300	300	300	400	450	60
330	-	-	Not less than width of wall				300	300	45
440	-	-	-	Not less than width of wall				300	3
650 and over	Not less than width of wall								

Note: The Figures given are approximate equivalent values of the imperial figures given in table 2 of by-law 44(2) of the building code.

- where no widths are indicated, calculations will be required to determine them.
- the minimum depths of the footing should be approximately equal to the thickness of the wall.

7.4.7 It is suggested that the Manual/Handbook should contain simple diagrams of foundation sizes for likely soil conditions, foundation materials and wall construction methods likely to be found in low-cost housing schemes in Kenya.

7.4.8 The Grade II By-laws simply require that:

> 'Foundations shall be adequate to support the load transmitted and be generally to the satisfaction of the council' (By-law 18) without any definition of what would be satisfactory.

Walls:

7.4.9 The Building Code (other than the Grade II Building Code) refers to a complex system of calculating the thickness of structural walls based upon imposed loads (dead and live), wind loads and the crushing strength of the material used. In actual fact for small domestic buildings 'rules-of-thumb' are used based upon the designer's experience. By-law 52 requires that a structural wall shall not be less than 8½ in (equivalent 200mm) thick and, with reference to the table in the third schedule such a wall shall not exceed 30ft (9.14m) high and 30ft. (9.14m) long. The length of the wall is determined as the length between buttresses or a dividing wall, both of which provide lateral support. The range of thicknesses of concrete blocks in Kenya are:

240mm (9½in)
190mm (7½in)
170mm (6½in)

140mm (5½in)
90mm (3½in)
70mm (2½in)

Therefore under the present Building Code the minimum thickness of an external load bearing concrete block wall would be 240mm, however houses designed by the NHC for Kibera had external load bearing walls of 140mm.

7.4.10 These minimum thicknesses are however based upon the use of bricks or blocks 'composed of burnt clay, stone, concrete or sandlime and have a resistance to crushing of not less than:

400lb/sq in/- ($2.75N/mm^2$) for a small house (defined as a one or two storeyed dwelling house of a capacity of less than 566.5cu.m).

whilst there is a M.O.W Specification it is difficult to be sure that all concrete blocks purchased by individual builders of low-cost housing conform to this crushing strength. We have already shown (para 7.3.6) that a cheap local material is excluded from use because its crushing strength does not conform to the required and yet, in low-cost housing, it is quite safe to use it.

7.4.11 In Kenya most of the research on building materials is carried out by the University of Nairobi. The Civil Engineering Department is more interested in the stability aspect of the materials while Housing Research and Development Unit looks into other aspect. Some testing laboratories exist in the country but they are mainly used for testing of materials to see if they comply with the standards and specifications. There is therefore a need for the University of Nairobi and the Bureau of Standards to determine a Kenyan Standard for locally used building materials with a priority for such local materials as locally hand made clay bricks, murram blocks and murram cement blocks.

7.4.12 No data is given for timber based external walls ie. timber frame (faced with either timber off-cuts or boarding or other facing materials). However an experimental timber housing project was undertaken by the Nairobi City Council at Kariobangi following a symposium on 'Urbanisation and Timber Housing in December 1968. The HRDU carried out a study of this project in 1973 at the request of the NHC 2/ and the relevant conclusions of their study were:

a. For poor soil conditions (ie. black cotton) a single storey timber framed house is economical as strip foundations need only be shallow or spot footings may be used due to the flexibility of the frame.
b. Plastered external finishes (plaster on chicken wire and polythene sheeting) had more capability of accommodating streses.
c. Plastered external surfaces reduce the potential for external spread of fire.
d. A performance specification is required by the designers.
e. More reseach is required into:
   - plastering methods
   - joints
   - design requirements for foundations especially an expensive clays.
   - reduction in warping of timber
   - methods of timber preservation

7.4.13 Discussions with Mr. C.R. Francis 3/ have revealed three factors in the use of timber framed construction:

- the nailing pattern of the joints is more important than the quality of the timber.

2/ KARIOBANGI EXPERIMENTAL TIMBER HOUSES; User reactions, construction, kitchen design and climatic performance, HRDU February, 1974.

3/ Mr. C.R. Francis-UNIDO Expert with the Forest Department

- a boron diffusion treatment of timber is effective and cheaper than pressure impregnation.
- a Code of Practice for both the treatment and use of timber in housing is lacking in Kenya.

7.4.14 The Grade II By-laws state:

No walls shall be constructed to a lower standard that of wattle or similar timber adequately framed together and filled and covered with mud. Such walls shall be capable of supporting the roof. The covering shall be of adequate thickness..... (part of By-law 19 - emphasis added). Thus whilst mud & wattle (or similar but not inferior) construction may be used what the council may consider to be adequate is not defined.

Roof Structures:

7.4.15 The By-laws do not contain any specific requirements regarding the design and construction of the roof structure other than the requirements for fire protection (with a definition of the roof coverings, access to roof spaces, need to be wheather proof and roof coverings). The Grade II By-laws are more specific in that thay require that the roof materials shall be:

.....supported on an adequate frame of poles, timber or similar material (part of By-law 21)

7.4.16 However reference to the Ninth Schedule of the By-laws provides three tables giving detailed sizes for timber common rafters, valley, hip rafters and ridges, and purlius. In addition a fourth table specifies timber sizes for ceiling joints. (see Appendix)

7.4.17 Whilst all these tables would be in theory relevant to low-cost housing it is doubtful if they are compatable with the types of minimum structures erected in site and service, squatter upgrading and settlement plots.

7.4.18 In particular no provision is made for the types of makuti roofed structures created at the coast. The typical construction of such a dwelling is shown in Figure 7.1.

7.5 CONCLUSIONS:

7.5.1 Materials

The range of acceptable materials for low cost housing has to be widened to accommodate traditional and proven materials and forms of construction. The concept of 'permanent' and 'temporary' materials must be eliminated and only applied where a definite temporary construction is to be permitted for a specific short period ie. temporary structures on site and service plots.

Materials or forms of construction must not be prohibited for social/political reasons. The only reasons for probibition should be technical ie.

- structural instability
- fire risk
- potential health risks

Far more local research is required to determine minimum standards and forms of construction with local materials or materials which are not compatable with foreign standards (ie. British Standard Specification or Code of Practice).

7.5.2 Construction Standards.

The easiest way of ensuring that buildings are correctly designed and constructed is by the application of a code of practice. Again the application of foreign codes of practice are possible with high-cost buildings and materials, but are irrelevant to many local constructional techniques or materials. Even with high cost buildings can one be sure that the local materials conforms to the standards inherent in the foreign code of practice?

APPENDIX A

NINTH SCHEDULE THE LOCAL GOVERNMENT (ADOPTIVE BY-LAWS) (BUILDING) ORDER 1968

TABLE 1: COMMON RAFTERS

Clear spans for various sections at different centres for tiled roofs.

Effective span m	Centres of rafters mm					
	305	380	457	533	609	760
0.91					76x38	76x50
1.21			76x38	76x38	76x50	76x50
1.5	76x38	76x38	76x50	76x50	76x50	76x50
1.8	76x50	76x50	76x50	76x50	76x50	102x50
2.1	76x50	76x50	76x50	102x50	102x50	102x50
2.43	102x50	102x50	102x50	102x50	102x50	127x50
2.7	102x50	102x50	127x50	127x50	127x50	127x50
3.0	102x50	127x50	127x50	127x50	127x50	127x50

Notes: (a) Rafter sections given in mm, the depth being the first dimension given

(b) For Spanish or Italian half-round tiles the depth of the rafters to be increased by 20%

(c) For pitches exceeding 35^{o} the span can be increased by 10%, and for those exceeding 45^{o} by 15%.

TABLE 2: VALLEY, HIP RAFTERS AND RIDGES.

Valley Rafters: a) make 38mm thick and twice the depth of common or jack rafters where the valley rafter is supported intermediately by purlins which latter are strutted under junction with valley rafters; or

b) make 50mm thick and same depth as specified for ridges and hip rafters where the valley rafter is intermediately supported as a) above.

Hip Rafters and Ridges

Sections to be as follows:

Depth of Rafter	Roof pitch up to about	
	35°	45°
mm	mm	mm
76	152x32	152x32
89	152x32	178x32
102	178x32	203x32
114	203x32	229x32
127	203x32	229x32
152	229x32	279x32
178	279x32	279x32

TABLE 3: PURLINS

Clear Span m	Sections given in mm								
	Clear distance apart of purlins in m								
	0.6	1	1.2	1.5	1.8	2.1	2.5	2.7	3
1	51x38 51x51	51x38 51x51	51x38 76x38	76x25 76x25	76x38 76x51	76x38 76x51	76x38 76x51	76x51	76x51
1.2	51x38 51x51	76x25 76x38	76x38 76x51	76x38 76x51	76x51	102x38 102x76	102x51	102x5	102x51
1.5	76x25 76x38	76x38 76x102	76x51	102x38 102x51	102x51	102x51 102x76	102x51 102x76	127x51 102x76	127x51 102x76
1.8	76x38 76x38	76x51	102x51	102x51	127x51 127x76	127x51 127x76	152x51 127x76	152x51 152x76	152x51 152x76
2.1	76x51	102x38	127x51 102x51	127x51 127x76	127x51 127x76	152x51 127x76	152x51 152x76	178x51 152x76	203x51 152x76
2.5	102x51	102x51 102x76	127x51 127x76	152x51 127x76	152x51 152x76	178x51 152x76	178x51 152x76	203x51 152x76	203x51 152x76
3	127x51 102x76	152x51 127x76	152x51 127x76	178x51 152x76	203x51 152x76	203x51 203x76	203x51 203x76	203x76 203x102	203x76 203x 102

Notes: a) the bottom row of dimensions shown in each frame should be used where the purlins are inclined to a greater extant than 30^{o} to the vertical plane

b) For Spanish or Italian half-round tiles the depth of the purlin to be increased by 20%, the depth being the first dimension given.

It must be noted that in these three tables we have calculated a direct conversion from imperial to metric dimensions. In terms of timber sizes it is preferable to quote applicable 'ex-stock' sizes in order to obviate the extra costs incurred by the mills having to produce special sizes.

Whilst the Kenya Bureau of Standards has produced a Kenyan Standard Specification for Sawn Timber (KS 02-17: 1976) it is primarily concerned with the grading of timber with reference to its use, quality (amount of imperfections permitted) and qualities of bow, spring and twist. There are no specific recommendations as to standard metric dimensions.

The potential standard timber sizes extracted from the Kenya Standard Specification are shown in comparison with the standard 'ex-stock' sizes produced by Timsales for Select 2nd Grade Timber.

KBS quoted sizes	Timsales	
Width or Depth (mm)	Width(mm)	Depth(mm)
25		25
32		32
38	38	38
50	50	50
63		
75	75	75
100	100	100
115		
125	125	125
150	150	150
175		
200	200	200
225	225	
250	250	250
300		
	300	300

Thus the existing 'ex-stock' sizes from Timsales would be (longest dimension first) mm:

38x25	100x50	150x38	200x200	250x50
38x38	100x75	150x50	225x25	250x75
50x25	100x100	150x75	285x32	250x100
50x38	125x25	150x100	225x38	250x250
50x50	125x38	150x150	225x50	300x25
75x25	125x50	200x25	225x75	300x32
75x38	125x75	200x32	225x100	300x38
75x50	125x100	200x38		300x50
75x75	125x125	200x50	250x25	300x75
100x25	150x25	200x75	250x32	300x100
100x38	150x32	200x100	250x38	300x300

It is attractive to round the calculated metric sizes up or down to the existing stock sizes viz:

102 x 76 mm = 100 x 75 mm
or 203 x 102mm = 200 x 100 mm.

However in the latter of the two samples $6mm^2$ of timber has been lost and such a 'rounding' policy would have to be checked against the structural strength of the timber and the effective span.

ADDENDUM

7.6 Immediately prior to the completion of this Discussion Paper the Study Team received the comments of Mr. C.R. Franscis of UNIDO (referred to earlier in this chapter) upon the regulations governing the use of timber in buildings as given in the Building Code. As there was insufficient time to follow-up his comments we have reproduced the salient points in this Addendum for comment and prior to further research.

7.6.1 The fire separation distances given in the Code are greater then is normally used for timber houses, but the concept of firepartition between dwelling units is satisfactory.

7.6.2 The description on the use of timber is inadequate and unduly restrictive because of its brevity. An engineering design code (for example CP.112) is very conservative and inapropriate for light frame design. The Australian and New Zealand codes for light frame construction are based upon experience and full scale tests and are therefore more appropriate and economic than engineering analysis. He suggests that the application of the Australian code, combined with the New Zealand nailing requirements (see comment in para. 7.4.13) would give a standard of construction equivalent to traditional local masonry.

7.6.3 A Code of Practice for timber preservation is in course of production for discussion by the Bureau of Standards. The draft Code covers building requirements and contains recommendations for various typical situations.

7.6.4 The lack of a table of standard sawn and planed timber sizes is a current serious ommission and is necessary if factory production, with its attendant cost savings, is to become widespread.

As previously stated Mr. C.R. Francis B.E., C.Eng., M.I.C.E., F.N.Z.I.E. is the UNIDO Team Leader attached to the Ministry of Natural Resources to advise upon the development of the use of timber in building in Kenya.

CHAPTER 8

FIRE REGULATIONS

8.1 Wherever there are human beings there is a danger of a fire hazard being created. Whilst natural fires can also occur, with the exception of volcanoes, lightning and internal combustion, fires are nearly always the result of human activities for example broken glass concentrating sunlight onto an inflamable material. In low-cost housing fire hazards occur from two sources:

- internal: cooking, heating or cigarettes/matches
- external: bush/grass fires spreading to the dwellings.

In the climate and socio/economic framework of Kenya it is impossible to ensure that fires do not occur.

8.2 Therefore the objectives of the regulations in respect of fires in buildings are to:

- restrict the spread of the fire in the building to enable:

  a) the occupants to vacate the building
  b) the fire to be fought either by the occupants and/or the Fire Brigade

- to restrict the spread of the fire to the neighbouring properties.

The means of achieving the objectives are two-fold:

i) by defining the materials for the construction of the building and their use
ii) by controlling the siting of the building or the plot in order to reduce the possible

spread of fire to neighbouring buildings.

8.3 The current specific fire regulations related to the construction of low-cost houses is embodied in By-laws 69-75, 90-92, 94 and, by implication, 101-118.

It should be noted that the fire regulations for residential buildings are divided into:

Fire Resistance - Small House (By-laws 71-76)
Fire Resistance of Buildings Other Than Small Houses (By-laws 77-89)
Fire Resistance - Miscellaneous Provisions Applying to all Buildings (By-laws 90-93)
Roofs (By-laws 94 & 97).

8.4 For the purposes of this study the applicable regulations of Fire Resistance - Small Houses would apply because By-law 71 states that'"small house" means a one or two storeyed dwelling house of a capacity of less than 20,000 cu ft (566.4 cu m), but does not include a flat'. It may be argued that the sub-letting of low-cost housing does produce flats (of a type). However, we believe from reading the Building Code that the concept of flats is considered in terms of multi-storey construction i.e. 2 floors or more. Where all the rooms are on the ground then the means of access to the outside air (and therefore safety) are considerable.

8.5 The means of determining what materials may be used and their method of usage is by the requirement that they have a defined fire resistance. The definition of this fire resistance is the time during which the material or form of construction is capable of resisting the action of fire upon it. That is the time taken before the material or building element bursts into flame and/or collapses (By-law 69). It is also important to note that the required mean fire resistance of the element is its

resistance to fire on one side at a time Therefore, a wall, for example, can have either an internal or an external fire resistance requirement.

8.6 In addition, the term 'non-combustible' is used which is defined as a 'material which satisfies the test for non-combustibility prescribed in British Standard 476 Fire Tests on Building Materials and Structures'. (By-law 2 - Interpretation). A further expression used in the By-laws is 'non-combustible throughout' which is interpreted as a wall composed entirely (apart from any combustible internal lining) of non-combustible material or materials. (By-law 69(3)).

8.7 The required external fire-resistance of walls is determined by their distance from nearest boundary of the plot as shown in Table 8.1.

TABLE 8.1 - FIRE RESISTANCE OF EXTERNAL WALLS OF SMALL HOUSES

Distance of wall(m) from nearest boundary of plot		Requirements for non-combustibility and fire resistance
Not less than	Less than	
3.05	-	No requirements
1.5	3.05	Externally non-combustible
0.9	1.5	Non-combustible throughout
-	0.9	Non-combustible throughout and have a resistance to external fire of half-an-hour.

Source: Table under By-law 72, Building Code 1968 - amended to metric dimension

8.8 The internal resistance of external walls to fire shall be half-an-hour (By-law 72(b)).

8.9 Additional requirements for fire-resistance for walls separating one or more houses are given. However, for the walls separating lettable rooms in low-cost housing it would appear that a non-combustible wall with a fire-resistance of half-an-hour is required (By-law 86(b)). In addition the by-laws require that in separating walls in small houses 'no cumbustible material shall be built into or carried through or over a separating wall'. Therefore, the practice of carrying timber purlins across the tops of internal walls is not permitted. (By-law 74).

However, under By-law 222(3) for Scheduled Special Areas purlins may be taken through a party wall if under a non-combustible sheeted roof (g.c.i., asbestos cement, aluminium - uncoated) provided they are solidly embedded in the party wall. That is they do not rest on a wall-plate on the top of the wall (see Figure 8.1). If this is acceptable for party walls we consider that in the interests of the fire regulations it should apply to sub-let rooms in a low-income house.

8.10 Openings in external walls shall only be permitted where such walls are not less than the following distances from a plot boundary (other than a boundary abutting onto a street):

- 1.5m in any residential area
- 3m in any other area

Where an external wall is a return wall or at right angles to the nearest plot boundary this distance may be reduced to 0.76m or if a separating wall projects 0.6m beyond the face of such a return wall the distance from the plot boundary may be the thickness of the wall. See Figure 8.2.

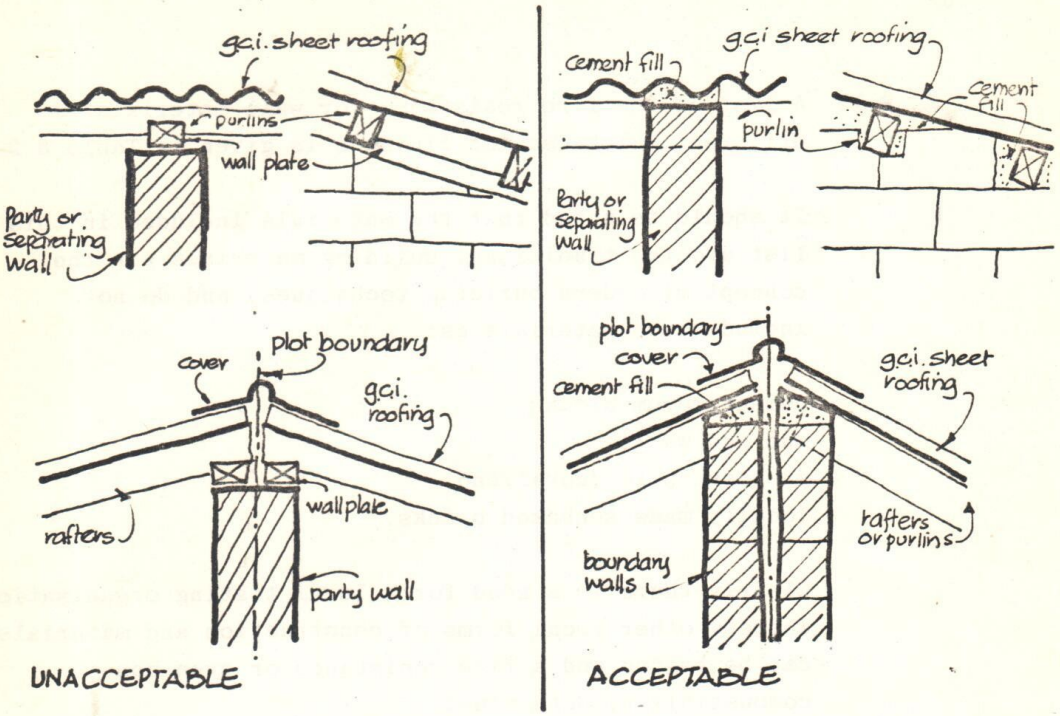


FIG. 8.1. EXPLANATION OF BY-LAW 222 (3)

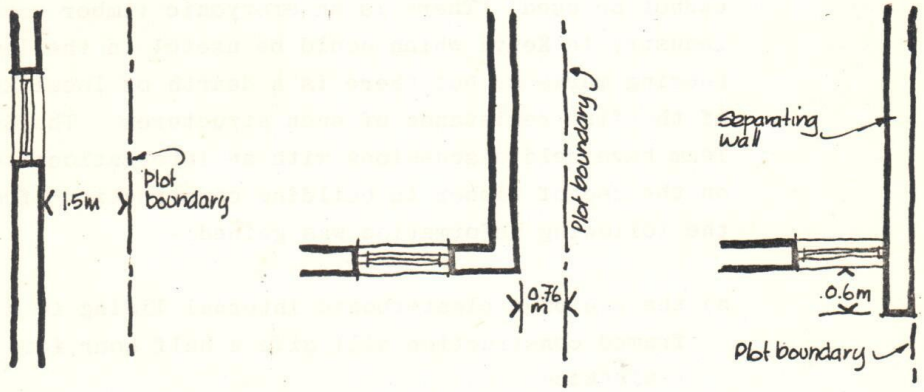


FIG. 8.2. POSITION OF OPENINGS IN EXTERNAL WALLS

8.11 A list of the fire resistance for wall materials of different thickness and finishes is given in Table 8.2.

It should be noted that the materials included in this list are the traditional building materials (in the concept of modern building techniques) and do not include such materials as:

cement/murum blocks
mud and wattle
mangrove poles/coral/and
locally made sunbaked bricks.

Clearly there is a need for a local testing organisation whereby other local forms of construction and materials can be tested and a fire resistance or even non-combustibility determined.

8.12 The use of timber construction is also not included in this table. Thus unless the building is surrounded by a space 3.05m to the nearest boundary such a material cannot be used. There is an embryonic timber construction industry in Kenya which could be useful in the low-cost housing markets, but there is a dearth of local knowledge of the fire resistance of such structures. The Study Team have held discussions with an international expert on the use of timber in building construction* from which the following information was gained:-

a) the use of a plasterboard internal lining to a timber framed construction will give a half hour fire resistance.

* Mr. C.R. Francis B.E., C.ENG, MICE, FNZIE - UNIDO Expert with the Forest Department.

TABLE 8.2 - PROVISIONS PRESCRIBING NOTIONAL PERIODS OF FIRE RESISTANCE FOR VARIOUS TYPES OF CONSTRUCTION

TABLE A1(5)

Construction	Minimum thickness in mm (excluding plaster) for period of hours				
	6hrs	4hrs	2hrs	1hr	½hr
SOLID CONSTRUCTION -					
- Stone, bonded and coursed; bricks of clay, concrete or sand. Lime: No plaster	200	200*	200**	100	100
- Concrete blocks:					
Class 1 Aggregate: No plaster			100	75	65
Plastered at least 12mm thick on each side			100	65	50
Class 2 Aggregate: No plaster				100	75
Plastered at least 12mm thick on each side			100	75	50
- Reingorced Concrete					
Aggregate with reinforcement (in two layers in walls or 125mm in thickness) in two directions spaced not further apart than 150mm centres, the volume of which is not less than 0.2 per cent of the volume of the concrete, with minimum concrete cover of 25mm	230	175	100	75	75
HOLLOW BLOCK CONSTRUCTION					
- Concrete Blocks					
Plastered at least 12mm thick on each side and 1 cell in wall thickness:					
Class 1 Aggregate		220	115	75	65
Class 2 Aggregate				220	75

* where plastered at least 12mm thick on each side with gypsum/vermiculite plaster not leaner than 1:2 and where the wall does not exceed 3m either in height or length, the thickness for this period may be 100mm.

** Where plastered at least 12mm thick on each side and where the wall does not exceed 3m. either in height or length, the thickness for this period may be 100mm.

TABLE A2(5)

HOLLOW STUD PARTITIONS

Construction	Minimum thickness of plaster in mm on each face for period of hours			
	4hrs	2hrs	1hr	½hr
STEEL OR TIMBER STUDDING:-				
Plaster on timber or metal lathing:				
- Portland cement plaster				
- Portland cement lime plaster or gypsum plaster			20	12
Plaster board with or without gypsum plaster:				
- 10mm thick plaster board on each side				5mm(neat single coat)
- 10mm thick perforated plaster board on each side			12	
- 12mm thick plaster board on each side			NIL	
- 20mm thick plaster board on each side			10	NIL
- Two 10mm thick plaster boards on each side			NIL	

NOTE: Class 1 Aggregate means pumice, crushed brick and burnt clay products including expanded clay and crushed limestone.

Class 2 Aggregate means flint, gravel, granite and all crushed natural stone other than limestone.

Source: Building Code 1968. Fourth Schedule Tables A(1) a(2) Walls and Partitions - modified to apply to low-cost housing and converted to metric sizes.

b) The fixing of vertical timber plank and cladding on the external face of a timber framed building reduces its liability to ignition from external fire hazards.

8.13 Roofs of low-cost houses under the Grade I By-laws shall, in terms of the fire regulations;

8/S - be so covered, or the building shall be so isolated from other buildings, as to afford adequate protection against the spread of fire into the building or to adjoining buildings (By-law 94(2)).

Therefore the requirements can be satisfied if either the roof is constructed of the following materials:-

(a) natural slates, or slabs of stone;

(b) tiles or slabs of burnt lay or concrete;

(c) slates, tiles or sheets of asbestos cement;

(d) corrugated sheets of galvanized steel, or of other not less suitable material, of an approved thickness;

(e) metal sheeting covered on both inner and outer surfaces with bituminous material, or a similar approved weather-resisting protective covering;

(f) glass tiles or sheets, or glass bricks or blocks in concrete or metal frames;

(g) lead, copper, zinc or aluminium, of an approved thickness;

(h) asphalt mastic with sanded or gravelled finish containing not less than 83 per cent of mineral matter and laid not less than ¾ in. thick on a suitable base;

(i) asbestos based roofing felt which conforms with British Standard 747;

(j) organic based roofing felt laid directly on a base of non-combustible material, not less than ½ in. thick; and

(k) organic based roofing felt covered with non-combustible material, not less than ½ in. thick, or with bituminous mecadam composed of fine gravel or stone chippings with not greater than 7 per cent of bituminous material.

or if the distance between the building and the boundary of the nearest adjacent plot is not less than 3.05m (By-law 94(4)).

8.14 CONCLUSIONS

8.14.1 The control of fire spread in both individual houses and in housing estates (especially high density estates) is of very great importance both to the home owner and his neighbours. We have already examined the incidence of incidental fires in both Mombasa and Nairobi. Whilst the costs of fires in low-cost housing, within the total reported fire losses of an urban area, may not be high the actual loss to the home owner could be enormous and calamatous - particularly when he is not insured and therefore has to find the money to rebuild his shelter.

8.14.2 Discussion Paper DP.1 (Chapter 3) also refers to the reported shortage of equipment and fire stations. Thus the chances of immediate professional fire fighting are small. The comments of the Chief Fire Officer of Nairobi to the Study Team are of interest. He recommends the following provision particularly in low-cost housing schemes:-

1) All houses, no matter how small they are, should have access roads. They should be accessible from both front and back. The roads should be wide enough to allow their trucks to enter into the premises.

2) Sufficient water and water hydrants for fire fighting should be provided in the estates.

3) All electrical wiring should be in conduits. Sufficient number of sockets should be provided to avoid overloading points.

4) Cooking facilities should be separated from living areas. Cooking space should be at least 3 x 1.83m.

5) Building materials should be fire resistant. Retardant paints and special ceilings should be used. Partition walls should be built up to the roof.

6) Since fire spreads more easily through the roofs, roofing materials should have good resistance to fire. Materials such as iron sheets, asbestos sheets, aluminium sheets, concrete and clay tiles are recommended.

7) Water hydrants for fire fighting purposes should be situated along the roads at distances not exceeding 120m. The mains should form rings and the diameter should not be less than 100mm.

8) Houses should have a fire resistance of not less than two hours to avoid the spread of fire.

Almost all the suggestions are good and practical except for the requirement that all houses should have direct road access. Whilst we shall examine this aspect of low-cost housing in Discussion Paper DP.6. Environmental and Site Planning, it is already apparent that such a proposal is extemely difficult to implement in squatter up-grading schemes.

The other suggestion[8] that all houses have a fire resistance of not less than 2 hours is quite impractical in terms of low-cost housing as the Government conceives such housing as it would seriously restrict the materials that could be used in such housing (see Table 8.2).

8.14.3 Accepting the need to control the spread of fire (in that outbreaks of fire are impossible to control due to human falibility) then the regulations presently embodied in the Building Code are satisfactory with one exception - the range of materials and forms of construction for which fire resistances are known is too restricted for low-cost housing in Kenya. Many of the traditional Kenya building materials and forms of construction plus some recent ones (murrum/cement blocks, sun dried bricks, mud and wattle, mangrove poles, coral and mud and timber construction) are not as far as we know covered by international standards. It would therefore be necessary to develop a local testing system similar to the Building Research Establishment in the U.K. We would suggest that such an organisation should be developed in the Ministry of Works.

8.14.4 In a low-cost house where jikos and paraffin stoves are used for cooking (and sometimes heating purposes) the dangers of fire outbreaks are high if the cooking is done of the floor of rooms. The use of raised concrete cooking slabs either in a kitchen, in a semi-open cooking space or in rooms would reduce the chances of the fire source being knocked over.

CHAPTER 9

SERVICES WITHIN THE PLOT

9.1 Introduction.

The services within the plot comprise:

- water supply
- sewage and waste water collection and disposal from the plot
- stormwater drainage
- electricity supply.

within the dwelling such services comprise:

- sanitary appliances
- kitchen water supply and sinks
- water
- water storage
- electrical installations

of these services the most critical to the well-being of the occupants of low-cost housing are:

i) the supply of potable water

ii) the disposal of human wastes and foul water.

9.2 Water supply.

9.2.1 The supply of water to a dwelling is controlled by By-laws 143 to 149 of the Building Code. Often these requirements are amended, revised or expanded by the local authority especially if it manges the supply of water within its authority.

9.2.2 The principal requirements are:

a. all plans to show an approved supply of wholesome water sufficient for the purposes of the building (By-law 143(1)

b. the water installation to comply with the British Code of Practice CP310, although the local council may specify other standards where the materials to be used are not included in the British Standard specification. (143(2)).

c. all installations shall be capable of sustaining a working pressure of 300lb/sqin. (21k/cm^2) (143(3))

d. unless the council agree every building shall be provided with a stored supply of cold water for domestic purposes which, for a house, shall be not less than 100 gallons (454 litres). Such tanks shall be protected against mosquito breeding and contamination. (By-law 143(5)).

e. water used for human consumption is drawn direct from a rising main unless the council give written permission otherwise.

f. every dwelling shall have all approved stop-tap between the council's water mains and the premises (By-law 144)

g. every storage tank shall have an overflow pipe discharging in a conspicuous position (By-law 145)

9.2.3 Water supply is provided in housing development through either commercial water points or kiosks, or individual house connexions. In the latter case there are housing schemes served by bulk metres especially in institutional housing estates and those served by individual metres, for instance those houses meant for rental or tenant purchase. However we have already commented upon the potential for contamination of stored water collected from commercial water points, kiosks or standpipes 1/. Therefore it should be the aim to provide piped water supplies to each plot and into the dwelling in all low-cost housing schemes. This would have the added advantages that effective water control would be excercised, direct charging methods can be effected and that water borne sanitation systems can be introduced.

1/ Discussion Paper DP2 Environmental Health. APPENDIX II,3 - Water supplies, KBLS November, 1979.

9.2.4 Normally individual houses are supplied through galvanised tubing of 20mm in diameter unless bigger diameters are warranted. While water to the kitchen is tapped directly from the incoming pipe, other areas in the house such as toilets, showers and splash basins can be supplied through a domestic water storage tank installed at some elevated place in the house.

The function of this storage tank is twofold:

- to ensure water for flushing toilets and other uses is available when short-duration breakdowns occur in the supply system.
- to provide adequate operating pressure at fixtures within the house.

The size of such a tank is based on 24-hour water demand for the household subject to a minimum size of 250 litres, which is the smallest available in the country.

9.2.5 The table given below shows comparison cost figures between galvanised sheet-metal domestic storage tanks and those made of asbestos-cement. These are currently available in Kenya.

Size (litres)	g.i. tanks	a-c. tanks
250	Kshs. 300	Kshs. -
350	400	450
450	450	700
1200	1000	1400
1500	1500	-

9.2.6 In order to consider alternatives to individual storage of water on the plot we investigated the alternative of bulk storage to serve the development. However the cost of bulk storage as installed cannot

make a direct and fair comparison to domestic storage tanks in that the size of the tank, the number and capacity of booster pumps and associated pipework, the type of materials used for the tower and the foundations will be generally influenced by the location, the site conditions, the number of persons to be supplied and aesthetic consideration as well. A storage tank with a capacity of 17,800 litres will cost Kshs. 55,000/= at present. This figure, however, does not take into account installation charges, the cost of pumping, piping, or the structural tower and not forgetting the fact that such a tank will only suffice for 20 plots.

The disadvantages of bulk storage vis-a-vis domestic units are:

- increased capital cost of water supply system for a given area.
- added maintenance expenses on the reticulation
- high risk of total "water-blackout" in cases of breakdowns.

9.2.7 The ability to store water in a dwelling so that, in a case of a water supply failure, water can be provided for a temporary period is essential ESPECIALLY if a water-borne sewage system is used. The alternative in a time of failure would be to supply water from a mobile tanker. This would be possible for the supply of drinking water, but would NOT work with a sewerage system which required a specific flow of water to carry the solid wastes. Therefore we believe that:

a. if a sewerage system is used then some form of water storage facilities must be provided
b. if no water storage facilities are provided then an alternative non-water borne sewage disposal system should be used.

9.2.8 The sizing of cold water supply pipes is based on the minimum pressure at the highest fixture of about 0.6 kg/cm^2. Under all circumstances the pressure at any fixture should not exceed 5 kg/cm^2. The maximum flow velocity is 3.0m/sec. to avoid objectionable noice. Flow rates vary from fixture to fixture as shown below:

wc flushing cistern	0.12 l/s
wash basin	0.15
private bath	0.30
shower	0.12
sink (depending on tap-sizes)	0.2 - 0.6

9.3 Sewage.

9.3.1 Sewage from a house is mainly composed of human waste and waste water.

9.3.2 The requirements for either its disposal on the plot or conveyance for disposal elsewhere are specified in By-laws 167 to 210 of Building Code, The Public Health (Drainage and Latrine) Rules (Rev. 1972) and as an overiding control Part IX (Sanitation and Housing) of the Public Health Act (1972).

Both the Building Code and the Drainage and Latrine Rules determine the technical requirements of installation whilst the Part IX of the Public Health Act gives the Medical Officer of Health power to decide that installations are unsatisfactory and to declare the building unfit.

9.3.3 The existing legislation permit the following forms of sewage conveyance and treatment:

i) conveyance by sewers to off-plot treatment works
ii) septic tanks on plots
iii) conservancy tanks on plots
iv) pit closets (pit latrines).

It is the objective of the Government that all urban areas shall be served by water-borne sewerage systems. However as not all existing or potential areas for development in urban areas are fully served by such schemes then alternatives have to be considered unless housing development is to be delayed.

9.3.4 The most common alternatives are:

a. septic tanks which constitute small scale 'treatment works' for sewage. They may be individual (ie. on the plot) or communual (ie. serving groups or all the dwellings on the estate). Whilst some treatment has occured the effluent is normally very pathogenic. Therefore the effluent has to be carefully disposed of. This can be done in three ways:

i) by discharge through land drains. This is only possible where there is sufficient space to accommodate the drains and the soil is freely draining.

ii) by discharge to a soakaway pit (cf Mombasa), but again the sub-soil has to be capable of absorbing the liquid.

iii) by conveyance through a system of small-bore (100-150mm) pipes to a communal discharge point, which because they contain no solids will be easier and cheaper to lay.

b. conservancy tanks which, in theory, are water-proof tanks which contain the sewage until it is pumped out.

c. pit latrines which enable some treatment to take place but do fill-up and have to be either pumped-out or abandoned. It should be noted that there is a considerable body of objection to the continued and future use of pit latrines in Kenya.

9.3.5 Discussion Paper DP2 - ENVIRONMENTAL HEALTH contained a number of suggestions for alternatives and improvements to existing forms 2/. However as we have had no feed-back from the working Party on this paper (due to the fact that it has not discussed the Paper) we are unable to comment further on these suggestions.

9.3.6 Due to the need to conserve land (ie. produce minimum plot sizes) in urban low-cost housing layouts it is not possible for the traditional individual septic tank be considered. The need to move the traditional pit latrine (over and above the official objections to its use) also prohibits its use in high density low-cost housing. Therefore, prior to comments on other possible systems of sewage disposal, we are left with some form of sewerage system with treatment occuring off-plot.

9.3.7 Sewage, containing both liquids and wastes, is normally conveyed through a drain pipe of a minimum of 100mm diameter to a public sewer whence it is transported either to the town's sewage treatment works or to the estates septic tanks. The drain pipes may be of pitch fibre, steel, cast iron, asbestos cement, concrete or P.V.C.

2/ DP2 Appendix II KBLS November 1979

The 'rule-of thumb' gradients for house connections for the two commonly adopted sizes are

100mm	1:40
150mm	1:60.

However there is a degree of variation allowed in these gradients in practice and a 150mm drain may be laid to a minimum gradient of 1:80 and still produce a self-cleansing velocity.

9.3.8 An inspection chamber is required by all local authorities prior to the connection of the drain to a public sewer. This chamber has to be located within the plot to facilitate the cleaning of blockages. Manholes have also to be provided at every junction, change of direction, gradient or pipe size.

The connection to the sewer is by Y-junctions or saddle connections. The drain is ventilated by a 75mm ventilation pipe connected to the nearest inspection chamber.

9.3.9 Within the houses, sanitary pipe-sizes and materials vary according to the appliances to which they are connected, e.g.

wc	100mm. diam. (cast iron, steel).
shower)	
kitchen sink)	
wash basin)	50mm. diam. (steel)
splash area)	

9.4 Waste water disposal.

9.4.1 Waste water is defined as water discharged from a sink, shower or lavatory basin has to be conveyed to a sewer by means of discharge from a waste pipe over a trapped gulley and thence to the drainage system of the plot by means of normally a 100m drain. It is important that waste water from a kitchen or cooking area ishandled in a such a manner.

9.4.2 The rural practice of throwing waste water from food preparation or washing clothes onto the soil (either within the plot or outside it) must be discouraged. Where, in non-water borne, sewage disposal systems an excess of water is not required in the container then waste-water must be piped to a properly constructed soak-away pit.

9.5 Wayleaves.

9.5.1 It is interesting to note that the majority of site-and-service schemes have the sewers at the rear of the plots. 3/ This is logical in that in most low-cost housing developments the kitchen, w.c and shower unit is placed at the rear of the plot i.e furthest from the entrance. As a result the position of the sewer is closest to the drainage sources and connections are shortest. However sewers are sited in public land or land to which the public (i.e the local authority) has access. Therefore to accommodate such a public sewer at the rear of the plot necessitates either a public strip of land or a public wayleave - that is a stretch of private land to which the local authority has access for maintenance purposes. In terms of finding the most economical use of the site in low-cost housing schemes wayleaves across private land have, in most cases,been utilized. This aspect of site planning will be discussed in more detail in Discussion DP6 ENVIRONMENTAL AND SITE PLANNING, but within the context of this paper the effects of the wayleave upon the plot development and on-plot sewerage requirements is relevant.

3/ Evaluation of site and services programme in Kenya HRDU University of Nairobi (Draft: July 1979), plus observations by the Study Team.

9.5.2 The wayleave is normally 3m wide which is sufficient to enable maintanance work to be undertaken. Within this area no buildings may be constructed so as not to interrupt access. However it has been observed that wayleaves across private land do have boundary walls or fences crossing them.

9.5.3 We understand that in Dandora Phase II the local authority has required two such wayleaves - one for the sewer and one for the water supply (which follows the same alignment). We see no practical reasons for this as both a water main (at a depth of 0.5m) and a sewer (at a minimum depth of 1.20m) can be accommodated and there is little chance pollution to the water supply.

9.5.4 If such a sewer wayleave is proposed then in the development of the plot and consideration of its minimum size it must be accepted that some $45m^2$ (as for a $100m^2$ plot 15m wide) or 45% of the plot would be sterilised for building. Obviously by careful plot planning this area could be incorporated wholly or in part in the private open space.

9.6 Stormwater drainage will be dealth with in DP6.

9.7 Electricity supply and electrical installations are controlled by E.A.P.& L. We have already indicated the importance of security lighting in the public areas of low-cost housing. Such a provision is normally considered of a high priority in user-reaction studies of low-cost housing schemes. Assuming such a provision of security lighting it is the normal practice for the E.A.P.& L. to make connections to houses upon individual application. The E.A.P.&.L. are thereafter responsible for the proper wiring and provision of socket outlets in the dwelling.

9.7.1 The second highest known source of fires in Nairobi (1976-78 4/ are electrical fires which are caused by short circuits. In low-cost housing such fires are often caused by the overloading of the few socket outlets provided. Where sub-letting is permitted there will be considerable use of a radio, T.V or even a record/ tape recorder in the rooms. To accommodate such loads at least two sockets should be provided in each room.

4/ Discussion Paper DP1 - ECONOMICS OF BUILDING CONTROL Chapter 3 - Fire Hazards: KBLS November 1979

CHAPTER 10

DESIGN AND LAYOUT ASPECTS

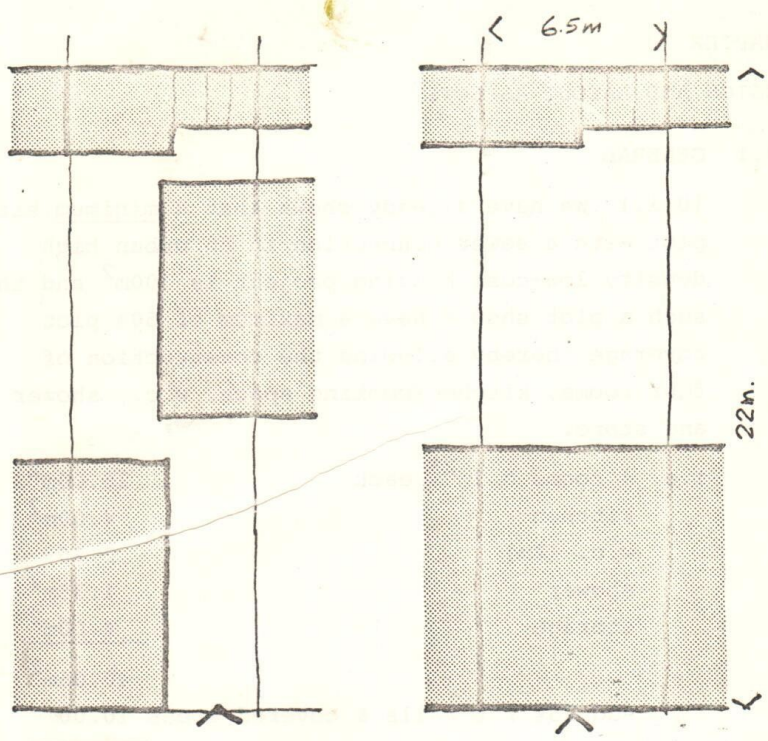
10.1 GENERAL

10.1.1 We have already shown that a minimum sized plot with a sewer connection in an urban high density low-cost housing project is 100m^2 and that such a plot should have a maximum of 50% plot coverage thereby allowing the construction of four rooms, kitchen/cooking space, w.c., shower and store.

i.e. 4 rooms @ 7m^{2*} each	28.00m^2
kitchen	4.00m^2
w.c. (2m)	2.70
shower	1.35m^2
storage	4.00m^2
	40.05m^2
Add 25% for walls & covered areas	10.00
Total	50.05m^2

10.1.2 To obtain the maximum use of the plot it will necessary to arrange this accommodation in such a way that the unbuilt space provides the most useful areas for open air activities. To achieve this objective, especially on the minimum sized plots, it will be necessary to site the building on a terraced or semi-detached manner. Both of these terms should be considered, not in the normally accepted terms, but more accurately as attached one-side or attached both sides.See Figure 10.1.

Note* this provision does not conform to the present by-law requirement that one room should be 120sqft. (11.15m^2) - with sub-let dwelling such a requirement seems unnecessary.



Semi-detached layout Attached layout

FIG.10.1. ALTERNATIVE LAYOUTS ON MINIMUM PLOTS
Based upon alternative site development layouts
for NAIROBI Dandora Phase 1 Site and Services Scheme

These basic forms of layout have two advantages:

i) they provide the maximum area of useable private open space

ii) they enable buildings to be designed which allow sub-letting i.e. individual access from each room to the open air.

10.1.3 Such forms for individual self-built houses do create the problem of party walls. From our discussions with development agencies of site-and-services schemes (particularly Dandora) we have been told that the plot owners object to the concept of shared walls. Each plot owner wishes to have his (or her) own wall, thereby precluding their neighbours from having any interests in their building. In addition individual walls allow alterations and extensions to be made on each plot without party-wall legal agreements and the possibility of disagreement between neighbours. Certainly such a concept, if used properly, reduces the dangers of fire spread through roof timbers. However it is very important that there either be no gap between the two walls or that any gap be permanently sealed both at the sides and at the top to stop it being used as a dumping ground for refuse or for harbouring vermin.

10.2 VENTILATION.

10.2.1 The use of the basic house layouts described above does create potential problems with the requirements for ventilation.

These requirements in respect of single storey low-cost housing are set out in both the Building Code (By-laws 150-157 and 190) and in the Public Health Act. (Drainage and Latrine Rules) Rule 59.

The princpal requirements of this legislation are:

1. All domestic buildings shall be fitted with approved means of ventilation (By-law 150)
2. Each habitable room windows shall be constructed so that an area equivalent to 1/20th of the floor area can be apened and such an area shall not be lower than 5ft 9in (1.75m) above the floor (By-law 151(3)).

The Grade II By-laws also require that a minimum of 1/20th of the floor shall be provided as opening lights in windows but with addition that this standard is also applied to the kitchen, roofed bathroom and latrine. (By-law 13).

3. Such windows shall be considered to open onto the external air if:
   a. it faces the plot boundary
   b. it faces onto a street or public open space
   c. it opens onto an internal open space in the same plot which is not less than 8ft (2.4m) wide or the wall in which the window is situated does not intersect with a line taken at an angle of 68^{o} taken from a point on the wall opposite 5ft (1.5m) above the floor of the (see Figure 10.2). (By-law 152 (1))
4. No person shall erect a back-to-back dwelling (By-law 153) which is defined as a dwelling with:
   a. only one external wall containg door and/or window openings
   b. a least two parallel external walls not containing door and/or window openings
   c. approved through-ventilation cannot be obtained in every habitable room. (By-law 154(1)).
5. Approved through-ventilation may be obtained by communication to one external wall by way of a lobby or passage which is itself adequately ventilated. (By-law 154(2)).The Grade II By-laws require that every habitable room kitchen, roofed bathroom and latrine shall be provided with through or cross ventilation by means of openings which give direct access to the external air and that the aggregate area of such openings shall be not less than 1/100th of the floor area of such rooms.
6. <u>If required by the Council</u> every habitable room shall have a sufficient number (undefined) of permanent air vents to ensure cross ventilation to the external air which shall be at a height of not less than 2/3rd of the average height of the room. Such cross ventilation may be either by:

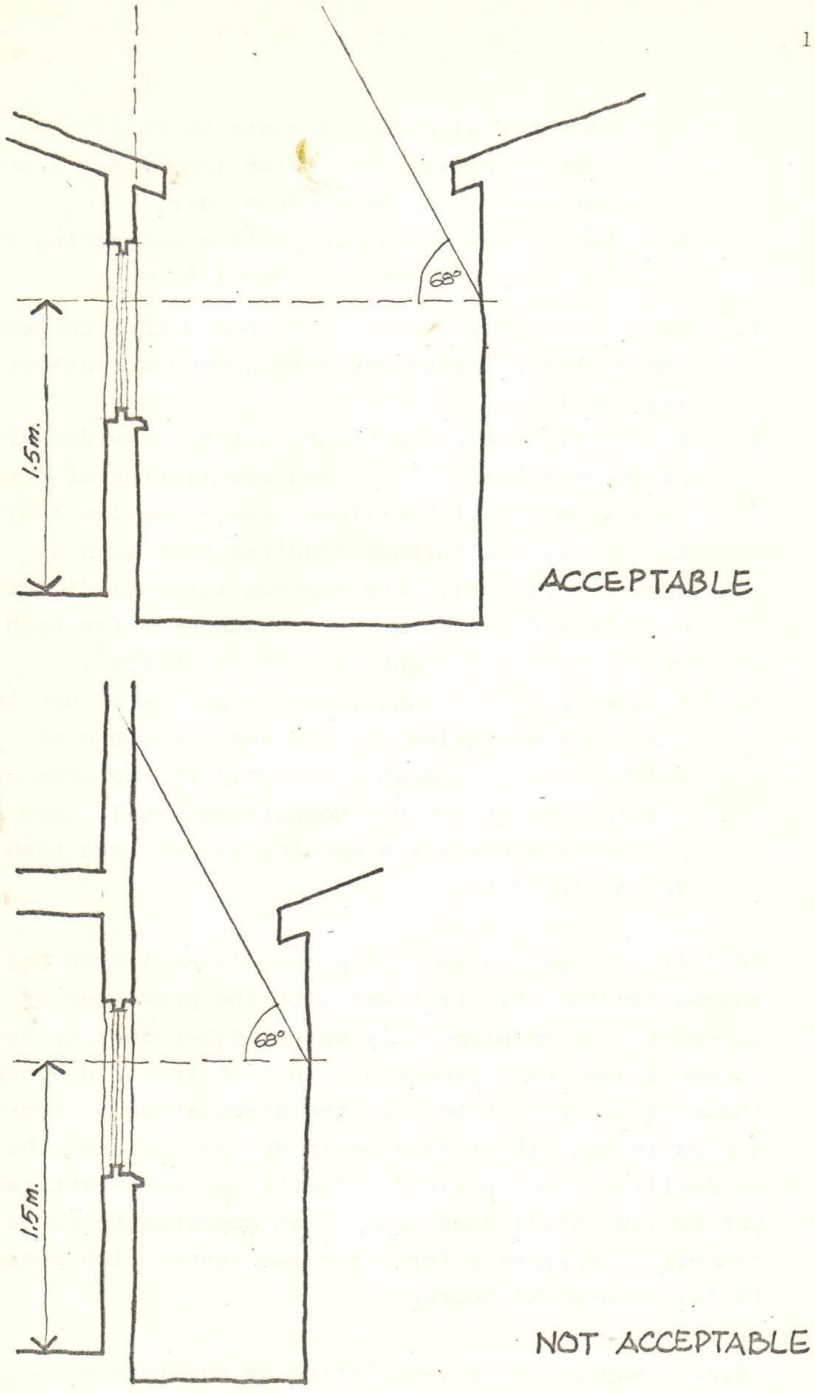


FIG. 10.2 EXPLANATION OF BY-LAW 152(1)

a. one external wall and vents to ventilated lobby or passage way which itself has direct ventilation to the external air.
b. the council may accept a flue connecting directly with the open air. (By-law 155).

7. Every kitchen and habitable room with a cooking space shall be provided with approved ventilation. (By-law 156)
8. A w.c. or choo compartment must be provided with an opening for lighting and ventilation of not less than 10% of the floor area. (By-law 190(2)) As this By-law further requires that such a compartment shall have minimum internal dimensions of 1.4m x 0.76m then the minimum area for both ventilation and lighting will be 1064cm^2.
9. W.C. compartments shall have a window of not less than 1858cm^2 exclusive of frame the whole of which shall be openable directly to the open air, and in addition such a compartment shall have a permanent ventilation opening of not less than 929cm^2 (Rule 59).

10.2.2. The provision of 'approved'ventilation has caused considerable problems with the provision of low-cost housing especially where higher density developments have been proposed. In fact it would appear that there is a conflict between the description of back-to-back houses in that it is assumed in By-law 153 that the types of dwellings so described cannot have cross-ventilation yet By-law 155(3) does provide an opportunity for a local council to approve a form of cross ventilation possible in 'back-to-back' houses.

10.2.3 Why is cross-ventilation or any form of ventilation important? We have already indicated that, in the Kenyan context, there is little or no correlation between standards of ventilation and ill-health, but that ventilation is concerned with levels of human comfort.

Even here one must add a proviso in that, as we have shown in Chapter 6, the demands for ventilated human comfort in the temperate zone (where the majority of urban areas lie) are not so critical as in the hot-humid and hot-dry climatic zones.

10.2.4 The provision for ventilation can therefore take two forms:

- 'permanent' ventilation in the form of screened bricks or unglazed shutters
- 'temporary' ventilation by use of openable windows or louvres.

Note: The description 'permanent ventilation' is a misnomer in that any occupant of a habitable room can if they so wish block-up a 'permanent' ventilator.

The permanent ventilators are primarily to ensure a movement of air into and out of the room- this will be achieved by the provision of at least 2 standard screened air bricks in the walls at a high level, which together with the normal spaces around doors and windows will allow air changes to take place and thereby the chances of suffocation or the retention of expired air removed . The temporary ventilation permits a movement of air through the room which both physically and psychologically produces a cooling effect - such a situation is improved if local breezes can be guided into the dwelling. Where such a facility is provided by openable windows it must be accepted that such ventilation is controlled by the occupants and at night the desire for security and for the absence of insects normally results in all windows being closed.

10.2.5 One of the critical factors in ventilation in low-cost housing is the extensive use of g.c.i for roofing. This material, unless a ceiling is provided or it is heavily insulated internally, is one of the worst transmitters of solar heat into the dwelling. Even where ceilings are provided there will be a build-up of hotter air close to the underside of the roof. It will therefore be necessary for this heat to be allowed to escape and thereby draw in cooler air at lower levels.

Thus in many ways a roof ventilator as proposed in By-law 155(3) has greater advantages over windows in walls.

10.2.6 It is understood that the interpretation of the ventilation requirements is, too often, the provision of windows in opposite walls. This is ideal in terms of cross ventilation yet except in the hot-humid climates of the coast and the lake area it is NOT essential.

10.2.7 We therefore believe that the local authorities must examine the ventilation proposals of low-cost housing with much more open minds and decide whether or not the proposals satisfy the spirit of the requirement of not.

10.2.8 In enclosed kitchens, and where cooking is done in sub-let rooms then the basic ventilation requirements are complicated by the addition of potentially dangerous fumes from jikos or kerosene stoves. In rooms used only for food preparation and cooking it is recommended that <u>either</u> an area of permanent ventilation of not less than $0.5m^2$ be provided <u>or</u> a flue be provided over a cooking slab. Where cooking takes place in sub-let rooms a flue must be provided over a cooking slab (see Chapter 5, Para 5.2.7.) The provision of a covered, but NOT totally enclosed, outside cooking area obviates all the requirements of vemtilation.

10.2.9 The ventilation of a w.c. or choo compartment is extremely important and we do not disagree with the present requirements of the Building Code (By-law 190) and the Public Health Act.

10.3 LIGHTING.

10.3.1 The lighting of single storey low-cost housing is covered by By-laws 150, 151, 152, and 162 of the Building Code of which the principal requirements are:

a. every habitable room shall have a window or windows opening directly onto the external with a total area, exclusive of frames, equal to 1/10th of the floor area of the room. (By-law 151(1))

It should be noted that this requirement is also specified in the Grade II By-laws (By-law 13) with the addition that the same requirements are also applied to the kitchen, roofed bathroom and latrine.

b. where an open verandah or canopy extends from the wall containing the window then the total area of the window (exclusive of frame) shall be icreased by 5% for each 1ft (30.5cm) that the canopy or covered verandah extends from that wall. (By-law 151 (2)).

c. the requirements for windows opening onto a courtyard apply as previously described and illustrated (see para 10.2.1 (3c)).

d. kitchens shall be provided with approved light (By-law 156(4))

e. no window or other higed or moveable part (ie. shutters) below 2.9m above the adjacent ground level shall open out onto any street, public open space or common access. (By-law 162).

10.3.2 These requirements tend to be standard throughout most temperate lands. It is however considered necessary perhaps to reconsider the minimum area of windows in hot-humid and hot-dry climates as discussed in Chapter 6. In addition one wonders whether the specific reference to a window (normally mentally associated with glazed openings) is not too precise and that another description to also allow unglazed timber shutters would give a greater scope for satisfactory variations to accommodate the demands of specific climatic areas.

10.4 HEIGHTS OF ROOMS

10.4.1 The requirements of the Building Code in respect of room heights are:

a. habitable rooms

Every room shall have an average height of not less than 2.43m provided that:

i) under a sloping roof it shall be at least 2.43m high over $7m^2$ or 50% of the floor area (whichever

is the greater) measured at height of 1.5m above the floor.

ii) the height shall be increased to 2.74m below 1220m altitude above sea level.

By-law 159.

In Scheduled Special Areas the average height of habitable rooms if a ceiling is provided shall not be less than 2.36m with a minimum height of 2.13m over not more than 25% of the floor area. If a ceiling or similar insulation is not provided the average height measured to the underside of the roof covering shall be not less than 2.54m with a minimum height of 2.28m over not more than 25% of the room. (By-law 225).

For Grade II By-law areas the minimum average height of habitable rooms shall be:

where ceiling is provided - not less than 2.36m with a minimum height of 2.13m.
where a ceiling is not provided - not less than 2.51m with a minimum height of 1.13m. (By-law 10(1)).

b. kitchens.

Every kitchen shall have a floor to ceiling height of not less than 2.43m. (By-law 156(2))
No specific requirements are proposed for kitchens in the by-laws for Scheduled Special Areas and thus it could be assumed that By-law 156(2) would apply but as the average height for a habitable room with a ceiling is 2.36m then there would be a conflict unless ceilings are specifically excluded from kitchens.

In areas to which Grade II By-laws apply kitchens must have a minimum height of 2.13m to the underside of the roof or ceiling (By-law 11).

c. W.C. compartments and/or showers, and stores, the minimum height shall be 2.13m. (By-law 160)

No minimum heights are defined for Scheduled Special Areas.

In areas to which Grade II By-laws apply the minimum internal height for a latrine compartment is defined 1.98m (By-law 8(2)). The same minimum internal dimension is also specified for a bathroom (By-law 12).

10.4.2 It is interesting to note that in By-law 159(iii) one finds the first reference to a varation due to an implied climatic variation and this altitude criteria would make this variation apply to the hot-humid and hot-dry climatic zones defined in Chapter 6. It is difficult to determine whether this requirement applies to the Scheduled Special Areas. Because no specific variation is stated for such Areas one must assume that it does apply. Certainly it would not apply in areas to which Grade II By-laws are accepted. However from the comments made in Chapter 6 we believe that the provision of a separate ceiling under sheeted roofs or the avoidance of sheeted roofs in hot-humid and hot-dry climatic zones is much more important than the heights of rooms. We would therefore recommend that for low cost housing in hot-humid and hot-dry zones a minimum average height of 2.4m (as defined in By-law 225) should be required in rooms with a ceiling and the height raised to 2.7m under sheeted roofs without a ceiling.

10.4.3 In kitchens (ie. enclosed rooms) the additional potential heat from the cooker makes the height of the room more critical. We therefore recommed that (together with adequate ventilation) the minimum height of 2.36m should apply.

10.4.4 For W.C.'s and shower rooms a minimum height of 2.13m should be applied. However the need to provide water storage facilities could affect this dimension particularly where it is necessary to establish a head of water sufficient to operate a shower. (say 1m). However these are minimum dimensions not ideal dimensions.

CHAPTER 11

CONCLUSIONS

11.1 Introduction:

In Chapter 1 we stated that the objective of building legislation is not to design ideal buildings, but to determine the minimum acceptable standards compatable with the needs of the occupant of the dwelling and to safeguard the interests of the general public. We have been informed that the application of minimum standards for low-cost housing, to help the poorest members of the community, would also enable the speculators to increase their profits even further. We accept that this is possible, but believe that it is more important for the low-income housing programme, as defined by the Government, to be assisted. If by so doing some other developers obtain extra profits - so be it. Having accepted that possibility it is also necessary to find a means of ensuring that the benefits of such revised standards do benefit those for whom they are intended. This we believe is possible.

11.2 Legislation:

11.2.1 Throughout this paper we have quoted extensively from the Local Government (Adoptive By-laws) (Building) Order 1968 (often referred to unofficially as Grade I By-laws) and have made special reference to By-laws 215-227 which apply to Scheduled Special Areas. In addition we have also referred to The Local Government (Adoptive By-laws) (Grade II Building) Order 1968. All this legislation has the overall title of the Building Code.

11.2.2 For low-cost housing (especially site and services schemes, and squatter upgrading projects) it has been normal to try to apply the Grade II By-laws. This has not always been successful for

two reasons:

a. the resistance of many councils to the adoption (or even acceptance) of the Grade II by-laws on the grounds that these only apply to rural as opposed to urban developments and therefore produce 'sub-standard' buildings.

b. where such By-laws are adopted and accepted there are often conflicts or omissions within them that have to be plugged by reference to the'Grade I' By-laws. 1/

11.2.3 We conclude therefore that the Grade II By-laws should not be applied to low-cost urban housing, but should be used for the development of the peri-urban areas whilst they remain predominantly agricultural.

11.2.4 For urban areas the requirements of the by-laws applying to Scheduled Special Areas (By-laws 215-227) should be expanded, clarified and ammended. Such a proposal has many advantages:

i) it will not create new legislation
ii) it can be implemented by order of the Minister of Local Government and Urban Development under regulation 210 of the Local Government Regulations 1963.
iii) the 'taint' associated with the Grade II By-laws will not apply.
iv) the existing by-laws for Scheduled Special Areas already, by their definition, apply to high density or low-cost residential areas.
v) only those aspects which conflict with the other By-laws need to be defined by specific by-laws.

1/ See Minutes of the Works & Town Planning Committee, Nairobi City Council, 23rd February 1978 - item 18 Housing Standards and Options.

vi) a local authority can define the areas to which these new requirements shall apply as stated in By-law 215 and thereby control the concern expressed in paragraph 11.1 above.

vii) on a small, but important point, as the by-laws 215 to 227 lie almost at the end of the 'Grade I' By-laws it will only be necessary to re-number by-laws 228-259 PART IV ADVERTISEMENTS.

11.2.5 The existing by-laws do give considerable latitude to local concils to consider alternative materials, methods of construction and interpretation of specific by-laws and from experience we know that this is sometimes done. However too often, where sufficient staff of the right calibre are not available there is what we would describe as 'a lack of professional confidence'. That is the officer lacks sufficient experience and confidence in his professional judgement to decide upon solutions which do not conform to the traditional solution or the detailed solution given in a by-law or the schedules at the end of the 'Grade I' By-laws. In the manpower situation already described, this situation is unlikely to improve in the near future.2/ It is therefore necessary to create by-laws which, whilst ensuring that basic minimum standards are maintained in the public's interest, do give latitude for the designer to respond to changing socio/economic situations with regard to public and private needs, ideas and materials.

11.2.6 It has been suggested to us that a performance specification would satisfy this requirement, but we are concerned that such a provision on its own would only reinforce some of the present criticisms that certain by-laws are 'too vague' necessitating a return to the earlier (and often superseeded)legislation for details. We therefore believe that such a performance specification must be supported by technical advice on the means of satisfying this specification and/or examples of solutions.

2/ Discussion Paper DP4.1 Political & Administrative Aspects KBLS December 1979.

Such a method could incorporate the 'Deemed to satisfy' technique as used in other countries. 3/

11.2.7 This proposal has a number of advantages and disadvantages:

a. advantages:
- the technical advice in the form of a Manual/Handbook is not a legal document and therefore subsequent ammendments and modifications to its contents can be dealt with administratively.
- approval of solutions not included in the Manual/Handbook, but satisfying the requirements of the by-law, does not mean that a local council official is breaking'the law'.
- local authorities in specific climatic zones or because of specific local requirements can easily introduce local variations so long as the basic objective of the by-law is not changed (which would required approval by the Minister of Local Government and Urban Development together with the Minister of Health).
- if such a document is in the form of a loose-leaf book then revisions or ammendments can be easily produced, distributed and incorporated.

b. disadvantages:
- the 'deemed to satisfy' system is much easier to apply where there are relevant and accepted Standard Specifications or Codes of Practice. The lack of such criteria (other than the limited number taken from other countries) especially for local materials and construction methods in Kenya has already been commented upon.
- to ensure that the technical advise is kept up-dated and distributed to the local concils requires a technical committee (drawn from the wealth of professional expertise in Kenya-private, public and academic) together with resources for testing new materials and techniques.

3/ The Building Regulations 1976, UK
Draft Building Regulations, Botswana, Building Research Establishment 1975.

11.3 APPEALS AND AMMENDMENTS

11.3.1 One of the problems of the current building control regulations in Kenya is their apparent inability to successfully accommodate changing national needs - hence this present Study!. Whilst the 'deemed to satisfy' concept, based upon a performance specification defined in the by-laws, goes some way to providing greater flexibility, there is still need for an authority to consider and approve additions and modifications to the 'deemed to satisfy' solutions to the requirements of a particular by-law.

11.3.2 At present there is no quick and efficient system of appeals against the decision of a local authority regarding its interpretation or application of the building control regulations although legislation does, exist to, in theory, permit such appeals:
The Public Health Act 1972.
Rule 126B - A local authority, where it considers that the operation of a by-law would be unreasonable may with the concent of the Minister of Local Government (and Urban Development) and the Minister of Health relax the requirements of the by-law or dispense with its compliance.

Rule 126C (3) - Where there is a disagreement between the local authority and an applicant for building permission as to whether the submitted plans would or would not contravene any of the by-laws then the applicant may refer the matter to a subordinate court of the first class for a determination.

The Housing Act. 1972 - Section 19
The National Housing Corporation has the right to apply to the Minister of Local Government (and Urban Development) to suspend the operation of any by-law inconsistent with the conditions specified by the Corporation for any housing development scheme.

11.3.3 Clearly the only recourse of any private or public applicant for building approval (other than the NHC) is through a first class Magistrate's court. As has been previously stated 4/ such an arrangement is unsatisfactory because of:

a. the lack of technical knowledge and experience of the Magistrate
b. the time taken to get the case heard.

11.3.4 What is needed is technically based appeals machinery which can quickly respond and decide upon conflicts and whose decisions can be ratified by the Minister of Local Government and Urban Development. Such decisions would therefore be applied to all local councils. It is suggested that a techinical committee, supported by full-time administrative/technical staff, be created and it would contain a representative of:

- the Ministry of Housing
- the Ministry of Local Government and Urban Planning
- the ministry of Health
- the Ministry of Works
- the Architectural Association of Kenya
- the Kenya Institute of Engineers
- from one local authority in each of the three climatic zones.

Where such a committee is required to consider the requirements of the by-law (other than 'deemed to satisfy'

4/ Discussion Paper DP 4.2 - LEGAL ASPECTS (Paragraph 4.5) KBLS December, 1979.

solutions) then it should have powers to co-opt a legal advisor.

11.3.5 The critical factor in the use of such a committee is the speed in which it's meetings can be called, the speed of decision making, the speedy ratification of the Minister and the dissemination and application of the decision to all applicable local authorities.

;

11.3.6 Following the Minister's ratification of the committee's decision it is important that, if necessary, a revised technical sheet for the Manual/Handbook be prepared and sent to all local authorities in order to up-date their Manual/Handbooks.

CHAPTER 12

PRELIMINARY TECHNICAL RECOMMENDATIONS

12.1 The word 'preliminary' is used in the title of this section as the examination of all the technical aspects has not yet been completed ie. Discussion Paper DP6 Environmental & Site Planning is to follow. In addition this is a Discussion Paper and the comments of the Working Party will be relevant to the final technical recommendations.

12.2 We would again emphasise that it is not the objective of either our investigations or the proposed by-laws to design an ideal low-cost housing scheme. The objective is to provide opportunities for the designers of both the development and the houses to create the maximum number of acceptable solutions compatable with the needs of the target population and the urban population.

12.3 The area of the plot.
Should be not less than 100m^2 with a maximum of 5% plot coverage where sewered sewage disposal is provided. Comments upon plot sizes for non-sewerd sewage systems will be made later.

12.4 Development of the plot.
The application of By-law 153 must be excluded from the new by-laws for low-cost housing, but with the rider that an acceptable form of ventilation must be provided. For definitions of what constitutes an acceptable ventilation system see section 11.3.4.
In climatic zones other than the temperate zones this recommendation will be modified - see Chapter 13.

12.5 The Dwelling;

12.5.1 Habitable rooms - should be not less than 7m^2 and shall contain 3.5m^2 per person.

12.5.2 Kitchens - should be not less than 4m^2. In fact it should also not be much larger than 4m^2 in which case it will be used as a habitable room

- where a dwelling, because of its design, is to be used for subletting, additional cooking spaces shall be provided either as:

a. cooking space of not less than $2.5m^2$ or,

b. where cooking is to be undertaken in the habitable rooms then their area shall be increased by $0.5m^2$ per person and the room shall be provided with a cooking slab (0.5m x 0.9m at a height of between 0.5 and 0.6m above the floor) and a flue to an approved design sited over the slab.

12.5.3 W.C. & Showers - should be in seperate compartments each of which shall have an area of not less than $1.05m^2$ with minimum internal dimensions not less than 1.40m (length) and 0.75m (width).

Where dwellings are specifically designed for sub-letting or multi-occupancy the provision of w.c.s(or vyoo) shall be on the basis of 1no.w.c (or choo) per two habitable rooms.

12.5.4 Storage - in dwellings designed for sub-letting or multi-occupancy storage shall be provided on the basis of $1m^2$ per habitable room, but such storage may not be provided on a communal basis where the space so created exceeds an area of $3m^2$.

12.6 Room heights and ventilation.

The minimum room heights in the temperate zone should be:

12.6.1 Habitable rooms - average height 2.35m with a minimum height of 2.15m over not more than 25% of the floor area where a ceiling is provided under a sheeted roof.

- where no ceiling is provided under a sheeted roof /average height 2.50m with a minimum height of 2.30m over not less than 25% of the room area.
- acceptable ventilation shall be provided by either:

a. at least 2 air bricks (each fitted with fly-screens and having an open area of not less than $45cm^2$) in not less than two external walls, or

b. at least one external wall containing an air brick (as specified in a) above) and a flue, with a total cross-sectional area of 45cm^2, giving direct access to the open air through the roof or external wall.

12.6.2 Kitchens - to have a minimum height of 2.35m from the top of the finished floor to the underside of the roof or ceiling.

- permanent ventilation to the external air by means of an fly screened open area of not less than 0.5m^2 which may include the internal cross-sectional area of a flue pipe extending to the open air.

12.6.3 Vyoo & Showers - should have minimum internal height (from finished floor level to the underside of the roof, ceiling or supports for a water storage tank) of 2.13m, Where the compartment contains the cold water storage tank then the minimum internal height shall be not less than 2.0m.

- the compartment shall have permanent screen ventilation with a total open area of not less than 1/10th of the floor area of the compartment.

12.7 Materials and construction.

12.7.1 Walls may be built of stone, bricks, concrete blocks, murrum/cement blocks, timber framing, mud and wattle (or similar local construction) or other constructional systems with a proven capability to support the roof, EXCEPT for kitchens, w.cs and shower compartments where the material or constructional system must be capable of resisting the effects of water.

The concept of temporary and permanent materials must no longer be used as an excuse for not approving a building. Where it can proven, on technical grounds, that a material has only a short life then the construction of the building must be approved for a defined period of time in order to

a. allow the plot developer to construct his 'permanent' dwelling in site-and-services schemes.

b. allow the owner to reconstruct in approved materials in squatter upgrading schemes
c. allow the allottee to occupy his plot until future sub-division in the case of settlement schemes (when implemented).

12.7.2 Foundations shall be capable of supporting the loads imposed upon them subject to the characteristics of the soils or sub-soils.

12.7.3 Roofs shall be properly constructed to support the load of the roof covering material and to resist destruction by wind or corrosion.
Roofing materials shall be capable of resisting the penetration of rain. Where metal sheeting is used as a roofing material it shall be treated to resist corrosion and a ceiling shall be provided under it in all habitable rooms and kitchens.

12.7.4 Floors shall be constructed so that they are themselves impersions to the upward penetration of moisture or should contain an approved water-proof membrane. The floors shall be finished so that they produce a smooth, impervious and dust-proof surface. Floors of kitchens, w.cs and showers shall only be constructed of concrete and shall have a smooth water-proof surface.

12.7.5 The internal faces of all walls shall have a smooth surface and in a kitchen, w.c. and shower such internal finishes shall be capable of resisting the penetration of water.

12.7.6 All structural timber shall conform to Kenya Standard KS 02-17:1976 Specification for sawn timber.

12.7.7 Where timber is used as a structural component it shall be treated to resist insect attack (unless the timber has a natural resistance), fungus attack and termite attack and/or the constructional system used shall avoid such attacks.

12.8 Fire regulations.

12.8.1 The existing regulations are satisfactory except in two respects:

a. the fire resistance of a number of local materials is unknown and this lack of knowledge could preclude their use other than in detached dwellings where there is a minimum distance of 3m. to the nearest plot boundary.

b. timber buildings are often discouraged in high density low-cost housing developments due to their 'fire risk'. However they should be permitted where a non-comustible wall is used on the boundary (or party wall) in attached dwellings. We have already commented that the self-help builders avoid party walls and prefer two independent walls - this would further decrease the dangers of fire spread from one plot to another.

12.8.2 Further recommendations on this subject will be made in Chapter 13.

12.9 Services.

12.9.1 Water - all dwellings shall be supplied directly with a supply of wholesome water.

- where water-borne sewerage systems are constructed each dwelling shall have a tank for the storage of cold water. The size of the tank shall be on the basis of 1/3rd of a days supply for agreed plot occupancy at a basis of a consumption of 60 litres/capita per day.
- water shall be supplied to the w.c., shower kitchen and cooking areas (other than those cooking facilities permitted in habitable rooms)
- a cold water tap and supply shall be provided in the w.c. compartment.

12.9.2 Waste water - discharge from sinks, and surface water from yards and cooking areas shall be conveyed either to a sewer via trapped gulley or shall, in the absence of a sewer, be conveyed to a soakaway to the council's satisfaction.

12.9.3 Sewage - requirements shall be specified for alternative forms of on-plot sewage disposal subject to the comments upon Discussion Paper DP2 - ENVIRONMENTAL HEALTH.

CHAPTER 13

MODIFICATIONS TO PRELIMINARY TECHNICAL RECOMMENDATIONS FOR DIFFERENT CLIMATIC ZONES.

13.1 Kenya can be divided into three climatic zones - temperate, hot-humid and hot-dry - as described in detail in Chapter 6. We believe that whilst it is an objective of this study to produce model (or national building by-laws) for low-cost housing in Kenya, such regulations should accommodate the differing design and construction needs of these zones as defined in Chapter 6.

13.2 Having obtained agreement to the requirements for each zone one is faced with the problem of how to implement the agreed by-laws. As will be seen in Figure 6.1 and Table 6.1 the majority of the urban areas lie within the temperate climatic zone. It is therefore recommended that the model by-laws produced shall be relevant to the temperate zone. Climatic variations would be accommodated by either:

a. two appendices to the model by-laws which would apply to the hot-humid zone and the hot-dry zone. The Preamble to these appendices would define the urban authorities to which each appendix applied, or
b. produce the model by-laws and allow local councils to prepare their own by-laws (as they are empowered to do by the Local Government Act 1978 Part XIV and the Public Health Act 1972 Part IX Section 126A) <u>based upon the model by-laws</u> but with their own local modifications, ammendments and additions, or
c. a combination of both a) and b) ie. local by-laws would include both the model by-laws plus the relevant appendix.

13.3 We would recommend c) of these three alternatives because:

- the approved model by-laws plus the appendices would provide a national basis for the local by-laws.
- the value of the Manual/Handbook as a technical back-up would not be restricted
- there are within each climatic zone minor variations (ie. lake area v. coast area) which could be

accommodated by the local by-laws.

- the basis of the model by-laws, together with the appendices, gives a means of control over local councils creating regulations which will inhibit the Government's housing policies.

13.4 Assuming that either alternatives a) or c) given in paragraph 13.2 above are agreed then the following preliminary technical recommendations would be the basis of the modifications to the model by-laws and would be included in the appendices, be illustrated in Manual/Handbook and, if alternative c) is accepted, form the basis of local by-laws.

13.5 HOT-HUMID CLIMATIC ZONES.

13.5.1 The principal climatic characteristics of the hot-humid zone are:

- high daytime temperature
- intense solar heat
- very high humidity.

Therefore the most important aspects of house design are ventilation of the interior and constructional form that will neither transmit nor hold heat. The almost constant breezes of the coast can, if utlized in the dwelling, provide efficient cooling. At the lake area night-time temperatures are much lower and therefore continuous air movement within the dwelling is not so important at night. The ventilation aspect is in fact the concious movement of air through the building and not just the air changes.

To achieve the necessary level of air changes compatable with human comfort requires consideration of the following aspects of house design and layout:

- plot size and plot coverage
- siting of building
- orientation of the building
- area, siting and construction of openings.

13.5.2 Plot sizes

It is recommended that plots shall be of a minimum size of $200m^2$ for schemes with water-borne sewerage and with a maximum plot coverage of 50%.

13.5.3 Siting of buildings

The back-to-back concept should not be permitted due to the problems of obtaining proper through ventilation compatible with the needs of the climate. However to obtain the maximum use of the plot it will be necessary to permit one-sided development, but modified to ensure through ventilation by the provision of the maximum number of external walls as shown in Figure 13.1.

13.5.4 It is difficult to regulate for the proper orientation of the plots and buildings - this must be left to the planner of the estate.

13.5.5 Having created opportunities for maximum cross or through ventilation,by the plot size and the layout within the plot, it is necessary to ensure that the openings in the external walls are of sufficient minimum size and construction. As was stated in Chapter 6, large glazed areas (whether capable of being opened or not) can have an adverse effect upon human comfort. Therefore the use of internally insect-screened unglazed shutters or aluminium glazed louvres is to be recommended. It is recommended that the equivalent of 1/10th of the floor area of every habitable room should be provided in the form of unglazed openings or louvres. In addition an area of 1/20th of the floor of the room shall be provided as permanent ventilation sited underneath the ceiling. All openings, both permanent and temporary, must be provided with insect-proof mesh.

13.5.6 The construction of roofs is critical to the level of human comfort in this zone and metal sheeted roofs without a ceiling should be prohibited. We can see no technical reasons to prohibit the use of the proven traditional system of makuti roofs where a ceiling is provided. The ceiling would prohibit the entry of insects especially mosquitoes.

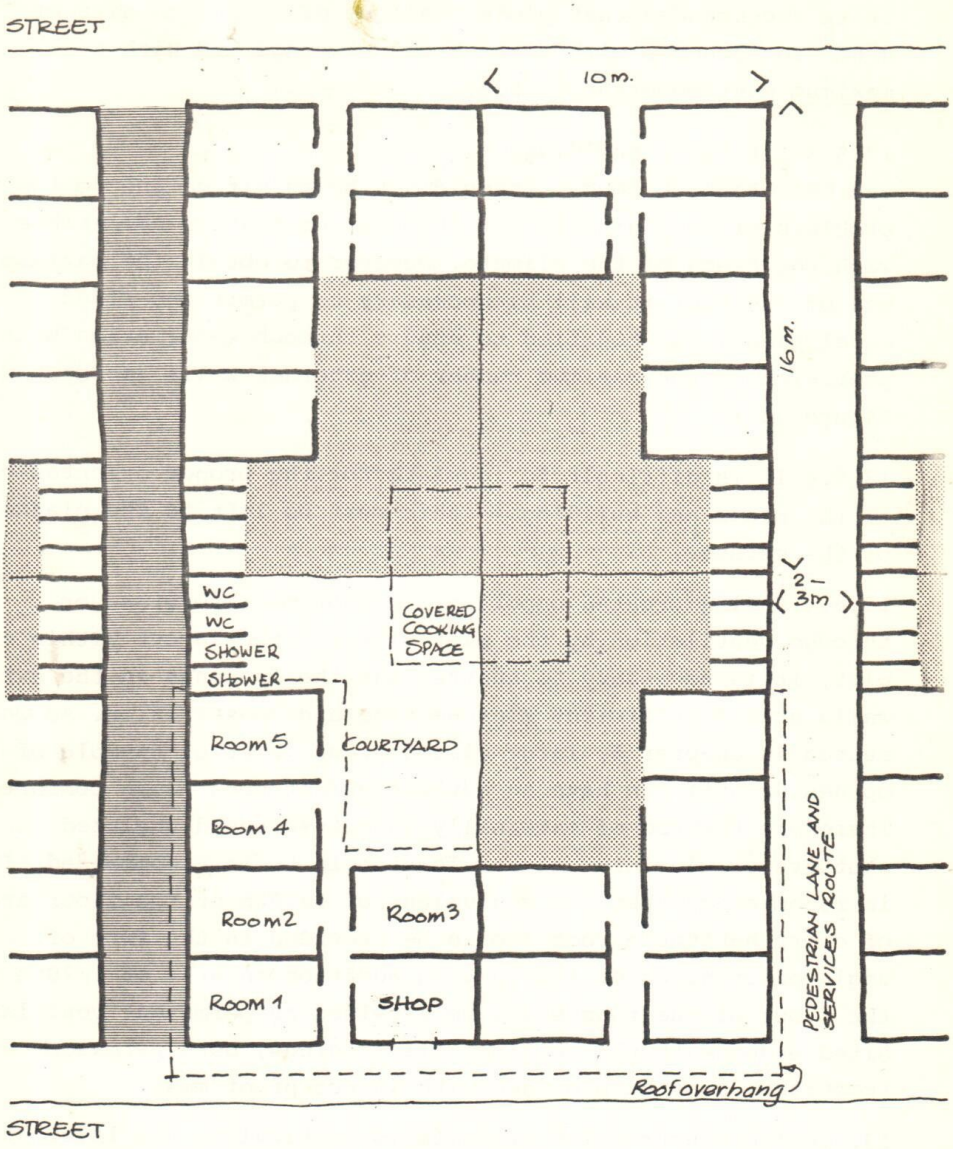


FIG.13.1. POSSIBLE HIGH-DENSITY HOUSING LAYOUT IN HOT CLIMATIC ZONES

13.5.7 Room heights do not have to be increased in this zone subject to proper roof construction and the provision of ceilings.

15.5.8 Walls of habitable rooms can be of any suitable material including traditional forms of construction - ie. the mangrove pole/coral/and mud at the coast - so long as a smooth internal finish is provided.

13.6 HOT-DRY CLIMATIC ZONES.

13.6.1 The principle climatic characteristics of this zone affecting house design and construction are:

- very high daytime temperatures
- intense solar radiation
- warm nights
- low humidity

13.6.2 As a result of the low humidity level air movement is not so critical to comfort levels. In fact a cool dim interior is an attraction. As dust and insects can often be troublesome a reduction in the area of openings can be an advantage.

13.6.3 Therefore in the layout of plots and houses which reduces the area of walls and roofs subject to solar radiation is to be encouraged. Compact layouts and house forms help to achieve this. However the plot should have plenty of well shaded private open spaces to accommodate the traditional life-style of the people.

13.6.4 Whilst compact house layouts grouped around a courtyard are valuable, efficient ventilation to extract any build-up of heat is important. To accommodate such a need layouts as shown in Figure 13.7 are suitable.

13.6.5 Walls shall be of stone, concrete block or any proven local traditional heavy construction subject to the provision of a smooth faced internal finish. The construction of lightweight sleeping areas either within the courtyards or on the properly constructed flat roofs of houses should be permitted.

13.6.6 The used of screened perforated blocks, timber screens or unglazed timber shutters should be permitted. The open areas of such openings shall be not less than 1/20th of the floor area of habitable rooms. A proportion of this area shall be sited immediately under the ceiling in two external walls.

13.6.7 Again the use of metal sheeted roofs without a ceiling should be prohibited. Permitted materials for the ceiling should include woven grass, palm fronds or reed mats. Flat roofs of heavy construction shall be permitted.

CHAPTER 14

APPLICATION OF RECOMMENDATIONS TO TYPES OF LOW-COST HOUSING.

14.1 The forms of low- cost housing predominant in Kenya at present are:

a. Site-and-services (described in paragraph 1.7)
b. Squatter-upgrading schemes (described in paragraph 1.9)

14.1.1 In addition there is also the development and up-grading of the peri-urban areas such as Dagoretti in Nairobi. These areas were (and still are) predominantly agricultural areas which, because of their proximity to the town and the private ownership of land, subject to considerable pressure for development as low-income dormitory areas. Such areas where originally subject to the minimum of building control under the County Councils, but since their incorporation into the area of administration of the urban authority, are in theory subject to urban by-laws and standards with resulting conflicts.

14.1.2 A further alternative, Settlement Schemes, has been mooted in Kenya and by the IBRD, but has not as yet been implemented in Kenya. Such a scheme envisages a planned development of plots; together with spaces for roads, schools, shopping centres, health facilities and public open spaces, but without the provision of sewerage. The concept is that this would produce the cheapest initial form of basic development which, because of its planned layout, would be simple to upgrade at a later date.

14.1.3 Site-and-service schemes - the revised Scheduled Special Area Model By-laws would apply as such services are fully planned from the inception.

14.1.4 Squatter upgrading schemes - because the scheme attempts to upgrade an existing development (albeit an unsatisfactory one) with the minimum of demolition then the Model By-laws will have to be applied with flexibility ie.

i) Plot sizes - whilst a minimum of $100m^2$ (for sewered schemes) is given, an acceptance of say $95m^2$ for some plots may have to be accepted. Conversely it should also not be necessary to reduce a person's plot size to reach a $100m^2$ 'magic' size.

ii) Plot coverage - whilst a maximum of 50% plot coverage will be the objective it should not be necessary to demolish a house simply because it has a plot coverage of 55% or 60%. However where it is clear that the building/private open space ratio is very unsatisfactory then some rooms will have to be demolished before the development is legalised.

iii) Building materials and construction - the basic principal here should be phased upgrading; that is any building, unless it can be technicaly shown to be unsafe or unsanitary, that does not conform to the by-laws should be given an approval for a temporary period sufficient to enable the plot-owner to upgrade his building to the minimum standards.

iv) Services - The provision of services should be in accordance with a phased implementation plan and therefore illegality should only be applied when the plot owner has not utilised these services after they are available. For example it may be necessary to accept a water supply from a kiosk of stand pipe initially.

14.1.5 Settlement Schemes - as these are planned schemes for future upgrading then the minimum standards to be applied should accept both the initial and the future situations viz:

a. plot sizes - ultimately (with a sewerage reticulation scheme) $100m^2$ plots will be permitted. Therefore initial minimum plots should be multiples of this size ie. $200m^2$, $300m^2$ or $400m^2$. The actual size will depend

upon the form of the initial sewage system considered acceptable ie. individual septic tanks (if soil conditions are satisfactory), consevancy tanks (expensive to maintain), pit latrines or the alternatives described in Discussion Paper DP2. Whatever initial system is accepted disposal of the effluent will create a problem.

b. Plot coverage - accepting an initial minimum plot of $200m^2$ then plot coverage (to allow subsequent sub-division) should be a maximum of 25% - for $300m^2$ plots it would be 17% and for $400m^2$ plots 12.5%.

c. Building Materials and construction - because the initial density will be low the Grade II By-laws should be applied When sub-division is permitted the Model Scheduled Special Areas By-laws would be applied.

d. Water Supply - whilst individual house connections may not be possible we would still recommend the use of individual standpipes on plots rather than communal water points due to the potential contamination of water referred to earlier.

14.1.6 Private low-cost housing areas.

These developments pose a particular problem with regard to building control in that whilst the majority of the area is predominantly semi-rural/agricultural) there often lies within it a one or more small urban enclaves where density of housing is high especially in comparison with the surrounding areas.

As has already been stated in Chapter 11 we do not consider that the Grade II By-laws are truly compatable with the needs of urban high density low-cost housing on the basis they were never intended to be used for this purpose. However we would suggest that in these areas of mixed densities, the Grade II By-laws should be applicable to the low-density areas and the Model Scheduled Special Area By-laws applied to the defined area of the townships. The application of such a policy will be considered further in Discussion Paper DP6.

SECOND WORLD BANK/GOVERNMENT OF KENYA URBAN PROJECT

KENYA LOW-COST HOUSING BY-LAW STUDY

DISCUSSION PAPER
DP3

INFRASTRUCTURE

NOVEMBER 1979

SAAD YAHYA & ASSOCIATES
KITOLOLO & PARTNERS
HALCROW FOX AND ASSOCIATES

FORWARD

The Discussion Papers are prepared to enable members of the Steering Committee to fully contribute in the preparation of this Study. Therefore they are not final reports but evolving stages in the process of preparing the Manual/Handbook and the Draft Final Report. As such it is intended that their contents should receive the fullest attention of the members of the Working Parties and, subsequently all members of the Steering Committee. After discussion they will subsequently, in an elaborated, extended or modified form, be the basis of the Draft Final Report.

In particular, this Paper DP3 - INFRASTRUCTURE is in the form of an interim report upon the general provision of infrastructure (roads, water, sewerage and surface water disposal, electricity and refuse disposal) for the overall development of low-cost housing areas. It deliberately excludes consideration of the provision of service connections and supplies within the plot and dwelling, which will be considered in detail in Paper DP5 - TECHNICAL AND DESIGN ASPECTS. After the discussion of its contents this paper will form a major input into Paper DP6 - ENVIRONMENT AND SITE PLANNING where, if necessary, its contents will be amplified.

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1.00 INTRODUCTION:

1.01 The United Nations Centre for Human Settlements (Habitat) has defined infrastructure as the complex networks designed to deliver to or remove from the shelter, people, goods, energy or information. In the context of the Kenya ye- aws tudy, however, infrastructure will be construed as the external public services within a housing development, which services include roads, stormwater drainage, foul sewerage, potable water supply, refuse removal systems and the supply of electric power.

1.02 Since the study as a whole is confined to low cost housing, this discussion paper will similarly aim at identifying the level of infrastructure required to achieve acceptable minimum standards compatible with low-cost housing. To be able to arrive at some appropriate recommendations, one needs to examine the existing construction and design practices, legislation, materials specifications, performance specifications as well as costs in various major urban centres in the Republic of Kenya.

1.03 Selected towns which provide useful geographical and social spread have been visited in the course of the study. It would appear from the observations made that there exists a definite pattern concerning the installation of infrastructural services within housing development in Kenya; the developers are generally responsible for the cost of providing the services within their respective plots and the local authorities ultimately take these over for maintenance purposes BUT on condition that such services are constructed in accordance with the adoptive standards of or accepted design methods by the particular area council.

2.00 EXISTING SERVICES:

2.01 The existing services have directly been influenced by the planning and zoning layouts of the areas in terms of siting, density, road patterns, distribution systems and location of public service mains. This in turn has affected the capital cost of providing the infrastructure and eventually the cost of the shelter. It is intended to expound on this in discussion paper DP5 - TECHNICAL AND DESIGN ASPECTS.

2.02 In most urban areas in Kenya potable water supply is available and the main sewerage systems along with treatment works either already exist or are in the process of being constructed. These have been invariably financed by the public sector. Service reticulation within a housing development area is finally connected to the public service mains.

2.03 The cost of infrastructure in relation to other components in housing construction is not as high as generally believed. The analysis of building costs in Africa region broken down by functions gives an idea of this.

Table 1:*

COMPONENT	PERCENTAGE OF TOTAL COST
Infrastructure	2 - 20
(Sub)Structure	8 - 12
Walls (external and internal)	13 - 31
Roofing	11 - 20
Flooring	3½ - 4½
Doors and Windows	7 - 9
Finishes, paints, varnishes, etc.	8 - 25
Electrical installation	4 - 7
Sanitary installation	11 - 14

* Construction and Building Materials Industries in Africa - U.N. Economic and Social Council

The gap between the lower and upper figures in respect of infrastructure, walls, rooofing and finishing seems big but this is due to the wide choice of both materials and techniques that can be adopted e.g. simple earth to reinforced concrete.

Recent projects involving infrastructure installation in Kenya also indicate some variance in total cost for relatively similar level of servicing as can be seen in Table 2.

Table 2:

AREA	SCHEME	PLOT SIZE	COST/PLOT	LEVEL OF SERVICE
Thika	Site & Services	23.5 x 12.5M	Ksh.5,138/= (1977)	earth roads, open earth drains, g.i. water pipes, p.c. pipe sewers connected to public main.
Homa Bay	Site & Services	23.5 x 12.5M	Ksh.21,000/= (1979)	murram roads, open earth drains (lined at places), g.i. water pipes, p.c. pipe sewers connected to public main.
Machakos	Site & Services	23.5 x 12.5M	Ksh.14,000/= (1979)	murram roads, open earth drains, p.v.c. & g.i. water pipes, p.c. pipe sewers leading to new oxidation ponds.
Nanyuki	Site & Services	23.5 x 12.5M	Ksh.14,430/= (1979)	Murram roads, open lined drains, g.i. water pipes, p.c. sewer pipes connected to public main.

2.04 Roads:

At present adoptive standards for roads vary from one urban area to another. These standards are often not in writing especially in the smaller towns where there are not qualified personnel. In such places designs tend to be accepted without much scrutiny dependent on whether a developer has employed a professional consultant or not. Generally, however, smaller towns somewhat copy the standards set by the larger municipalities. Table 3 gives an indication of the adoptive standards for some of the major towns.

Table 3:

TOWN	ADOPTIVE STANDARDS
Nairobi (Estimated Population: 800,000)	Bus routes : 18m. road reserve; 7m. carriageway Major access road : 15m. road reserve; 7m. carriageway normal Residential Street : 12m. road reserve; 5.5m. carriageway Short cul-de-sac : 9m. road reserve; 5m carriageway Footways : 2m. wide on each side of c/way cul-de-sac one side footway accepted. Stormwater drainage : piped drains (min.300 diam) or concrete lined open drains Open earth drains will remain unadopted Streetlighting : Council's standard poles and lanterns (Structural) Specification : Subgrade : 150mm., C.B.R. 4% Sub-base : 150mm. murram (can be omitted if C.B.R. of sub-grade is greater than 12%) Base Course : 150mm waterbound stone. Surfacing : 25mm machine laid dense carpet Concrete kerbs and channels or concrete edge blocks Footways : 100mm murram slurry seal with chippings or double seal coat. Waterproof shoulders 1.5m. wide. murram roads will remain unadopted.

Table 3: Cont'd

TOWN	ADOPTIVE STANDARDS
Mombasa (Estimated population: 400,000)	Road reserve : 15 or 18m. generally 9m. permitted in low cost housing areas Carriageway : 7.5m. 5.0M. permitted in low cost housing areas Stormwater drainage: piped drains (minimum 230 diam.) open drains remain unadopted Footpaths : 2.0M wide on either side of carriageway Streetlighting : Council's standard lanterns (Structural) : Compacted Subgrade Specification Sub-base : 150mm coral rag Base Course : 230mm coral rag or Mazeras stone in two layers Surfacing : M.C.O. seal coat 50mm. hot premix machine laid Kerbs and channels footpaths : 100mm coral rag with premix lighter specification for unadopted streets accepted

Table 3: Cont'd

TOWN	ADOPTIVE STANDARDS	
Kisumu (Estimated population: 120,000)	Carriageway	: 7.0 & 5.5m. wide
	Stormwater drainage	: open concrete lined channels pipe drains also permitted
	Footpaths	: 2m. wide on either side of carriageway
	Streetlighting (Structural)	: Council's standard lanterns
	Specification	: Sub-base : 150mm murram Base Course : 150 - 230mm stone Surfacing : colas with chippings Kerbs and channels - sloped to form open drains

Table 3: Cont'd

TOWN	ADOPTIVE STANDARDS
Nakuru (Estimated population: 80,000)	Carriageway : 7.0 & 5.5m. wide Stormwater drainage : pipe drains (minimum 225 diam.) open culverts lined. Footpaths : 1.0m wide with 1.0 shoulders on either side of c/way. Streetlighting (Structural) : Council's standard lanterns. Specification : Sub-base : not specified! Base Course : 150mm stone (5.5c/way). 230mm stone (7.0c/way). Surfacing : colas with chippings. Kerbs and channels. footpaths : 100mm murram with colas and chippings. earth roads are not adopted

Table 3: Cont'd

TOWN	ADOPTIVE STANDARDS
Thika (Estimated population: 60,000).	The standards are generally similar to those for Nairobi. Carriageway : 7.0 & 5.5m. wide. Stormwater drainage : open lined culverts piped drains. earth drains remain unadopted Footpaths : 2m. wide on either side of c/way. Streetlighting (Structural) : Council's standard lanterns Specification : Sub-grade : generally natural murram or rock. Sub-base : 150mm murram. Base Course : 100mm stone Surfacing : 25mm asphalt machine laid. Kerbs and channels. murram and earth roads remain unadopted

Table 3: Cont'd

TOWN	ADOPTIVE STANDARDS
Webuye (Estimated population: 30,000)	Carriageway : 5.5m wide. stormwater drainage : concrete lined open drains piped drains permitted. Footpaths : 2m. wide on either side of carriageway. Streetlighting (Structural) : Council's standard lanterns. Specification : Sub-base : 150mm. murram Base Course : 150 - 230mm stone Surfacing : 25mm asphalt machine laid. Kerbs and channels

Expectedly, Nairobi has the most elaborate standards which cover all density zones. This is so because professionally qualified personnel with experience in their respective disciplines are in the employ of the City Council and there is a definite development pattern for the City of Nairobi as a whole. The adoptive standards become less rigid and sketchy in the rest of the towns. Mombasa, however, being the oldest and one of the larger Kenyan towns should by now have set more exhaustive standards than those presently available.

The all-in cost of construction roads to the adoptive standards varies from Ksh.150/= to 250/= per square metre of carriageway as at June, 1979.

2.05 Sewerage:

The local authorities are inclined to accept sewerage schemes for adoption and subsequent maintenance purposes if the conventional design approaches and construction techniques have been followed. Some of the salient points of adoptable sewerage reticulation are:

- every plot connected (through a manhole) to a sewer main
- manholes at every junction, change of direction, gradient or pipe size
- gradient sufficient to achieve self-cleansing velocity of flow (0.6m/sec. - 1.0m/sec.)
- durable materials to resist corrosive elements for an indefinite design period (concrete, P.V.C., pitch-fibre, steel)
- design capacity of sewers to serve the ultimate development of the neighbourhood (65 litres - 120 litres/capita/day)
- adequate protection (min.150mm concrete bed and haunch/ surround; minimum 1.0m below ground level)
- termination into sewerage disposal/treatment works.

Most urban centres, with the assistance of the Ministry of Local Government and the Ministry of Water Development, have constructed sewage treatment works and some are in the process

of doing so. In the older towns, the conventional mechanical type of treatment plants are being used whereas oxidation ponds are found in the newer towns. However the former are now at the end of their design periods of 10 to 15 years and are progressively being replaced by the latter type of treatment works. This is true for Nairobi, Mombasa, Kisumu and Nakuru. Sewerage systems are fairly well established in many towns in Kenya and new areas are being connected as extensions to the systems are implemented. In un-sewered parts and where treatment works do not exist or areas to be developed cannot be economically or physically connected to existing main sewerage, the local authorities have allowed pit latrines, septic tanks, conservancy tanks or private lagoons to serve as a temporary solution.

The situation with regard to sewerage in the main urban centres is summarised in Table 4.

Table 4:

TOWN	EXISTING SERVICE SITUATION			
	Sewered Sectors (% of total)	Type of Treatment Works	Septic/Conservancy Tanks	Pit Latrines
Nairobi	70%	Full Conventional & oxidation ponds Outfall to watercourse.	Both permitted. Septic tanks with radial arms or Soakaways	Exist in the outskirts and in unauthorised development
Mombasa	20%	Partial (Screening & sedimentation) & oxidation ditches. Outfalls to the sea	Septic tanks form the commonest method, with soakage pits down to water level.	Exist mostly in mainland residential areas.
Kisumu	40%	Full conventional & lagoons Outfall to the lake	Septic tanks with soakaways permitted	Exist in the outskirts and squatter areas.
Nakuru	60%	Full conentional & lagoons Outfall to the lake	Septic tanks and soakage pits permitted.	Exist in the outskirts & old parts of the town.

Table 4: Cont'd

TOWN	EXISTING SERVICE SITUATION			
	Sewered Sectors (% of total)	Type of Treatment Works	Septic Conservancy Tanks	Pit Latrines
Thika	99%	Lagoons. Outfall to watercourse.	Permitted in the remaining 1% of the town area due to topographical obstacles	Exist in un-authorised development
Webuye	100%	Lagoons. Outfall to watercourse.	Not permitted	Exist in old part of the town but shortlived

For sewer networks the commonest types of pipes used are pitch fibre, concrete and, of late, PVC, along with masonry or precast concrete manholes with cast iron and concrete covers. Pitch fibre drains cost approximately 1½ - 2½ times as much as concrete pipes while, on the other hand, P.V.C. pipes cost only about ¼ - 1/3 as much.

2.06 Water:

The Kenyan Government has the ownership and the power to control every body of water under or upon any land in the Republic. For the purpose of distribution of water supply in an area, however, the Ministry of Water Development may appoint a water undertaker who shall be responsible for water supply within that area. Under these circumstances, therefore, a few of the local authorities are in charge of their own water supply systems while the rest are not.

Water occurs mainly in three forms: groundwater, surface water and atmospheric water, and the degree of treatment varies in accordance with the quality of water obtainable from these services.

In Kenya, the majority of the urban centres have a supply of potable water. Whether this is distributed to individual plots or households or through kiosks, a charge is levied based on consumption, but varying from centre to centre. The main features of drinking water supply system are

. Abstraction
. Treatment
. Bulk Storage
. Distribution
. Domestic Storage.

The design for distribution of water is generally based on 135 lit/capita/day allowing for public use, loss and waste, with 3m/sec as the upper limit for velocity of flow. All water reticulation pipes must be of durable material to last an indefinite period of design. Distribution pressures normally range from 2 - 6 Kg/sq.cm.

2.07 Refuse:

Collection of refuse is undertaken in all major urban centres in Kenya. The method of collection happens to be exactly the same everywhere. Each household is provided with a dustbin (after paying for it), then the local authority vehicles pick up the refuse from the individual plots or from centralised collection points for dumping.

3.00 RELEVANT LEGISLATION:

3.01 The provision of infrastructure has not been exhaustively tackled in any of the existing legislation in Kenya. Lacking, in particular, are national design guidelines, materials and performance specifications, details and methods of construction, and simple explanatory handbooks.

3.02 The Streets Adoption Act, CAP 406:
This is an act of Parliament to regulate the construction and improvement of streets in certain local authority areas; to provide for the adoption by certain local authorities of streets of a satisfactory standard; and to provide for matters connected with the foregoing and incidental thereto.

The act outlines the procedures to be followed in respect of road making for adoption by the area councils. It, however, leaves the structural specifications to the discretion of the local authorities but, in general terms, stipulates that a street has to be levelled, paved or metalled, kerbed, channelled, lighted, sewered and drained if it is to be declared an adopted street, and added to the register. Nevertheless, elements of the road such as sewers, drains, or lighting facilities can be adopted separately by the local authority if they are constructed to the satisfaction of that local authority. Under the same act, the area council has the power to construct an unadopted street to adoptive standards and charge the cost of doing so to the frontagers or beneficiaries in accordance with formulae based on frontage lengths, plot areas and degree of benefit for each plot in the vicinity. Where any local authority feels that a certain street does not warrant construction to adoptive standards, such a street can be made to lower specifications and be maintained for a period to be determined by the local council concerned but for not less than two years.

The Streets Adoption Act, recognising the safety and welfare of all citizens, also gives powers to local authorities to serve notices to the owners of plots along any unadopted street

Sh. 1000 per month.

Major Issues.

LOW-COST HOUSING BYELAW STUDY
POLITICAL AND ADMINISTRATIVE ASPECTS (Draft Outline)

1.1 Administration of housing standards — CM
1.2 Administration machinery for approval
1.3 Decision-making process and flow of applications
1.4 Data storage and availability for other purposes
1.5 Police powers and enforcement; preventive measures
1.6 Manpower and training
1.7 Inter-ministerial relationships

2.1 The politics of housing standards and attitudes towards sites and services — CM
2.2 Popular images and stereotypes of low-cost housing
2.3 Community participation in standards formation
2.4 Possible political outcomes of new standards
2.5 The politics of enforcement
2.6 Corruption

3.0 Building byelaws, zoning codes and land use controls — SY

4.0 Proposals for change — CM/SY

Method

Annual Reports
HRDU Studies
Waweru Reports
Interviews with officials, councillors, developers, etc in sample towns
Participant observation.

requiring them to carry out repairs in order to obviate or remove what in their (local authorities) opinion constitutes a danger to any person, passenger, or vehicle in the street.

The application of this act is in

- all municipalities
- all county divisions established or deemed to have been established by or under the Local Government Regulations, 1963
- every other local authority area or part thereof which the Minister may declare to be a local authority area.

3.03 The Water Act, CAP 372:

The aim of the act is to make better provision for the conservation, control, apportionment and use of the water resources of Kenya, and for the purposes incidental thereto and connected therewith. In the main, therefore, the Water Act highlights the administrative structure and procedures pertaining thereto and leaves out the technical aspects such as the minimum standards for potable water, quality of effluents before discharging into water courses, and construction and design aspects of water supply systems in general.

The Minister of Water Development may, under this act, construct and maintain, with public funds, upon any land such works as deemed necessary or desirable for the purposes of

- protection of the source or course of any body of water
- disposal or control of flood water
- conservation of water
- distribution, apportionment or measurement of water.

The Water Act classifies projects for the use of water or for the drainage of lands into four categories:

- private projects - those which concern the use of water or the drainage of swamps within the limits of private lands

. community projects - projects, other than public or urban, conducted in accordance with rules approved by Water Apportionment Board and agreed by a Local Water Authority for the purposes of the use of water or drainage of lands within a certain area.

. public projects - projects including the supply of water or hydro-electric engergy to persons other than the operator, in consideration of payment thereof, or the drainage or reclamation of lands in consideration of payment thereof.

. urban projects - projects undertaken, operated or maintained by a municipal authority, corporation or other body, for the supply of water to municipalities, townships, trading centres or other urban communities.

The Water Apportionment Board determines the class of any proposed project.

3.04 The Public Health Act, CAP 242:
For the purpose of this paper, only the Public Health (Drainage and Latrines) Rules, which are part of the Subsidiary Legislation in CAP 242, are relevant and hence will be examined. Their application is by a ministerial gazette notice specifying the areas.

The act covers wide-ranging aspects of sewerage including enforcement of drainage of undrained buildings by the local authorities, construction of drains, waste pipes and waste-water fittings, grease traps, water closets, slop-hoppers, urinals, septic tanks and other sewage filter installations, disposal of sewage and, to a greater length, administrative formalities concerning sewerage as a whole.

Under these rules, a local authority can compel owners of buildings to connect to a public sewer if it is within sixty metres or to provide other approved means of disposal in a situation where a public sewer does not exist within that distance.

The main points, relevant to the provision of infrastructure, which come clearly from the Public Health Act are

. excavation and laying of drains;	excavate to required depth, provide timbering where necessary, true to gradient and in straight lines, properly backfilled and rammed
. quality of pipes and materials;	good sound cylindrical pipes made of glazed stonewater, heavy cast iron or other equally suitable material
. capacity of drains;	adequate size, minimum 100mm internal diameter, proper fall and with watertight, socketed or other approved suitable joints
. protection;	drain to be laid on adequate and efficient bed of good cement concrete at least 75mm in thickness
. self-cleansing velocity;	minimum gradients - 1/40 for 100mm. diameter and 1/60 for 150mm. diameter
	flushing tanks and inspection chambers to be provided where minimum gradients are not possible
. inspection chambers;	where two or more drains, converge at every point where angle, bend or deviation from direct alightment

occurs, at the plot boundary if such drain communicates directly with a public sewer and at every point such that no part of the drain is more than 10.0 metres from an inspection chamber.

Although the Public Health (Drainage and Latrines) Rules have covered most ground among the acts afore-discussed in this paper, like all of them they have omitted certain important technical points. In the case of sewerage minimum design flows, quality of effluents, treatment methods and the general sewerage system design guidelines need to be included.

3.05 The Building Code:
In excercise of the powers conferred by regulation 210 of the Local Government Regulations, 1963, the Minister of Local Government made an order known as the Local Government (Adoptive By-Laws) (Building) Order, 1978 which any municipality or county council may adopt as building by-laws.

The by-laws lay emphasis on siting of buildings, building materials, building services and the general administration concerning these. The absence of guidelines on the provision of the infrastructural services such as water supply, sewer reticulation and road network is conspicuous.

3.06 The Electrical Power Act, CAP 314:
This is an Act of Parliament to facilitate and regulate the generation, transmission, transformation, distribution, supply and use of electric energy for lighting and other purposes, and for purposes connected therewith.

The act applies to every public or local authority, company, person or body of persons generating, transmitting, distributing, supplying, or using electric energy, and to all works or apparatus for any or all of these purposes.

The East African Power & Lighting Co. Ltd. has effectively got the monopoly to generate, distribute and sell electric power in Kenya. The Act itself deals mainly with the administrative procedures related to generation and supply of electric power, while the Electric Power Rules, a subsidiary piece of legislation, outlines the technical and safety requirements for consumer installations.

4.00 COMMENTS AND RECOMMENDATIONS:

4.01 General:

The design practices, standards of materials and construction methods or codes of practice in many developing countries have largely been adopted from industrialised countries. Many of these codes and standards were designed for different conditions in their countries of origin and may have undergone several changes in keeping with advancement in technology. They are, nonetheless, the outcome of scientific research coupled with many decades of experimental application together with several modifications in the course of time.

In the absence of appropriate research facilities and the lack of long periods of trial application, most of the developing world have not been able to prepare codes of practice of their own.

In Kenya, although these borrowed codes of practice are in use satisfactorily, most of the infrastructure can be constructed using local materials and thereby cut down on cost considerably without, in fact, lowering the already set standards.

4.02 Roads:

Many of the existing low-cost housing schemes do not appear to have any roads and stormwater drainage. The developers have tended to provide earth or murram roads along with open earth drains initially. This was for a good cause: to further lower the low cost of infrastructure. However, they have more often than not ended up with services which, on one hand, could not be adopted by the local authorities because they do not meet the adoptive standards and, on the other hand, required disproportionately large sums of money for maintenance purposes after only a short span of time. Ultimately neither the local authorities nor the developers have looked after these. Consequently the roads have progressively been washed away by the rains or covered by weeds and the drains slowly but surely silted up or choked with debris and refuse. In the final analysis the little funds that were available for this service did not serve the purpose.

There is need, therefore, to compromise between the local authorities and the developers: the former must be ready to lower the adoptive standards for infrastructure in low-cost housing developements while the latter must be prepared to spend a little more to meet the standards.

In a low-cost housing area, apart from refuse collection trucks, ocassional buses, fire fighting vehicles or ambulances, most of the traffic is composed of pedestrians. Furthermore, human feet are more destructive to unpaved surfaces than are rubber wheels. So why not tarmack the roads and footpaths and instal lined stormwater drains? This will, no doubt, lead to a more pleasant and healthier environment to live in than has hitherto been the case.

In order to keep the construction costs relatively low, however, the neighbourhoods must be planned such that there are fewer roads and more footways leading to houses. The roads specification must be made as light as practicable too.

Suggestion:
- 4.0m. wide road with hammerhead parking/turning area
- no road-side footpaths
- no road-side kerbs and channels
- 1.0m. grassed shoulders
- no sub-base course as most sub-grades in Kenya can be consolidated to achieve CBR $>$ 12%
- 150mm. stone base
- 25mm. premix surfacing

Such a specification will cost in the region of Ksh.60/= to 80/= per square metre as at June 1979 in Kenya. (Compare this to Ksh.150/= to 250/= per square metre for full adoptive standards).

4.03 Sewers:

Sewage must be conveyed from the houses as soon as it is formed to the places of disposal or treatment. This must be done in conduits made of non-absorbent, durable and tough materials

which will resist corrosion and abrasion for an indefinite design period.

The design of this infrastructural service is based on the projected water consumption, the strength of domestic sewage produced, the temperature of the area and the quality of effluent required. These criteria apply universally and are not dependent on the social level of the communities served.

Not all the sewerage systems in the low-cost housing developments in Kenya have been successful. There are instances where the designers have failed to recognise the fact that apart from the natural human waste, sewage in many parts of the country may also consist of bones, charcoal, cardboard, rags, maize cobs, sticks or even stones. They have, therefore, gone ahead and specified small-bore (100mm. and 150mm. diameter) sewers as a cost-cutting approach. After a very short spell relative to the normal design period of sewer reticulation systems, however, the incidence of blockages increased tremendously. In addition to this, theft of the light-duty manhole covers used as another measure towards reducing the capital cost of infrastructure became the order of the day. Further dumping into the sewers resulted and added to the problem. The maintenance bill rose so sharply that eventually re-construction with bigger - diameter (not less than 225mm. diameter) sewers became inevitable.

The present design practices and construction methods using local materials along with locally manufactured items for sewerage are, nevertheless, satisfactory. The cost of the end production cannot be made any lower without interfering with the current standards. The only recommendation here, therefore, is the compilation of a handbook on design formulae, materials specifications and construction details on sewerage and sewage treatment/disposal works in general. The hand book can contain information such as :

. design formulae - The most commonly applied ones are

Manning Formula, $v = C\sqrt[3]{(m)^2} \cdot \sqrt{(i)}$

Barnes Formula, $v = C m^{1/2} i^{1/2}$

Crimp & Bruges Formula, $v = 124\sqrt[3]{(m)} \cdot \sqrt{(i)}$

Where v = Velocity of flow

* C = coefficient varying with different materials

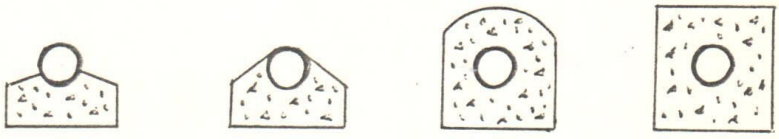
m = hydraulic mean depth

i = gradient

* Manning:
  - concrete pipes, C = 99.1
  - c.i. pipes, C = 114.3
  - earth channels, C = 49.5

* Barnes:
  - c.i. pipes asphalted, C = 174.1
  - c.i. pipes uncoated, C = 136.6
  - smooth concrete conduits, C = 95.1m
  - earth channels, C = 58.4

. construction details - especially types of concrete protection to sewers



Type A Type B Type C Type D

DEPTH OF PIPE	TYPE OF CONCRETE PROTECTION	
900 in fields 1200 in roads	150 225 300 375 Type C or	450 500 600 Type D
1200 to 4000	Type B, C, or D for ogee joints. No protection essential for SS-joints	Type B
4000 to 6000	Type B	Type B.
6000 and greater	All pipes to be in heading and Type D to be used.	

. Sewage disposal design - W.H.O. have recommended lagoons as the most suitable method of sewage treatment in Kenya in that they provide one of the cheapest solutions. The formula used is that by Marais but modified by Gloyna -

$$R_T = \left(\frac{L_o}{L_p} - 1 \right) \frac{1}{K_T} \quad \text{------ (1)}$$

$$L_p = \frac{600}{(0.18d + 8} \quad \text{------ (2)}$$

Where R_T = detention time in days at temperature T.

L_o = oxygen demand of the incoming sewage in milligrammes per litre

Where L_p = BOD of effluent

K_T = breakdown rate per day of sewage organics at temperature T

d = depth of pond in metres (normally $\geq$1500 for natural balance between aerobic and anaerobic conditions).

The value of KT varies for different temperatures

T^{O} C	KT
Below 14^{O}	0.12
14^{O} - 18^{O}	0.22
18^{O} - 22^{O}	0.32
Over 22^{O}	0.42

4.04 Water:

The Kenya Government set up, five years ago, a ministry especially charged with the responsibility of water development. This ministry is in charge of all matters connected with water in Kenya.

For the purpose of distribution of water supplies in any area, the water undertakers who are invariably the local authorities, or the ministry itself in smaller urban areas, take over the responsibility in their respective areas. Mombasa Municipal Council which is the second largest in Kenya is not, however, the water undertaker. One of the advantages of the local authorities being the water undertakers in addition to their responsibilities for other services is that it becomes that much smoother to co-ordinate the planning and implementation of infrastructure as a whole.

It is suggested, in view of this, that where qualified personnel can be made available, water undertaking be given to the local authorities.

4.05 Electricity:

This is synonymous with the East African Power and Lighting Company who are responsible for all distribution networks besides other functions as outlined in Section 3.06.

Problems connected with the supply of electricity as an aspect of infrastructure are currently:

. the costs : the E.A.P. & L. Co. normally carry out the planning and implementation of all power supply schemes but the total costs are met by the developers. Needless to say, some profit margin determined by the company is always added. Occasionally a small rebate can be allowed. In some cases the power company can insist on a guaranteed minimum return from a scheme as a pre-condition to implementation.

. man power : it is becoming more difficult day by day to obtain estimate figures for reticulation of electricity from the power company because they find it difficult to cope with the work load resulting from the amount of development taking place in Kenya to-day. Often consultants have to be content with very sketchy estimates while at the cost-planning stages of projects.

. charges : whereas it would be cheaper to mount street lights on power poles the practice is to instal separate streetlight columns and power cables. This is so because the local authorities have found it more acceptable in terms of electricity charges since these will be metered.

Intensive streetlighting in housing developments may not be justified, but security lighting, especially in car parking areas and open spaces is essential. It is recommended, therefore, that the streetlighting requirement be dropped from the adoptive standards by the local authorities but the provision of security lights be included.

4.06 Refuse:

The existing system using individual dust bins can be modified by switching over to plastic bags. This will avoid spillage by stray dogs and scavengers and during collection by cleansing department employees of the local authorities. The method is tidier and healthier, although, in the long run, it may cost nearly the same as the present method.

SECOND WORLD BANK/GOVERNMENT OF KENYA URBAN PROJECT

KENYA LOW-COST HOUSING BY-LAW STUDY

DISCUSSION PAPER
DP4

POLITICAL, ADMINISTRATIVE AND LEGAL ASPECTS

DECEMBER 1979

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FOREWORD

The Discussion Papers are prepared to enable members of the Steering Committee to fully contribute in the preparation of this Study. Therefore they are not final reports, but evolving stages in the process of preparing the Manual/Handbook and the Draft Final Report. As such, it is intended that their contents should receive the fullest attention of the members of the Working Parties and, subsequently, all members of the Steering Committee.

This Discussion Paper, as proposed in the Inception Report, is in two parts. It is bound together in one volume as the same Working Party will examine both parts.

The first part, D.P.4.1., deals with the administrative and political aspects including an analysis of the administrative procedures for building control, plan approval and manpower resources, the political aspects of the provision of low-cost housing and the opportunities for public participation in the formation of building standards.

The second part, D.P.4.2, deals with the legal aspects. In this section we have examined the various regulations and pieces of legislation relevant to the provision of low-cost housing in Kenya from a legal point of view. This has been undertaken in order to both determine their effects and to determine the hierachy of powers embodied in the legislation. As a result of this exercise we shall be better able to recommend the best way of implementing any revised, ammended or new regulations.

DISCUSSION PAPER

DP4.1

POLITICAL AND ADMINISTRATIVE ASPECTS

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CHAPTER 1

1. THE ADMINISTRATION OF HOUSING STANDARDS

1.1.1 INTRODUCTION:

The Building Code is a codification of rules specifying how people should build. The name used for such rules varies from country to country. The following is a list of the more common names:

- Building Code
- Building Byelaws
- Building Standards
- Building Rules
- Building Regulations

1.1.2 In all cases the prescription will carry a certain amount of authority and coercion, usually deriving from statute. Where the rules are merely advisory, then they are regarded as guidelines e.g the Sites and Services Guidelines prepared by the National Housing Corporation. Thus quite apart from laying down the rules of behaviour a building code can also be educative.

1.2. THE OBJECTIVES OF BUILDING CONTROL

1.2.1 We dealt in some detail with the objectives of building control in the Inception Report. Let us now ask the same question in another form, what are the requirements of a good standard? What criteria should an acceptable or an appropriate building code satisfy? It seems to us that the following are the more relevant criteria, and all administrative efforts should aim at promoting measures and techniques that satisfy these criteria. An acceptable code must be:

1.2.2 Technically feasible in that the materials and techniques specified must result in safe and sanitary structures that are easy to erect.

1.2.3 Economic in the use of materials, labour, equipment, energy and land.

1.2.4 Easily understood by designers, builders, craftsmen as well as developers; in the context of low-cost housing this means rules that are understandable to builders and 'fundis' using self-build methods

1.2.5 Sympathetic to the needs of the poor by not penalising them and taking undue advantage of their poverty, ignorance or lack of influence.

1.2.6 Compatible with the use of traditional skills and local/unprocessed materials.

1.2.7 Easy to administer from the point of view of administrative resources such as manpower, time, accommodation, transport and equipment.

1.2.8 Enforceable to the extent that the code is not so permissive that it can be totally ignored

1.2.9 Consistent with national development goals, in this case the national housing and urban development policy.

1.3. THE APPLICATION OF A BUILDING CODE

1.3.1 Current practice in Kenya is that the building code is adoptive. That is Government has produced a model which can be adopted by those local authorities who wish to do so. However this is only one approach. There are alternatives, such as:

1.3.2 NATIONAL CODE - which would be mandatory and applicable to the whole country. The advantage of this would be its uniformity; but it would be a fairly crude piece of legislation since it would not take into account local conditions such as climate, physical conditions, local materials and traditions.

1.3.3 NATIONAL CODE WITH LOCAL EXCEPTIONS. This alternative would take into account prominent local circumstances; naturally it has to be highly selective in the type of circumstance it chooses to recognize, since too many exceptions or modifications will negate the purpose of a national code.

1.3.4 PROVINCIAL/REGIONAL CODE. This would be specific to a province or some other administrative region. Unfortunately the district/county is too small an area while the province has no elected government.

1.3.5 ADOPTIVE CODE - based on a model which can be adopted by resolution of Council or on specific instructions from the Central Government. The advantage of this method is that in theory it gives local authorities a great deal of freedom in chosing what it wants. In practice the adoption of a code has very little to do with its inherent merits. The more critical forces are the commitment of the top officials e.g. town clerk or town engineer, to change and the receptiveness of the council to reforms introduced by particular individuals. For example the introduction of the present building code was not plain sailing in some local authorities. Town clerks had to fight for its adoption. In Machakos approval was obtained as recently as 1976, after the third submission to Council. In Mombasa the Code was adopted in 1972, but some features of the old Mombasa Municipality (Building and Subdivision) Byelaws (Cap 136) have been retained. There may well be local authorities who have not yet adopted the Code, although we have not come across any in our survey. 1/

1/ The same sample of 12 towns has been used for the purpose of this discussion paper as for the other papers i.e. Nairobi, Mombasa, Kisumu, Isiolo, Kajiado, Kakamega, Lamu, Machakos, Meru, Nakuru, Nanyuki and Thika.

1.3.6 LOCAL CODE. An example of this is the building legislation in use in Nairobi, and formerly in Mombasa. This situation enables a local authority to formulate a code that is specifically tailored to suit its particular social, economic and environmental circumstances. Whilst ideal from the local community's point of view it is very difficult to administer nationally because of the wide variety of ensueing standards and rules. It would also make standardisation of components difficult, or even the training of technical personnel.

1.3.7 MODEL BYELAWS. A code which is drawn up as an ideal example to be adopted if found appropriate e.g. the existing building code. It has the advantage of giving local authorities a choice and also presenting them with a ready-made solution which they do not have to spend any money on to formulate.

1.3.8 There are various other permutations of the main themes discussed above. There is also the alternative of giving professionals the responsibilty of self-control in that the local authority would then automatically accept a building designed by a certified architect or engineer, or designed by a layman but certified by a recognised professional as being adequate. This is an approach which is well worth further consideration and discussion.

1.4. MANPOWER RESOURCES:

1.4.1 Probably the most significant finding of this consultation as far as the administrative and political aspects are concerned is the fact that very few local authorites have adopted the Grade II Building Byelaws. In our sample only the main towns Nairobi, Mombasa and Kisumu have adopted these probably because of pressure of

donor agencies (including GOK). Consequently there is little staff and even less enthusiasm for their administration.

County Councils do not have specialized personnel for administering standards. Lamu, Machakos, Isiolo, Kajiado, Meru and Kakamega do not have specialized housing staff. They usually have a works suprintendent who among other things handles housing.

1.4.2 Nanyuki (in Meru) is a unique case where they have had for the last four years a Town Engineer and an architect. These were initially Technical Assistance Personnel, but they have now recruited locally. The engineer provided under Technical Assistance is still based in Nanyuki but is supposed to serve Nyahururu, Nyeri, Kirinyaga, Isiolo, Karatina, Embu (urban and municipal authorities) as well as Laikipia and Meru County Councils. In field interviews there was no evidence that he has done any work for Meru or Laikipia County Councils.

1.4.3 With the exception of Nairobi, Mombasa, Thika, Kisumu and Nanyuki therefore the work of administering standards falls on the District Health Officer. He judges whether there are health violations. All other issues are left to the administrative officers of the local authorities - either Town Clerks or County Clerks. No systematic records on standards or housing administration are therefore kept. Nairobi has had housing administration staff for a long time. Table 1 shows the position as in 1975.

TABLE 1.1:NAIROBI CITY COUNCIL HOUSING ADMINISTRATION STAFF - 1975

	Est.	Inpost	Surplus/Deficit
1. Engineering/Ancillary:			
1. Senior (G.& above	15	10	5
2. Junior	10	3	7
3. Technical Assts. and Trainees	0	0	0
4. Works Foreman/ Inspector/ Supervisor	41	8	33
2. Architects/Planners			
1. Senior	8	8	0
2. Junior	3	3	0
3. Trainee	6	6	0
3. Quantity Surveyors			
1. Senior	9	2	7
2. Junior	N/A	N/A	N/A
3. Trainee	N/A	N/A	N/A
4. Land Surveyors			
1. All Grades	9	4	5

Source: Coopers Lybrand . 1975

1.4.4 Table 1.2:TECHNICAL STAFF FOR SELECTED TOWNS AND DISTRICTS shows a significant shortage at technician/technical assistant level and the inability to fill all levels even where there are established posts. This leads to unrealistic workloads. As is also shown in Table 1.3- MOMBASA: VOLUME OF WORK; Table 1.4 NAIROBI: VOLUME OF WORK; and Table 1.5THIKA: VOLUME OF WORK. It is not our purpose to determine calculations of work loads but these tables are included to indicate the kind of workloads the technical staff have. Other building and population statistics are included in Appendix 1 Tables 1 - 8.

1.4.5 Senior Officers lament the fact that even when there are established posts they are hard to fill since the personnel is attracted away by the private sector.
Lack of technical personnel affects not only building control but all development projects. Badly needed water and sewerage schemes are often held up because Town Councils and Councy Councils do not have the manpower to identify projects and prepare feasibility studies. Coffee farmers in Machakos District are clamouring for better roads in return for the coffee cess, but the County Council is ill-equiped to execute the work. Road and infrastructure maintenance in municipalities and townships also suffers from the same problem. Even senior posts are difficult to fill. Nakuru recently advertised for a Deputy Town Engineer and not a single application was received!

TABLE 1.2:TECHNICAL STAFF IN SELECTED TOWNS AND DISTRICTS

	A		B		C		D		E	
	Est.	Inpost	Est.	Inpost	Est.	Inpost	Est.	Inpost	Est.	Inpost
Mombasa	3	3	4	4	0	0	6	5	3	3
Kisumu	1	0	2	1			1	0	1	1
Machakos	0	0	0	0	1	0	0	0	1	1
Kakamega	1	0	1	0	1	1	0	0	1	0
Meru										
Nakuru	1	1	3	1	1	1	1	1		
Nanyuki	1	1	1	1	0	0			3	3
Thika	2	1			1	1			3	2
Lamu					1	1				
Isiolo										
Kajiado					1	1				
Machakos					1	1				

Source: Interviews

Notes: A Architect/Planner
B Engineer
C Works Superintendent/Clerk of Works
D Building Inspector
E Surveyor/Draughtsman

1.4.6 Although building control staff are in most local authorities situated in the Town Engineers Department, the most successful units seem to be those placed in a separate section headed by a town planner e.g. at Thika, Mombasa, and Nairobi. The senior planning staff heading the units have been able to integrate, with a large measure of success, building control with overall development control. The organization trees found in the various towns visited are shown in Appendix 2.

1.5. APPROVAL PROCEDURES

1.5.1 Building Plans: Where local authorities have site-and-service projects and personnel to run them provision is usually made for the allottees of plots to buy plans from the local authority for a nominal fee (about shs. 20/=). There have been cases such as Thika where a unique incorporation of a group farm has had an architect to prepare all the plans and they are then purchased from the Council. However in upgrading situation and isolated private developments, building plans are a problem for the low income groups. There are no architects in rural areas and small towns. Hence anybody with minimal drawing skills (usually Ministry of Works technicians and Ministry of Health technicians) have fairly lucrative practices preparing plans for rural and small town clients. Usually plans cost anything from shs. 200/= to shs. 4000/= depending on the availability of these illegal 'architects' and the client's means. These costs are beyond the economic reach of the target population. Thus we recommend that there be a much wider selection of types of house plans be made available for sale by local authorities for upgrading situations and other private projects.

TABLE 1.3: MOMBASA WORKLOAD

A. BUILDING APPLICATIONS:

Summary:

	1974	1975	1976	1977	1978
Total number of application received	1406	1181	1239	1327	1354
Total No.of appl. not approved	2	2	-	3	7
Total No. of appl. cancelled	4	6	-	-	-
Total No. of appl. pending	282	351	422	530	496
Total No. of appl. approved	1118	772	856	797	851
Total No. of drainage cert. issued: Permanent	98	95	89	90	209
: Temporary	6	3	5	6	1
Total No. of occp. Cert. issued	104	211	209	179	210

B. TOWN PLANNING SECTION:

(i) Sub-Division Schemes:

	1971	'72	'73	'74	'75	'76	'77	'78
submitted	30	26	34	58	56	60	56	72
approved	29	26	34	55	48	58	50	69
disapproved	-	1	-	-	-	-	5	2
withdrawn	-	-	-	3	8	2	1	1
approved subject to Commisioner of Lands	13	12	21	42	33	40	39	53

(ii) Consolidation Scheme:

	1971	'72	'73	'74	'75	'76	'77	'78
submitted	80	6	7	3	12	12	20	12
approved	17	6	6	3	11	12	20	12
disapproved	-	-	-	-	-	-	-	-
withdrawn	1	-	-	-	-	-	-	-
subject to Commissioner of Lands approval	-	1	2	2	2	1	4	3

(iii)Change of use:

	1971	'72	'73	'74	'75	'76	'77	'78
submitted	-	-	-	-	-	11	23	21
approved	-	-	-	-	-	7	18	11
disapproved	-	-	-	-	-	2	5	6
subject to Commisioner of Lands approval	-	-	-	-	-	21	4	5
withdrawn	-	-	-	-	-	1	-	4

C. BUILDING PLANS: 1978

* Permanent	777
Temporary	577

D. ACTION TAKEN UNDER THE LOCAL GOVERNMENT BUILDING BYELAWS:

	Authorised Structures			Dangerous & Negl.Structure			Structure Control to approved plans		
	'76	'77	'78	'76	'77	'78	'76	'77	'78
January	NIL	33	3	NIL	NIL	7	NIL	3	2
February	28	5	2	2	5	8	1	NIL	1
March	NIL	NIL	2	NIL	7	7	NIL	2	2
April	2	2	3	NIL	6	6	3	1	1
May	3	3	1	NIL	8	5	2	3	3
June	NIL	5	NIL	NIL	7	5	NIL	2	2
July	5	2	2	2	9	3	NIL	4	4
August	15	3	3	NIL	6	4	1	3	2
September	12	2	1	1	5	6	NIL	4	3
October	10	NIL	1	1	3	4	NIL	5	2
November	NIL	3	2	NIL	4	4	NIL	4	1
December	77	NIL	1	NIL	6	5	NIL	2	2
TOTAL	152	58	20	6	66	62	7	33	25

Summary of Action Taken:

1976	1977	1978
152	58	20
6	66	62
7	33	25
165	157	107

1.5.2 Submission of Plans: In Nairobi plans are submitted to the Town Planning Section of the City Engineer's Department which circulates them to interested parties i.e.Public Health Department, Water and Sewerage Department etc. Town Planning Section also circulates to the other relevant sections among the 13 sections under the City Engineering Department. After approval by all parties concerned which usually takes about 3 weeks plans are then sent to the Works and Town Planning Committee of the NCC. The Works and Town Planning Committee meets at least twice a month. Technically therefore it is possible to get a building plan submitted and approved in a month. Appendix 3 Tables 1 - 2 show how two residential applications picked at random were processed. In Mombasa, Kisumu, Thika and Nanyuki where local authority Town Planners/Architects are available a similar process is followed. Other small towns however devise short-cuts as dictated by circumstances.

1.5.3 In most of the small towns e.g. Machakos and Meru the processing of applicatinns is very fast since only the District Health Officer, the Town Clerk and the relevant Council Committee if there is one are concerned. This should be evaluated from the point of view that there is no technical input since the personnel do not exist. Lamu presents a peculiar case where plans are submitted to the County Clerk who passes them to the District Health Officer for comment. Plans are then sent to the Provincial Engineer in Mombasa where usually they languish until the client goes to complain.

1.5.4 Again a distinction can be made between site and service plans and other plans; the former do not present an administrative problem since they are initiated within the Town Planning Section or similar technical sections and they go through the process quickly. It is the privately

sponsored situations which are problematic as far as low-cost housing is concerned. The requirement for five sets of plans (2 linen and 3 paper) are similarly onerous. Thus we propose that the machinery for approval outside the site and service situations be simplified in process and made cheaper to the client in the main towns by:

(a) Town Planning units - doing comeprehensive plans for the areas and making an assortment of building plans available to the clients at nominal cost.

(b) Handling the upgrading and private applications in similar manner as present site and service.

1.6 FLOW OF APPLICATIONS

1.6.1 In looking at Tables 1 - 5 it is not possible to identify all low cost housing applications. We have not been able to gather statistically significant cases of non-site-and-service application cases from records. As described in 1.5.2 the processing of site and service building plans which are done 'in house' is not always kept in the public records which show submitted plans. However, if we take the temporary buildings and site and service applications as surrogate for low cost housing it is clear that few applications have been coming up to the local authorities.

1.6.2 The flow of applications is impeded by the requirement that the low income upgrading client follow the same procedure as discussed in 1.5.2. In summary they are handicapped by the relatively high cost of plans and lack of technical people. Since he is not likely to command the resources of an architect to pilot his application through the Technical Department his application stands a better chance of being rejected or delayed in the bureaucratic maze. He probably just builds and waits for condemnation.

TABLE 1.4: NAIROBI: VOLUME OF WORK

A Analysis of building plans approved for private development during 1978:

Type of Building	No. of plans	Estimated shs.
Residential New	1691	217,873,960
" Adds. & Alts.	785	81,006,500
Commercial New	72	253,399,700
" Adds. & Alts.	105	35,845,300
Industrial New	89	235,711,100
" Adds. & Alts.	155	66,853,400
Public New	25	21,338,000
" Adds. & Alts.	47	20,884,100
	2969	1,131,141,600

B Number and estimated value of plans approved during the past 10 years:

Year	no. of plans	Estimated shs.
1969	1529	217,873,960
1970	1764	218,600,300
1971	2051	288,327,100
1972	1811	309,831,800
1973	3210	303,295,500
1974	2766	362,999,000
1975	1700	432,396,700
1976	1449	370,185,500
1977	2819	751,054,700
1978	2969	1,131,545,600

C The comparative values and number of occupation certificates issued during the past 5 years is as shown below:

Year	No. of Cert. Issued	Values(shs)
1974	1808	213,953,018
1975	1405	233,530,961
1976	1110	222,821,416
1977	840	220,091,426
1978	789	233,102,816

D Inspections by Building Inspectors.

Mileage and number of inspections made by building inspectors 1974-78

	1974	1975	1976	1977	1978
Inspections	17,981	15,356	11,982	10,901	11,491
Mileage	39,971	38,389	37,000	47,949	45.064

TABLE 1.5: THIKA VOLUME OF WORK

Building Plans approved by Council, 1972 - 1978

	1972		1973		1974		1975		1976		1977		1978	
	New	Ext	New	Ext	New	Ext	New	Ext	New	Ext	New	Ext	New	Ext
1. Residential (S/S)	170	-	-	-	-	-	-	-	-	-	182	-	150	-
2.Residential (other)	10	1	10	21	112	9	63	4	82	4	10	7	11	10
3.Commercial	4	12	7	21	-	4	1	4	1	6	3	4	-	12
4.Light Industries & Godown	-	-	-	-	-	-	7	1	3	2	3	5	-	13
5.Factories	1	5	-	1	4	8	3	3	4	3	4	6	-	8
6.Schools	2	7	-	5	-	8	1	1	-	2	-	4	-	2
7.Hotels					-	-	1	-	1	-	1	-	1	-
8.Hospitals			-	1	-	1	-	-	-	-	-	1		
9.Clubs			-	-	-	-	-	-	-	-	-	1		
10.Others (PO,Church, Petrol Station)	1	-	-	-	1	-	-	1	2	2				
Total	188	25	17	49	117	30	76	14	93	19	203	28	162	45

1.7 DATA STORAGE AND RETREVAL FOR OTHER USES:

1.7.1 Where Town Planning/Architect units have planned site and service buildings there does not appear to be storage and retrieval problems. Examples are the projects done in Nairobi, Mombasa, and Kisumu, where there are area plans and standardized building plans. In Thika the Mangu Investments Development and Ngoingwa Farm Development offer an interesting approach where the Town Planner /Architect has prepared an area development plan and standard building plans and charged the companies. These will be stored for retrieval. We would also suggest the Nanyuki approach, where a development plan was prepared for the area which is going to be upgraded after a building and population census was completed by the Town Engineer/Architect. This plan took into account the existing houses which were semi-permanent/permanent and incorporated them into the structure plan. The other purely temporary structures were to be upgraded by individuals using an assortment of standardized building plans prepared by the Town Engineer/ Architect. The cost of the building plans to the plot owners is nominal. The Nanyuki upgrading system makes storage and retrieval for other uses possible.

1.7.2 In Nairobi, Kisumu and Mombasa the general building plans storage and retrieval is inadequate because of the shortage of storage space and equipment. Plans are just stacked all over the floor and it is important that a plan filing system be given adequate space. There is no doubt in our minds that doing this will speed up the processing of plans. Sometimes plans get lost, as some architects argue, and have to be resubmitted. Easy retrieval may also allow clients to copy the building plans for later alterations/ subdivisions etc. rather than going to commission

new drawings. In Nairobi and a few other municipalities old approved drawings can easily be retrieved by members of the public on paying a search fee. However the permission of the architect and/or property owner must be obtained first so as to prevent indescriminate copying of designs. Nonetheless this precaution does not prevent interested persons from gaining unofficial access to drawings through friends in town hall.

1.7.3 If the information obtained from the applications were analysed and mapped systematically it would help forward planning and research considerably. The following data would be relevant:

- type of use
- floor area
- number of rooms
- additional families
- ownership
- car ownership

1.7.4 The ideal situation would be to incorporate all this data into an existing urban information system, especially in Nairobi, but such a system is probably premature. In the meantime simple mapping techniques would be very useful.

1.8 BUILDING CODE MONITORING AND ENFORCEMENT

1.8.1 Site and service monitoring and enforcement does not seem to be a problem during construction since the plans are done in the local authority offices and materials or loans therefore are given out on the basis of Building Inspector recommendations. We did ask the question on how regularly after construction are site and service buildings inspected and we were not able to generate firm statistical data. However, in most of the sites visited there did not appear to be a system for regularly monitoring low cost housing after construction. Indeed in Dandora, the show piece site and service scheme, one person has joined three plots and built an executive house.

Another has built a hotel at Nakuru. Other minor structural modifications are found in all low cost housing areas. What is not clear is whether "rich landlords" do these modifications with the collaboration of the Building Inspectorates where they exist or whether the lack of enough inspectors in most authorities means that their work is purely concentrated on the plan approval phase and not enforcement after. When we interviewed Building Inspectors we had the impression that they were just concerned with construction and not subsequent monitoring and enforcement. In any case there are few building inspectors on the ground as shown in Tables 1 and 2.

1.8.2 In practice most condemnation is not done by the Building Inspectors but rather by the Public Health inspectors on health grounds rather than building code specifications. It is from this point that there is no simple and clean-art process of appeal since the Health Act gives final (prosecutory) powers to the Health Officer.

1.8.3 In the detection of unauthorized structures building inspectors are assisted by municipal askaris. The latter are involved in demolitions, and in difficult cases they are supplemented by a regular police officer to lend the operation extra authority.

1.8.4 In some towns e.g. Machakos, the courts have been quite cooperative; 60 cases have been successfully filed at Machakos over the last four years. The Public Health Act and the Local Government Act are found to be more useful for this purpose than the Building Code, which is said to be "too technical".

The sequence of events is normally as follows:

1. Notification of infringement
2. Reporting to Committee and/or Council
3. Town Clerk takes legal action; this normally takes a long time, e.g. Mombasa has cases pending since 1965.
4. Town Clerk seeks up-to-date position on unauthorised structure
5. Town Clerk proceeds with action in the Magistrates Court (Code 252 may be used)
6. Court orders either demolition plus fine for non-compliance or fine only.

1.9 INTERMINISTERIAL RELATIONS

1.9.1 The relevant Government departments and agencies are:

- Physical Planning Department
- Department of Lands
- Ministry of Local Government
- Housing Department
- National Housing Corporation
- Building Committee - Interministerial coordination
- Town Planning Liason Committees

These institutions and other less important ones are listed in Table 6 which also shows the part they play in formulating and enforcing standards.

1.9.2 Physical Planning Department of the Ministry of Lands and Settlement: This department is responsible for the preparation of structure plans for all urban areas except for Nairobi. Many towns have no up-to-date and accepted plans. Plans are in various stages of preparation and approval. In spite of the fact that the Department has posted Provincial Physical Planning Officers most of the final decisions about plans are made in Nairobi leading to delays on the one hand, and to plans which are not totally in harmony with local needs and local technical variations on the other. Some local authorities visited

TABLE 1.6: AGENCIES RESPONSIBLE FOR FORMULATING AND ENFORCING RESIDENTIAL STANDARDS

	Policy Formation	Standard Setting	Plan Approval &Inspec-tion	Enforce ment	Notes
Housing Department	X	X			
NHC	O	O			
DPP/PPO		X			
Ministry of Health/MOH	X	X	X	X	
Commissioner of Lands	X	X	X		COL uses both statu tory&contr ctual meas ures
NCC	X	X	X	X	
Local Authority		X	X	X	
E.A.P.&L.		O			
Water Authority		X		X	
AG's		X			
Courts		X		X	
Provincial Admin/Chief				X	Chief may be used by LA to enforce
Lending Institutions		O	O	O	
Employers		X			
Labour Department		X			
COTU		O			
Architects/Engineers & Designers		O			
Bureau of Standards		X			
HRDU		O			
Donor Agencies	O	O	O		

X - Public Measure

O - Private Measure

complained about the fact that the Department is understaffed and cannot provide the service when required. For example Machakos has been waiting for some time for a new plan to cover the extended areas. All the authorities however appreciated the value and importance of the plans prepared.

1.9.3 Department of Lands

This department is the final authority through the Commissioner of Lands on all government held land. Although some Local Authorities act on behalf of the Commissioner, final sanction must be made by him. This results in long delays as far as acquisition of land for housing in general and low cost housing in particular. The most glaring example of delays and changes in acquisition policy is Kisumu where decisions by The Department of Lands have changed the type and nature of project at Migosi-Manyatta. Unlike the Department of Physical Planning, personnel and decision making process are extremely centralized in Nairobi and not easily available to local authorities.

The Department argues that it has limited revenue for acquisition of land for housing in general. Infact for the future it may not be realistic to expect as much acquisition as in the past given the department's finances. The department may be forced by budgetary constraint to acquire selectively as in Migosi-Manyatta. This will undoubtedly change the nature of public housing in general, and specifically with regard to low cost housing it will mean that there will be very little public land for projects. Thus a new form of providing housing on either land rented by government or by private individuals will have to be worked out.

1.9.4 Ministry of Local Government: This Ministry is ultimately responsible for all local authorities. Finances of local authorities are also ultimately controlled by this Ministry. The housing function of local authorities is however essentially dominated

by the Ministry of Housing and Social Services through the National Housing Corporation which provides funding, plans and supervision. It is important that the Ministry of Local Government interests itself in the housing function of its local authorities. First there are some local authorities like Meru with funds who could provide different housing schemes than those implemented by National Housing Corporation. Second it appears that the Ministry ought to provide an input into the NHC housing specifications for local authorities, particularly where they do not seem to be locally realistic. The impression obtained is that the Ministry has been too aloof. Perhaps the most critical area is where local authorities want to build low income rental houses and NHC resists this since site and service to date has been predicated on the concept of individual owner occupier. In fact many of the town clerks and town engineers we interviewed favoured rental schemes largely because they yield revenue surpluses to the council and remain in the council's list of assets.

As far as byelaw administration is concerned the Ministry's contribution is in practice very small. There is a case for creating the post of Building Inspector-General or Chief Building Surveyor in the Ministry to coordinate and direct all building code matters in the country.

1.9.5 The National Housing Corporation of Ministry of Housing and Social Services: With respect to low cost housing this corporation is administratively more powerful than its parent Ministry for two reasons:

1. The most important is the top leadership of the Corporation which often has its own priorities which are different from those of the Ministry.
2. The personnel, the technical officers in the parent Ministry have no power to control the Corporation. At best they are

left with pre-planning activities. The Corporation often ignores the parameters of the Ministry in its policy implementation. Local authorities claim that their demands are totally ignored by the Corporation. They further claim that even after projects are agreed upon the technical staff sent from the corporation do not stay in local areas long enough to familiarize themselves with the local technical problems. One example is the Isiolo project where problems of black cotton soil were not recognized in the design of the buildings and the infrastructure. In Meru houses were sited on a road reserve. In Nanyuki the design of drains did not take into account balck cotton. Other examples can be given. Ironically the original institution, which ultimately became the NHC, was specifically created to help local authorities with housing problems. This objective seems to have been lost. It may be worthwhile to rethink the role of NHC from several points. It may be important to return the funding function back to Ministry of Local Government. The technical functions could possibly be handled better by posting the officers to local areas thereby disagregating the staff in Nairobi. Another alternative would be to create regional offices. Similarly on-site temporary offices could be tried. The parent Ministry will then remain with overall responsibilities for National Housing Policy, but not construction, which will be left to local authorities.

The Corporation should also not allow local authorities to dictate the type of standards to be used in NHC - financed projects. For

example although the Chief Architect of NHC is quite prepared to allow mud and wattle construction, most local authorities will not allow it.

1.9.6 The Building Committee - Interministerial Coordination: This is a strange institution whose function is to meet to harmonize policy differences between the Ministries of Lands and Settlement, Local Government, Treasury, Planning and specific Local Authorities. Other relevant Ministries can be co-opted. In law it is composed of the permanent secretaries and the respective local authority clerks. In practice very junior officers are designated to attend. We do not think this would be a useful body if the Ministry of Housing increased its staff to have policy making and supervising departments. Conflict in policy could then be handled normally by inter-ministerial consultations and if they are fundamental by Treasury and finally Cabinet.

1.9.7 The Town Planning Liason Committees: These are coordinating committees that exist for the benefit of the major towns with representatives from the local council, the Commissioner of Lands and Department of Physical Planning. The meetings are chaired by the Director of Physical Planning. The Committees meet once a month and the business considered includes:

- important applications for changes of use
- applications for sites for specific extra-ordinary purposes, e.g. hotels, industrial plants, churches, etc.
- planning matters relating to government land.

The work of the Committee therefore has no direct effect on building control for low-cost housing. Occasionally however it has to deal with applications for land for institutional housing.

Administrative problems and the measures taken to solve them are summarised in Table 7.

TABLE 1.7: ADMINISTRATIVE PROBLEMS AND RECOMMENDED INTERVENTIONS

ISSUE	BYELAW NO.	PROBLEMS	RECOMMENDATIONS
Implementing authority	4	Only municipal and county councils may adopt the Building Code; Large town councils have special problems which cannot be dealt with at county level	Amend byelaws to enable town councils to adopt byelaws (if adoptive) when necessary
Submission of plans	5 & Schedule I	Application forms are sometimes too detailed and confusing. Some towns have no application forms at all	Design standard application form for low cost residential construction
		Plans are too expensive to prepare	Develop wider range of type plans and make them available in all towns. Make plan-printing facilities in Town Hall available to local draughtsman at a reasonable charge
		Imperial scales	Change to metric to suit new subdivision plans
Fees	6 & Schedule 10	Fee amounts were fixed more than 10 years ago and are now obsolete i.e. too low from the local authorities' point of view	Raise fees by 50%
Notification of results	7	One-month rule not widely known among builders and developers (2months for Grade II)	Attach to application form explanatory notes including explanation of one-month rule.** Allow applicant to build if LA has not reached decision after one month
Delays in approval	7	Delays caused by lack of adequate staff and transport. Insufficient or inaccurate information given by applicants.*	Improve staffing situation and transport facilities in building inspectorates. Give automatic permission to dwellings designed by a registered architect

* Some local authorities e.g. Nakuru issue a set of guidance notes together with the application form, an idea that should be copied by all towns.

** The AAK has agreed with NCC on a procedure for reminding the NCC! (Appendix 4)

TABLE 1.7: (Cont'd)

ISSUE	BYELAW NO.	PROBLEMS	RECOMMENDATIONS
		Delays in ratifying (Works and Town Planning) Committee's decision*	Give Town Clerk power to inform applicant of Committee's decision**
Appeals		No right of appeal is specified in the Building Code	Provide for appeal machinery preferably through a tribunal or appeals board
Adoption of Grade II Byelaws		Adoption discretionary Some LA's find the byelaws not suitable	Prepare universal byelaws applicable to all LA's subject to minor local modifications. Make adoption of new byelaws conditional upon granting of public funds for housing projects.
Committee Representation		Planning Committees e.g Works and TP Committee in Nairobi, are small council committees with no representatives from relevant Government Departments, yet they make important policy decisions affecting planning and environmental standards	Coopt representatives of Physical Planning Department, Commissioner of Lands, and Ministry of Housing or NHC on Planning committees; this is now done at Nakuru and Kisumu. Formalise the status of the TP Liason Meetings
Committee decisions		Local planning committees develop standards that are relevant to the local situation but are not well publicised except as Committee Minutes	Arrange for relevant Committee/ Council minutes to be compiled and printed properly as an addendum to the Byelaws which is easily accessible to practising professionals
MOHSS		LA's will not take advice or yield to pressures from MOHSS as far as standards are concerned	Appoint a well-trained professional cadre of provincial housing officers to guide local authorities
Checking of Plans		Checking floor areas, plot ratios, ground coverage, etc. is very tedious and labour-intensive, e.g. NCC has a full time officer doing only that. Developers and designers can cheat.	Impose a heavy penalty for filing inaccurate plans and information with intent to mislead council officers

* Nairobi WIP Committee meets twice a month

** At Machakos the Town Clerk issues permits and only reports executive decisions to Council.

TABLE 1.7:(Cont'd)

ISSUE	BYELAW NO.	PROBLEMS	RECOMMENDATIONS
Subdivisions		Demolition of temporary structurs on subdivision	Relax requirements on demolition
		Surrender of land for public purposes	Avoid demands to surrender land unless absolutely necessary
		Low quality of layout designs	Encourage Government and local authority planners to assist landowners and cooperatives with subdivision design.
Manpower		General shortage of office and field staff	
		Some inspectors cover too large an area	Aim for inspector/population target of/inspector per 50000 - 75000 population (Appendix 1 Table 7-8)
		Low professional status and lack of recognition	Elevate professional status through licensing system for building inspectors and building surveyors
		Shortage of engineers	Appoint town planners to look after development control
		Inspectors have no precise duties	Develop suitable job description (see Appendix 5)
Training		Lack of funds. Lack of or inadequate training programmes; no career structure	Get MOLG to prepare and implement a longterm programme for training and manpower development
Transport		Poor mileage rates. Lack of office vehicles.	Review mileage rates. Provide field vehicles in larger municipalities.
Office space & Furniture		Poor accommodation for inspectorate staff · Inadequate furniture, equipment and records storage space	Raise plan submission fees and utilise proceeds to improve facilities
Documentation		Information in the files is not used to full advantage for planning purpose.	Encourage Planning and valuation Departments to make better use of data on file.

2. THE POLITICS OF HOUSING STANDARDS

2.1 POPULAR IMAGES OF LOW COST HOUSING:

2.1.1 In the popular mind low cost housing means either houses built with traditional materials and techniques or the site and service structures found in a few towns which are termed "colonial" since they exhibit several characteristics associated with poverty and pre-independence urban housing practices. These are:

(a) very little space for families - like the provision of one room per family initially, e.g in core housing

(b) very few services e.g. water, non-tarmac streets, no public transport, sometimes no schools and other community services.

(c) "poor"construction and finish e.g. no paint, no ceilings, open hearths

(d) construction in bad locations e.g. Migosi-Manyatta flood-plain and sites near sewage works.

2.1.2 Low cost housing also fits colonial urban zoning where the races were separated and by coincidence the rich were segregated from the poor. Since they were so separated it meant that the other services were poorer in low cost housing areas. These were put in the environmentally worse areas.

2.1.3 It seems that official low cost houses are opposed both by the poor as well as the rich opinion leaders. As a result local authorities are opposed to low cost housing in general.

2.1.4 It is important here to note that the low cost housing we are talking about here is urban and essentially site and service on public land. This concept of low cost housing has essentially come to Kenya from Latin America and it has been suggested to us that it has been introduced too fast. Outside Nairobi it has essentially been

propagated and executed by NHC. The concept of low cost housing (site and service) assumes:

(a) cheap or unlimited public land,

(b) owner-occupier as the desirable consumer,

(c) stable urban population,

(d) ability to pay by the target population.

These are dubious assumptions since most of the people unless they have their original family land zoned into the city (e.g. Kawangware, Migosi) they perceive themselves as transients in the city. Second, availability of cheap and/or unlimited public land is a chimera. Thirdly those who have spare resources to build are not necessarily occupiers. They are landlords. Some of them are local authority councillors. Fourthly, the target income group cannot even afford to build in site and service. Many of them consequently sell their plots for fantastic profits to others. Site and service plots in a small place like Nanyuki change hands at shs. 20,000/= a plot. In Nairobi prices go up to shs. 50,000/=. Fifthly, the effective housing demand in smaller towns is for housing of higher calibre than current site and service. Sixth, local authorities would rather build to rent to augment their budgets rather than subsidize the rural elites who buy the plots from the site and service 'poor' allottees.

2.2 THE POLITICS OF HOUSING STANDARDS:

2.2.1 It is significant to note that even where local authorities have perfunctorilly passed Grade II byelaws no Councillor or politician will defend site and service schemes in public. There are several reasons for this. First the Councillors and MPs and Civil servants are part of the elite which sees speculative opportunity in building for rental to all income groups. Second, they are under attack for allowing housing which is considered "colonial". Thirdly, there seems to

be spare investiment capacity for housing in the rural areas. The demand for housing in places like Meru and Machakos is for housing civil servants - a higher quality than site and service 1/. Fourthly, in towns where people have been zoned into an urban area they wish to build themselves structures which they will rent and thereby lift themselves into a higher income group. Out of this they expect to improve their own houses. The present administration of site and service does not permit this.

A fifth point, which is a variation of the fourth, is that formerly agricultural land which has been incorporated into towns has been, to date, acquired with some kind of compensation. The people and politicians argue that they should be allowed to sell to individuals rather than Commissioner of Lands who pays less. They argue that even if the zoning requires high cost housing they will be able to sell plots and build such structures out of their own resources over time. An interesting institutional variations of this is in Thika where some of the farm buying companies have gone for technical advice from the Council, have got a total structure plan and are planning to build houses for their members who will be free to occupy or rent. In Migosi-Manyatta the proposal that plots larger than normal site and service plots be subdivided and acquired is being resisted. Thus it may be useful to organize local land owners into a company and develop an integrated plan as in Thika where the planning execution and allocations can be undertaken on a commercial basis.

1/ It is estimated by the Town Clerk of Machakos that there are some 900 Civil servants in the township in the low-medium income bracket, and only 100 houses for senior civil servants.

2.2.2 Perhaps the most controversial and sensitive area in building code administration is the demolition of shanties and other unauthorised structures. Local authorities are normally very cautious because of not only the political repercussions but also because when a shanty is demolished several families become homeless. In a recent Daily Nation editorial the case is related of a landlady who was served notice by Nairobi City Council to demolish unauthorised extensions within 14 days.2/

> But then a human problem arose. The dwelling was once upon a time built to accommodate one family. It is now "home" to no fewer than 22 families living in single rooms! While they appreciate that the civic order to demolish the extensions within 14 days, the tenants say they want adequate time to find alternative accommodation; some of them say it is the landlady's responsibility to find them alternative accommodation.....
> Some matters however are for the local authority to take up and resolve. Parts of Nairobi are one vast slum, and we are not refering to Mathare Valley. Inattention, neglect and a near-total failure to apply the byelaws have, over a period of years, converted middle-class residential areas into what can only be termed a disgrace to the capital city.

2.2.3 In Mombasa the Commission had to stop demolitions after the Minister of Local Government intervened.

2/ Daily Nation, November 28, 1979

2.2.4 The general hostility towards Grade II Byelaws and sites and service schemes has caught municipal professionals in an embarrassing situation where on one hand they must please their Councillors and townsmen and on the other they have to face up to realities as put before them by the NHC and the Ministry of Housing and Social Services. Quite often they compromise by saying, "Grade II is o.k. provided it is in permanent materials". Thus mud-and-wattle is considered equivalent to "going back to the old days". Even in Mombasa, where there is a long-standing tradition of building in local materials, new mud-and-wattle houses are prohibited. In his Annual Report for 1978 the Municipal Engineer writes, "There is no solution as yet to the problem of housing in Mombasa; then I strongly urge the Government to lift the ban on temporary buildings at least for the time being."

2.3 COMMUNITY PARTICIPATION IN STANDARD FORMATION:

2.3.1 Like many other Government of Kenya planning processes the local communities are seldom involved in planning housing in general and low cost housing in particular. All housing decisions are made by technical people in Nairobi and 'sold' to local authorities and local populations. There is little room for deviation. There is little room either for community participation in housing implimentation. Even in Dandora where some officials incharge of the project argue to the contrary they are systematically involved in deciding the type of houses, construction techniques and sequences.

2.3.2 It should be clear that as long as the basic assumption of low cost housing programmes is individual owner occupiers who are not members of community but poor

people who are put up by influentials who do not live in these communities - there will never be meaningful community participation. It is only in already existing communities that the community can be organized on Harambee basis to discuss alternative plans and strategies. These will be situations of upgrading like Dagoreti and Kawangware. Obviously the planning must be such that it will not just be camouflage for pushing out the poor. That would happen for example as a result of the proposals for Migosi-Manyatta where those with large plots would be forced to sell if they cannot meet the rates and infrastructure costs.

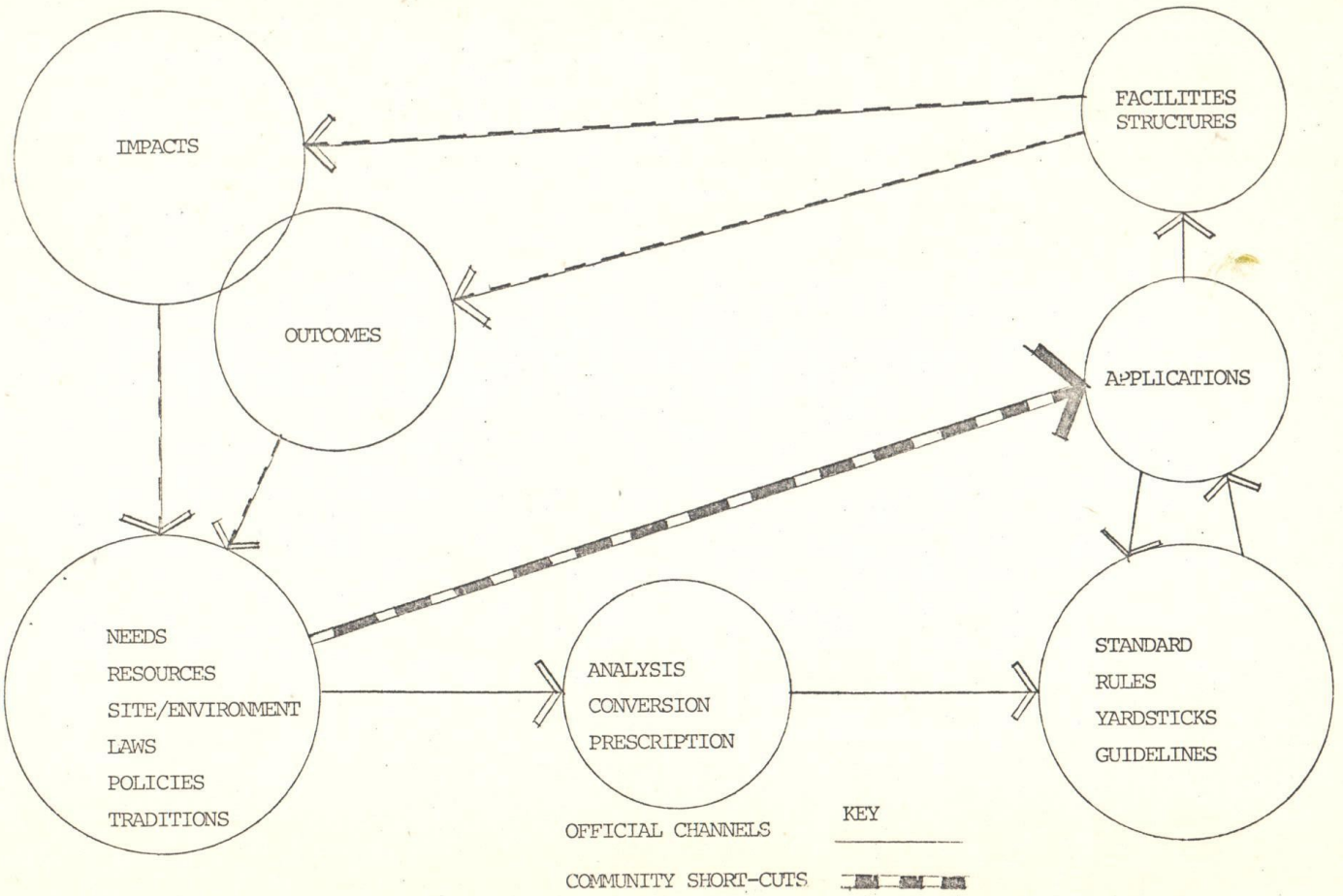
2.3.3 The community's role in setting detailed standards is already evidenced by the manner in which a large number of poor developers bye-pass official channels (Figure 1).This contribution however has been mainly in house construction. When it comes to the laying and maintenance of infrastructure there is very little experience of urban self-help in Kenya. The main reason for this is the general expectation that the local authority will or should do the work.

2.4 CORRUPTION IN LOW COST HOUSING:

2.4.1 The most significant aspect of corruption in low cost housing is the question of allocation of plots. There is no systematic statistical data on who gets plots but officials in Thika, Kisumu, Meru, Nanyuki, Machakos and Nairobi argued that it is possible that within a year more than 50% of all site and service plots change hands. 3/ Since there is always a provision that this should not be done it is important to discuss the mechanisms briefly.

3/ For instance the figure quoted at Thika was that more than 75% of the plots in the nine S/S schemes executed since 1968 have changed hands.

FIGURE 1: STANDARD FORMATION



2.4.2 Usually when site and service plots are advertised the influentials (Councillors, MPs, businessmen/women, civil servants etc.) find poor relations and/or friends who qualify for allocation. These usually get allocated plots. Soon after the person allocated then goes to a lawyer with the influential where they enter a legal contract transfering the plot to the influential or to his friends. All official correspondence, collection of materials etc. goes to the 'godfather' influential and thus the legalistic requirement is fulfilled. Not all influentials who get plots this way keep them. They sell them to others through legal contracts again. Very good money is being made in the towns by selling these plots.

2.4.3 Significantly since site and service concentrates on minimum standards some of the richer landlords are building mansions on adjoining plots in schemes in Nairobi, Kisumu and Nakuru.

2.4.4. As argued in other portions of this chapter, the solution to this problem where those with inside information get unfair returns maybe is to upgrade for the poor living on public land and in areas of individual land ownership to develop a formula for the individuals to upgrade themselves, thereby keeping the accumlated benefits to themselves.

2.4.5 The problem of corruption cannot be discussed in isolation from the general question of accountability and effective performance by officials and elected leaders. This is an issue which has received particular attention from no less a document than the National Development Plan 1979-83, which sternly warns,

> Ultimately, those who manage must be held responsible for production losses, poor services, uncoordinated field activities, and neglect of institutional responsiblities

and commitments. Managers need also to look at the planning capability, responsiveness to the public's needs, adaptability to changing economic situations, and accountability to regulatory bodies. 4/

2.4.6. In the field of building control and housing administration in general a great deal of improvement will be achieved by elevating the sense of professionalism among the technical and senior administrative staff.

2.5 POSSIBLE POLITICAL OUTCOME OF NEW STANDARDS:

2.5.1 Elsewhere in this report it is suggested that mixed zoning, emphasis on upgrading and extending funding institutions into low cost housing are probably the critical future policy instruments for increasing low cost housing without just relying on site and service only. If these policy instruments are followed, they are likely to become popular - in the sense that there will be mixed standards which will make it possible for the landowner in new town extensions to upgrade and provide mixed-standard housing.

2.5.2 Such strategies are likely to satisfy the major existing local demand in the smaller towns which need essentially middle and upper middle class houses for civil servants. The real poor who move into towns like Isiolo to work or are transients cannot even afford the site and service. Thus institutional funding for local authorities for rental housing should be expanded.

4/ Development Plan 1979-83, p. 491

3. BUILDING BYELAWS AND LAND USE CONTROLS:

3.1.1 The land use controls that are relevant to the formulation and implementation of a building code for low cost housing are:

(a) Zoning
(b) Subdivision Control
(c) Controls imposed by covenant in ground leases
(d) Bilateral agreements between developer and local authority/Government.

ZONING

3.2.1 All the towns visited had a development plan, either interim or approved, which demarcates discrete land use zones for various types of functions. For example Nairobi has recently rezoned large parts of the City; Machakos is working on the basis of a temporary plan pending the completion of a revised development plan to cover the extended areas of the township; Mombasa is in the strange situation of having two plans in operation. Developers are then guided by the type of zone in which their plot lies. There will be restrictions on:

- type of use e.g. whether low, medium or high density residential, or commercial, etc.
- minimum plot size
- ground coverage
- plot ratio (floor space index)
- maximum number of dwellings per plot

3.2.2 While the immediate effect of these restrictions is to limit the number of persons per plot and to roughly define the type of allowable development, these controls have wider and far reaching effects on overall urban growth. They affect the pattern and direction of growth, the transportation system and the demand for various types of services.

The quality of physical development is also affected in that high densities are usually associated with low income families and vice-versa.

3.2.3 Since land use is restricted to one or two particular types, a person who wishes to change the use of his plot or building must obtain permission from the local authority. This is another function of a development/building control unit. For example Mombasa dealt with 21 such applications in 1978 and Nairobi with 121 in 1976.

3.2.4 The manner in which applications for "change of user" are processed is basically the same as building permit applications. They are circulated to various departments for comment before going to Committee and/or Council. We shall therefore not deal with the routines in any detail. It is relevant to point out however that whereas a flexible attitude towards such applications is needed, local authorities must try to maintain a balance and adhere to planning principles. We are informed for instance that there has been so many applications for change of user from residential to lodging houses/bars in some parts of Nairobi that a ban has been inposed on any further approvals in these areas.

SUBDIVISIONS

3.3.1 The purpose of subdivision control is to:

- control the quantity of plots coming on the market
- control space and density standards
- to enforce servicing standards

3.3.2 Control is exercised by local authorities and the Commissioner of Lands under a variety of statutes including the Land Planning Act 1968; Town Planning Ordinance 1931; Building Byelaws; Street Adoption Act; Registered Land Act; and Land Control Act 1967.

3.3.3 The number of subdivisions approved by Nairobi City Council in the 11-month period from June 1978 to April 1979 was 189 subdivision applications out of which 6963 plots were created. Assuming the existence of one dwelling on each original plot, this means that 6774 new plots were added to the existing stock. The amount of building permits issued was however nowhere near that figure, since many plots remain vacant for a long time after subdivision. The number of building permits issued in the City in 1978 was only 2969, of which 57 per cent was for new residential construction. Mombasa on the other hand only dealt with 72 subdivisions in 1978, of which 69 were approved (Table 3)

3.3.4 All subdivisions must be approved by the Commissioner of Lands. Mombasa did have, until 1974 when it was abolished by the Central Government, a system which enabled subdivisions for low cost housing to be approved and executed speedily. The system known as the Village Layout Schemes, enabled the Council to approve the layouts for subdivision once the landlord had met prescribed standards on density and infrastructure wayleaves. 1/

1/ See S.O. Kiaye Village Layout Schemes in Mombasa. Paper read at HRDU Seminar, May 1977.

3.3.5 While discussing subdivisions, we could also mention consolidations and amalgamations, of which a very small number has to be processed by local authorities. For example Mombasa had only 12 in 1978.

CONTROL BY COVENANT

3.4.1 This is the control exercised by the landlord in ground leases. The landlord in this case is normally the Commissioner of Lands, County Council in the case of Trust Land, or town council. For example in site and service schemes the plot is usually held on lease from the local town council, which stipulates conditions ralating to:

- period during which development must be commenced and completed
- use of the premises
- occupancy
- transfers
- subletting
- materials to be used in construction and/or the minimum amount of money to be invested.

3.4.2 Thus the ground landlord is in a strong position to influence dwelling standards. His efforts supplement those of the building inspectorate, especially where the landlord is not the local authority. As discussed in the Discussion Paper DP1, prescribing a cost ceiling or floor is an effective way of controlling construction standards. There is therefore a case for extending these powers to selected groups e.g. cooperatives, so that they hold freehold title but grant leaseholds to individual members. A certain amount of self-control and monitoring would then be possible, with some relief to local authority personnel.

BILATERAL AGREEMENTS:

3.5.1 These are quite common in land use decisions, especially in the larger towns where developers and architects are experienced at exchanging concessions with planning departments. In building control such agreements are possible under Scheduled Special Areas provisions in the Building Code. However we doubt whether any such agreements have taken place, except for public projects.

3.5.2 The existence of local authority powers to make special agreements with developers of low-cost housing outside the normal building code requirements will give councils much greater flexibility in approving novel housing schemes. Such powers would be very beneficial if exercised responsibily.

4. CONCLUSIONS:

The recent ministerial changes which resulted in local government and urban development being merged into one ministry will have favourable effects on the administration of building byelaws. In the course of this study we have from time to time put forward the case for a greater measure of integration between building control and land use planning, since we feel that many of the difficulties that are now being experienced could successfully be solved by the application of sound planning techniques. We have also argued in this paper that urban planners could play a bigger role in development control and building control. In fact the most interesting and innovative practices are taking place in those local authorities which have merged the two functions under the leadership of an architect or planner e.g. at Thika, Nanyuki, Mombasa and Nairobi. This leaves the engineers, who are extremely scarce, to concentrate on professional engineering tasks.

Indeed manpower shortages seem to be the major problem facing local authorities and ministries. Not only is it a question of numbers; it is also a problem of professional status, training and conditions of service. The City Engineer reported in 1978, "As predicted in the 1977 Section's Annual Report, the number of planning and building applications continued to increase while that of the staff members decreased tremendously." The number of inspections made is actually going down while the amount of building work is increasing. 1/ We estimate that at least 50 building inspectors are needed for urban areas at the moment, leave alone county councils and future requirements.

1/ The number of inspections fall from 17,981 in 1974 to 11,491 in 1978 (NCC Annual Report 1978 p. 45)

It is beyond the scope of this assignment to carry out a manpower survey, but it is unlikely that there are more than 25 inspectors in the field.

At the National level it is necessary that a top-level post of Chief Building Surveyor/Inspector-General be created in the Ministry of Local Government and Urban Development to direct and coordinate all building byelaw matters.

There seems to be some confusion as to the application of the Special Schedule Areas provisions as opposed to Grade II Byelaws. This is a matter which will receive further attention in the technical Discussion Papers. It is apparent however that measures are needed to dispel this confusion.

The routine administrative difficulties experienced in administering the Byelaws are discussed in Chapter 1 and recommendations are listed in Table 7. Most of these recommendations can be implemented administratively by the Government Departments and local authorities concerned.

The areas where progress is still to be made is in allowing and assisting land-holding companies and groups in surburban locations to plan and subdevide their land, and ultimately to control developments themselves. Some trials are being done at Thika and Kisumu. In Mombasa the village layout system should be revived, as well as the construction of mud-and-wattle houses. In fact Mombasa has accumulated a wealth of experience that could be used elsewhere, especially in upgrading schemes and the processing of plans for house improvements.

APPENDIX 1

TABLE 1

REPORTED COMPLETION OF BUILDINGS FOR PRIVATE OWNERSHIP IN MAIN TOWNS
By Type of Building and Town, 1970-1977

	1970	1971	1972	1973	1974**	1975**	1976**	1977**
Number of New Buildings								
Residential	470	1426	1832	1499	1451	1855	791	799
Non-Residential	131	174	158	167	105	95	118	64
Floor Area of New Buildings ('000sq.m.)								
Residential	232.1	260.7	266.9	203.3	230.8	254.0	110.7	102.7
Servants' quarters	-	-	-	-	-	-	-	-
Total Residential	232.1	260.7	266.9	203.3	230.8	254.0	110.7	102.7
Offices	23.3	51.8	28.6	3.6	23.6	16.5	28.2	16.8
Shops	4.9	4.6	14.1	12.6	4.8	6.5	8.2	1.7
Godowns, Stores etc.	25.7	15.8	26.0	27.1	26.9	20.4	30.3	25.6
Factories	80.0	82.0	61.7	52.1	44.5	23.1	102.2	67.7
Other	80.9	43.9	79.1	23.7	28.4	16.6	22.9	5.1
Total Non-Residential	214.8	198.2	209.5	119.1	128.2	83.1	191.8	117.0
Cost (K£'000)								
New Buildings:residential	3917	5404	6660	4946	6856	9253	4887.9	4919.0
New Buildings:non-residential	4984	7333	5346	4768	3457	3253	6384.3	5312.4
Extensions:residential	320	497	527	299	375	454	458.0	495.0
Extensions:non-residential	703	743	788	1574	777	837	947.3	2671.3
Total Cost	9924	13977	13320	11588	11465	13797	12677.5	13397.7
Analysis of Cost by Town (K£'000)								
Nairobi	8399	12452	10087	5885	7658	9784	9076.3	8439.2
Mombasa	1249	1223	2742	1763	2856	2573	1801.9	2450.0
Other main Towns*	273	302	491	3940	951	1440	1799.3	2508.5

Source: Central Bureau of Statistics.

* Other main towns include Kisumu, Nakuru, Eldoret, Kitale. Thika, Nyeri Kakamega, Embu and Meru.

** Provisional

APPENDIX 1

TABLE 2

REPORTED COMPLETION OF BUILDINGS FOR PRIVATE OWNERSHIP-MAIN TOWNS

1977*

Details	Nairobi	Mombasa	Nakuru	Kisumu	Eldoret	Thika	Other	Total
Number of New Buildings								
Residential	539	143	7	1	37	63	10	799
Non-Residential	34	21	2	-	2	3	2	64
Floor Area of New Buildings ('000sq.metres)								
Residen tial	63.8	22.5	0.8	0.1	6.1	7.8	1.6	102.7
Servants' quarters	-	-	-	-	-	-	-	-
Total Residential	63.8	22.5	0.8	0.1	6.1	7.8	1.6	102.7
Non-Residential	6.8.	2.1	-	-	-	7.7	-	16.8
Offices	6.8	2.1	-	-	-	7.7	-	16.8
Shops	0.7	1.0	-	-	-	-	-	1.7
Godowns,Stores,etc.	14.4	10.2	-	-	1.0	-	-	25.6
Factories	23.7	19.9	-	-	21.0	2.7	0.4	67.7
Other	1.8	2.2	0.8	-	-	0.3	-	5.1
Total Non-Residential	47.4	35.4	0.9	-	22.0	10.7	0.4	117.0
Cost (K£'000)								
New Buildings,residential	3178.2	900.9	19.8	7.0	510.5	229.4	73.2	4919.0
New Buildings,non-residential	2535.7	1245.0	43.8	-	1020.0	445.5	22.5	5312.4
Extensions,residential	387.1	104.1	-	-	2.3	1.5	-	495.0
Extensions, non-residen-tial	2338.2	200.0	23.1	13.3	12.9	29.3	54.5	2671.3
Total Cost	8439.2	2450.0	86.7	20.3	1545.7	705.7	150.2	13377.7

Source: Central burau of Statistics
* Provisional

APPENDIX 1

TABLE 3

NUMBER OF UNITS AND VALUE OF BUILDINGS COMPLETED IN MAIN TOWNS BY COST CATEGORY 1977*

	RESIDENTIAL				NON-RESIDENTIAL			
	Number of Units		Value K£'000		Number of Units		Value K£'000	
	Public	Private	Public	Private	Public	Private	Public	Private
£ 0- 500	-	-	-	-	-	1	-	-
£ 501- 1000	36	14	34	13	4	-	3	-
£ 1001- 1500	2	20	2	28	2	-	3	-
£ 1501- 2000	36	80	64	144	2	-	4	-
£ 2001- 2500	289	36	632	86	2	1	5	3
£ 2501- 3000	172	186	471	551	2	1	5	3
£ 3001-3500	61	28	210	93	5	2	17	7
£ 3501-4000	22	18	82	68	3	8	12	32
£ 4001- 4500	57	15	239	64	1	3	4	13
£ 4500- 5000	10	79	48	377	7	5	34	15
£ 5001- 6000	13	89	72	486	13	3	73	29
£ 6001- 8000	250	57	1809	400	23	3	156	24
£ 8001-10000	21	41	169	376	13	9	117	88
£ 10001-12000	2	1	21	11	9	5	98	55
£ 12001-and above	3	127	44	2191	45	77	1595	6115
Total	974	791	3897	4888	131	118	2126	6384

Source: Central Bureau of Statistics.

* Provisional

Note: - Public refers to Central Government

APPENDIX 1
TABLE 4
TABLE 5

ANALYSIS OF REPORTED NEW RESIDENTIAL BUILDINGS, NAIROBI
1973-1977

Habitable Rooms*	1973	1974	1975	1976	1977
One	1	-	8	1	-
Two	162	135	117	92	82
Three	121	105	90	51	121
Four	555	311	602	238	181
Five	101	223	306	66	94
Six or more	121	254	277	110	61
Total	1061	1028	1400	558	539

Source: Central Bureau of Statistics.

* A habitable room is defined to mean a room used for the purpose of working, living or sleeping other than kitchen, bathroom lavatory, laundry-room etc.

MINISTRY OF WORKS HOUSING CONSTRUCTION, 1972/73-1976/77

	1972/73	1973/74	1974/75	1975/76	1976/77
Institutional Housing*					
Units Built (Number)	861	353	574	199	230
Cost (K£'000)	1493.7	769.1	2106.9	707.2	889.8
Cost per Unit (K£)	1735	2179	3670	3755	3863
Pool Housing**					
Units Built (Number)	185	212	54	31	24
Cost (K£'000)	574.2	386.2	287.2	164.8	145.3
Cost per Unit (K£)	3104	1822	5318	5316	6054

Source: Ministry of Works

*For specific Ministries

**For general civil service use.

APPENDIX 1

TABLE 6

REPORTED COMPLETION OF NEW NON-RESIDENTIAL BUILDINGS FOR PRIVATE OWNERSHIP

Analysis of Cost by Town and Sector of Ownership, 1973-1977

Sector of Ownership	Nairobi	Mombasa	Nakuru	Kisumu	Kitale	Eldoret	Thika	Others	Total
Transport, Storage & Communications									
1973	379	110	12	-	-	-	-	4	504
1974*	30	13	-	-	-	-	-	-	43
1975*	177	30	-	-	-	-	-	-	207
1976*	114	68	-	-	-	-	15	-	198
1977*	95	186	44	-	-	-	-	-	325
Wholesale and Retail Trade									
1973	492	39	18	-	-	25	-	34	609
1974*	126	132	20	-	-	-	38	2	318
1975*	596	98	57	-	-	-	-	66	817
1976*	1299	409	10	4	-	-	-	47	1769
1977*	242	74	-	-	-	-	-	15	331
Services and Other									
1973	137	396	44	-	-	-	-	33	610
1974*	422	56	-	-	-	-	-	155	633
1975*	334	103	-	-	-	-	27	162	625
1976*	329	8	28	37	-	4	19	35	460
1977*	246	62	-	-	-	-	5	7	320
Financial Institutions									
1973	17	-	-	-	-	-	-	-	17
1974*	21	379	-	-	-	-	-	-	400
1975*	3	855	-	-	-	-	-	-	858
1976*	756	93	-	-	-	-	-	-	849
1977*	401	125	-	-	-	-	-	-	526
Total**									
1973	1364	673	111	7	-	41	249	2323	4768
1974*	1292	1215	122	-	-	75	66	157	2928
1975*	1386	1178	147	-	-	102	42	253	3108
1976*	4270	887	232	41	-	4	763	177	6384
1977*	2536	1245	44	-	-	1020	445	22	5312

Source: Central Bureau of Statistics.

* Provisional

**Total includes 'other Sectors e.g. agriculture, mining and quarrying.

APPENDIX 1

TABLE 7

MANPOWER REQUIREMENTS (BUILDING INSPECTORS) IN 6 TOP TOWNS

Town	Population (1979 Census)	Building Plans* approved 1978	Reported Completion of Building		Value K£'000	Manpower @ 1 Bld. Inspector per pop.		
			1977	1978	(1977)	50.000	75000	100000
Nairobi	835,000	2968	573	789	8439	17	11	8
Mombasa	342,000	1354	164	230	2450	7	5	3
Nakuru	93,000	-	9	20	87	2	1	1
Kisumu	150,000		11	40	20	3	2	1
Eldoret	50,000		39	60	1546	1	1	1
Thika	41,000	207	66	144	706	1	1	1

*Source: Statistical Abstract, 1978

APPENDIX 1

TABLE 8

MANPOWER REQUIREMENTS (BUILDING INSPECTORS) FOR MAIN TOWNS

Main Town	Population (1979 Census)	Building Plans approved	Manpower @ 1 Bld. Inspector per		
			50,000	75,000	100,000
*Meru	73,000		2	1	-
Nyeri	36,000		1	NA	NA
*Kakamega	32,000		1	"	"
Kisii	31,000		1	"	"
Kericho	30,000		1	"	"
Kitale	28,000		1	"	"
Bungoma	25,000		1	"	"
Busia	25,000		1	"	"
Malindi	23,000		1	"	"
*Nanyuki	19,000		1	"	"
Webuye	18,000		1	"	"
Murang'a	15,000		1	"	"
Garisa	14,000		1	"	"
*Isiolo	11,000		1	"	"
Naivasha	11,000		1	"	"
Nyahururu	11,000		1	"	"
Athi River	10,000		1	"	"
Maralal	10,000		1	"	"
*Machakos	10,000 (Estim.)		1	-	-
*Lamu	9,000 (Estim.)		1		

* Towns in the Study Sample.

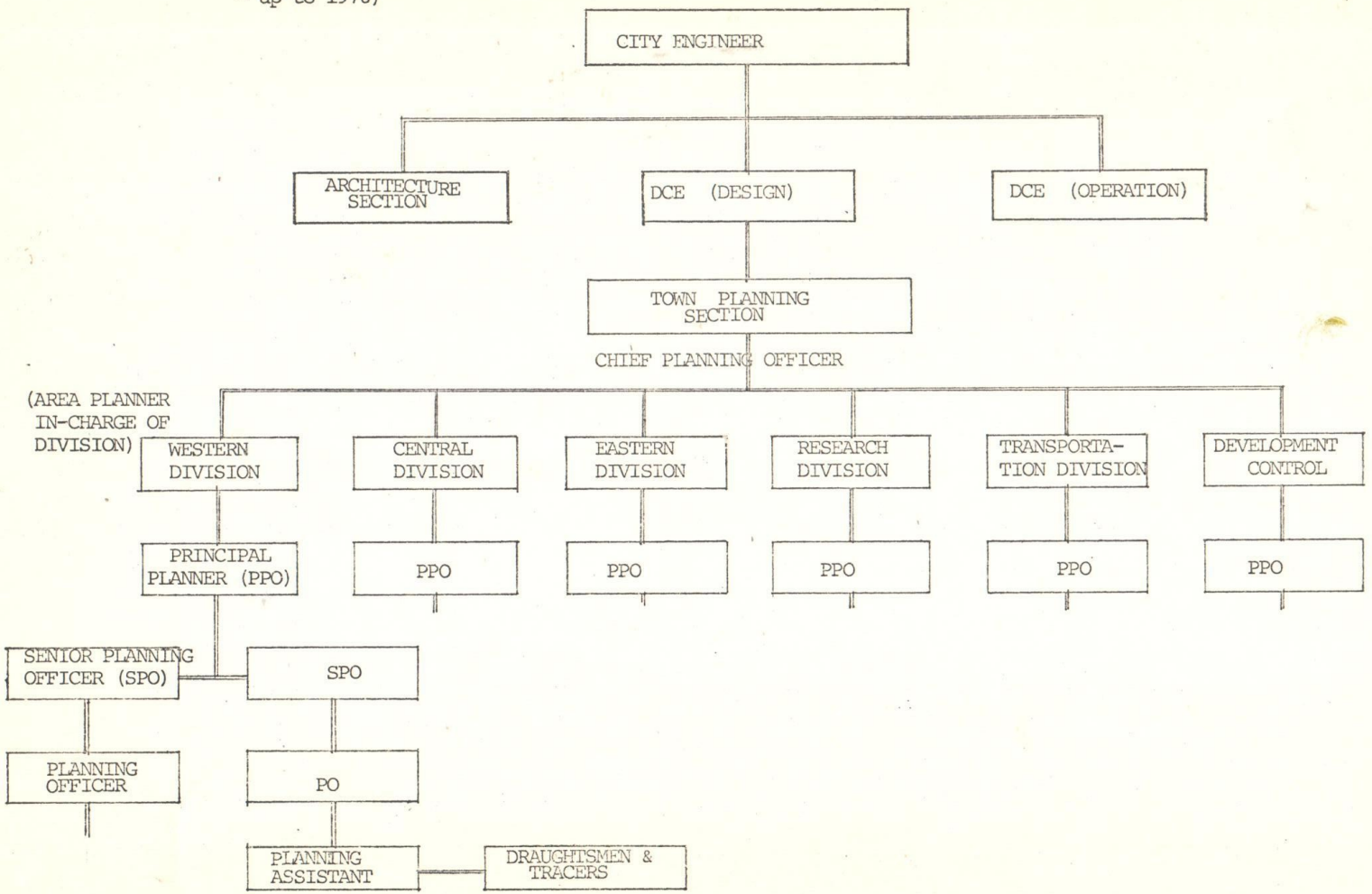
APPENDIX 2

ORGANISATION CHARTS

NAIROBI CITY COUNCIL

APPENDIX 2A

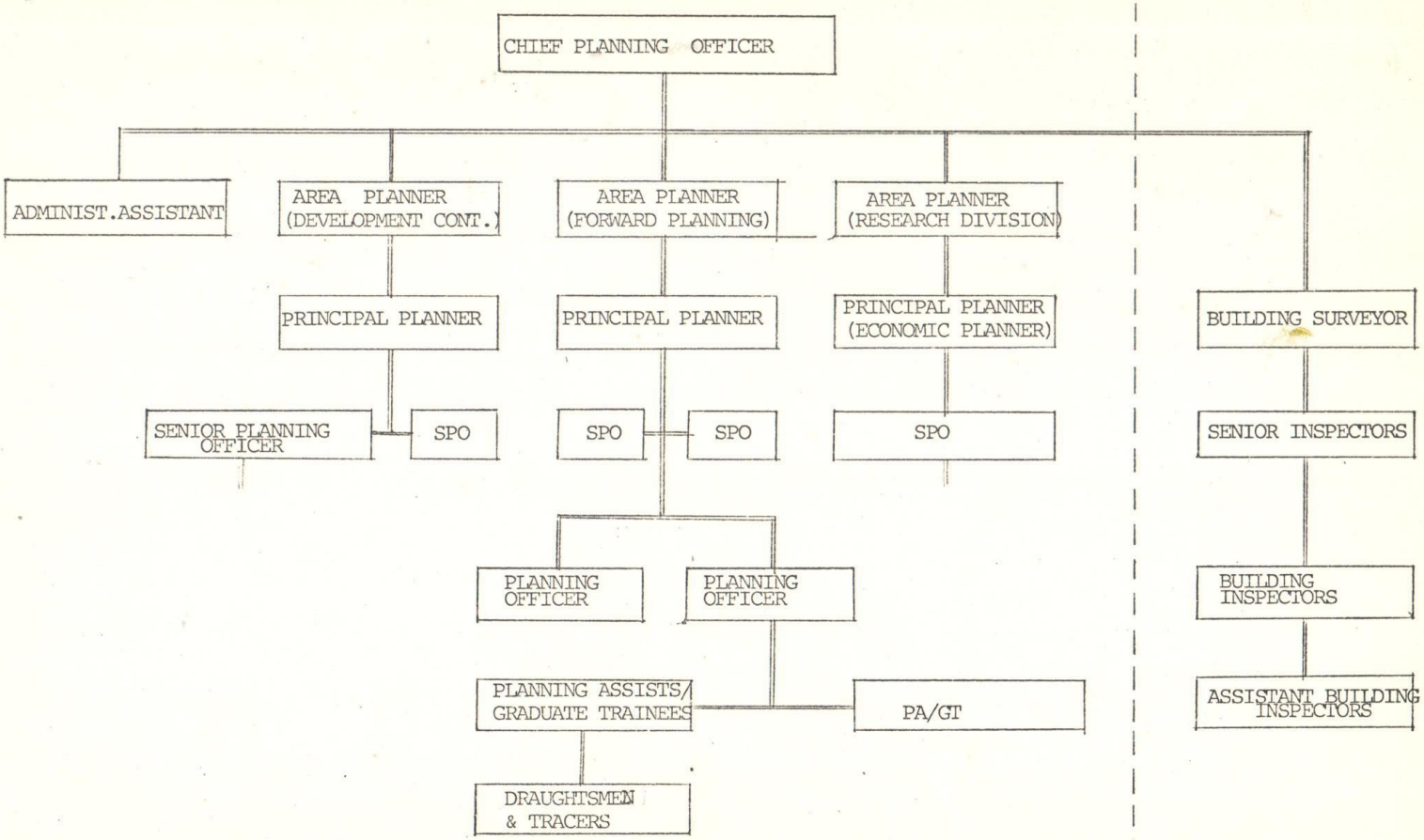
(Previous Organisation Chart
- up to 1978)



NAIROBI CITY COUNCIL

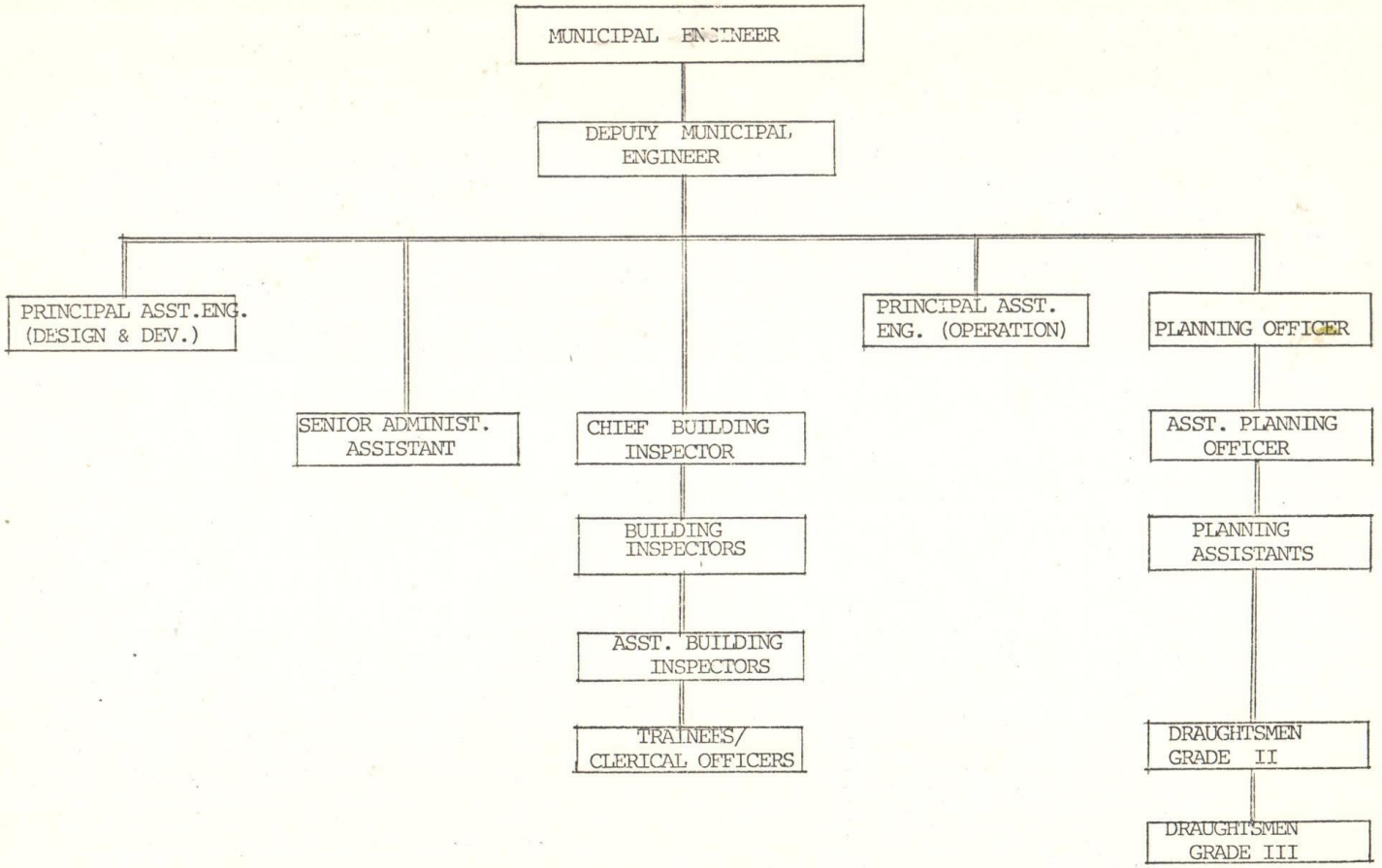
APPENDIX 2B

(After Upgrading of T.P Section to a Department)

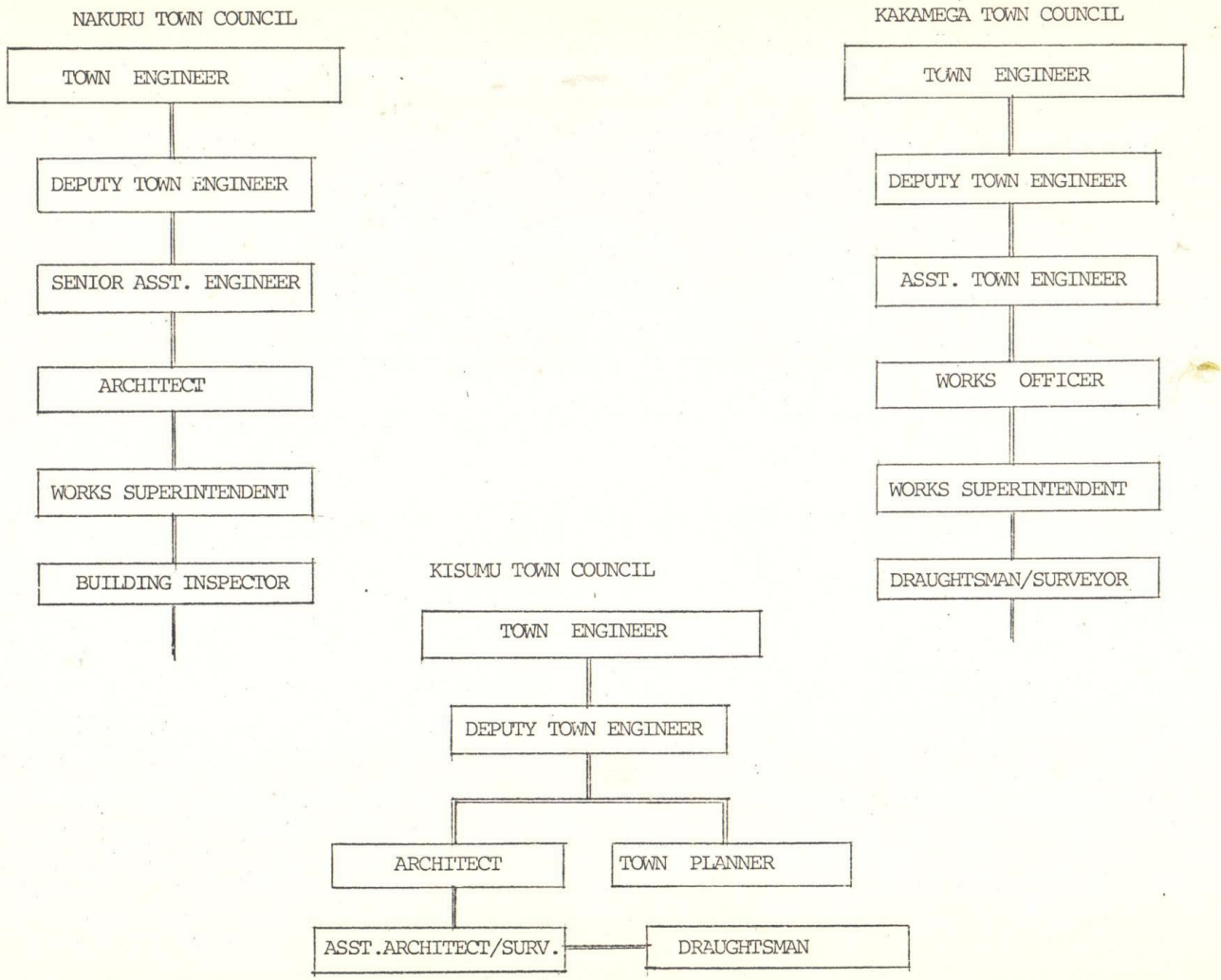


APPENDIX 2C

M O M B A S A

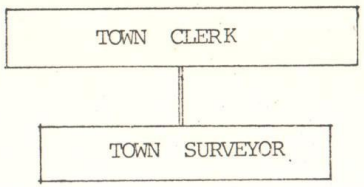


APPENDIX 2D

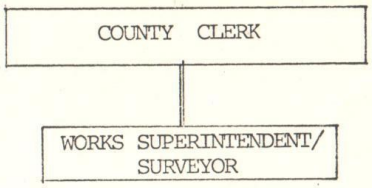

NAKURU TOWN COUNCIL
TOWN ENGINEER
DEPUTY TOWN ENGINEER
SENIOR ASST. ENGINEER
ARCHITECT
WORKS SUPERINTENDENT
BUILDING INSPECTOR
KAKAMEGA TOWN COUNCIL
TOWN ENGINEER
DEPUTY TOWN ENGINEER
ASST. TOWN ENGINEER
WORKS OFFICER
WORKS SUPERINTENDENT
DRAUGHTSMAN/SURVEYOR
KISUMU TOWN COUNCIL
TOWN ENGINEER
DEPUTY TOWN ENGINEER
ARCHITECT
TOWN PLANNER
ASST.ARCHITECT/SURV.
DRAUGHTSMAN

APPENDIX 2E

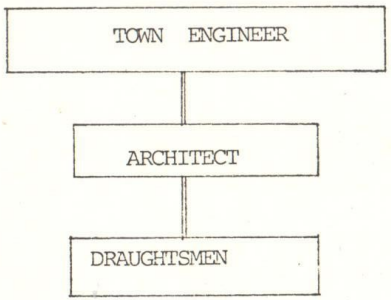
MACHAKOS TOWN COUNCIL



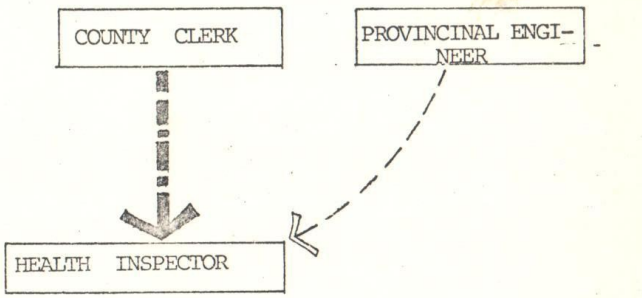
MACHAKOS COUNTY COUNCIL



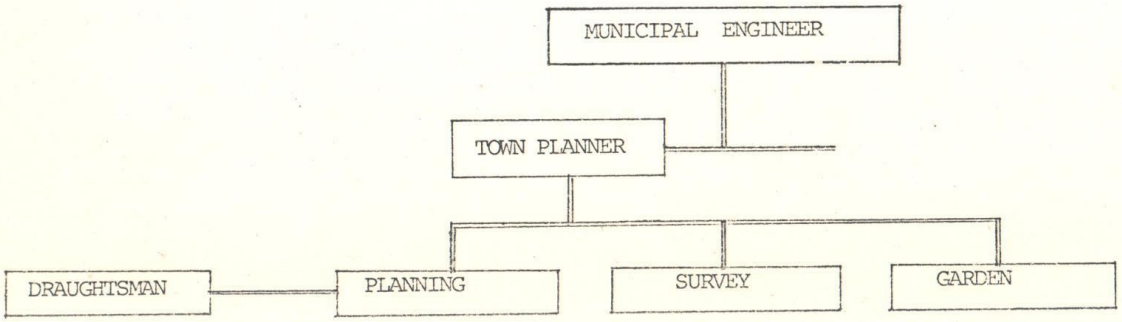
NANYUKI TOWN COUNCIL



LAMU TOWN COUNCIL



THIKA TOWN COUNCIL



PLAN REGISTRATION NO.
DWELLING HOUSE - RIRUTA
ESTIMATED VALUE - SHS. 80,000/=
PLANS FIRST SUBMITTED ON 10.8.74

Date	From	To	Comments
10.8.74	Owner/Agent	B.S	-
14.8.74	B.S	T.P	1. There are already two dwellings existing on the plot which is the maximum permitted on a farm plot. 2. 100ft. building line to be maintained along the Western boundary of the plot 3. Flats will not be permitted on this plot
26.8.74	B.S	MOH	1. Provide wash hand basins near WCs 2. Provide means of getting rid of fumes or smoke from kitchen
3.9.74	MOH	B.S	1. Pennanent cross ventilation to be provided to all habitable rooms 2. In view of T.P. Comments, further comments reserved.
5.9.74	B.S	Owner/ Agent	Deal with all comments given
16.12.75	Owner/Agent	B.S.	(Re-submission of the Plan)
16.12.75	B.S	T.P	1. Comment No. 1 (above) still stands
30.12.75	B.S	MOH	1. Galley trap to galley trap connections to be avoided
5.1.76	MOH	B,S	1. T.P. Comments to be cleared in first instance. 2. This proposal is for two flats. Plans to be ammended accordingly 3. Bedrooms and living room to be provided with cross ventilation 4. Use of space between the two flats to be indicated on plans 5. Further comments reserved
8.1.76	B.S	Owner/ Agent	Deal with all outstanding comments
23.1.76	Owner/Agent	B.S	(Re-submitted(3rd time) after due amendment)
23.1.76	B.S	T.P	No further comments plans cleared
26.1.76	B.S	MOH	Previous comment of 30.12.75 still stands
30.1.76	MOH	B.S	Fresh prints required without marking and cancellations
2.2.76	B.S	Owner/Agent	Ammend all outstanding comments
14.2.76	Owner/Agent	B.S	(Fourth submission
16.2.76	B.S	MOH	No further comments- Plans cleared
4.4.76	Plans Approved by Council		

APPENDIX 3

TABLE 2

PLAN REGISTRATION NO.

DWELLING HOUSE - LORESHO

VALUE - SHS.600,000/=

PLANS FIRST SUBMITTED ON 21.7.78

Date	From	To	Comments
21.7.78	Owner/Agent	B.S	1. Provide culverts to NCC satisfaction 2. Indicate the siting of the building from adjacent plot boundaries. 3. Provide vertical Dpc where there are differences in ground levels. 4. R.C roof slab finish specifications to be given 5. Provide splash area for domestic staff house 6. Domestic staff house to have a minimum area of 100sq.ft. 7. Additional inspection fee of 40/= will be required
3.8.78	B.S	T.P	No comments
10.8.78	B.S	MOH	1. Provide separate cooking facilities for servants 2. Building Inspector's Comment No.6 (above) endorsed. 3. Provide WHB within or near the servants WC
2.10.78	B.S	Owner/Agent	Deal with all the above comments
22.11.78	Agent/Owner	B.S	(Re-submission)
22.11.78	B.S	MOH	1. Provide chimney flue to servants cooking space 2. Show how waste water from WHB is drained
8.12.78	MOH	B.S	No further comments - Plans cleared
11.12.78	B.S	Owner/Agent	Deal with MOH comments
20.12.78	Owner/Agent	B.S	(Third Submission)
21.12.78	B.S	MOH	Plans Cleared

16.1.79 Plans Approved by Council

B.S -Building Survey

T.P -Town Planning

MOH -Medical Officer of Health

THE ARCHITECTURAL ASSOCIATION OF KENYA

Submission and Approval of Plans

Architects are reminded that in agreement with A.A.K. and City Council of Nairobi, that the following procedure may be carried out to implement Bye-Law 7.

"If after 30 days of submission of plans for approval, no comment has been received, an applicant may write to the Council as follows, and have the letter delivered by hand:-

'To the City Engineer,
Nairobi City Council

Att. Chief Planning Officer

Registered Plan no.....

LR.....

Developers Name.....

The above plan was submitted to you on.....
We have not received any communication from you as provided for under By-Law 7 of the Building Code.

Yours faithfully,'

If after 7 days of sending the above (by hand) there has been no reaction from the City Council the applicant should TELEPHONE one of the others in the following order:

1. Chief Planning Officer
2. Deputy Chief Planning Officer
3. Division Head Development Control

G.T. WILSON
PLANS APPROVAL LIAISON COMMITTEE

OCTOBER, 1979

APPENDIX 5

1. JOB DESCRIPTION: CHIEF BUILDING INSPECTOR

Job Title: Chief Building Inspector/Building Surveyor

Qualifications: University degree and/or professional registration in architecture, civil engineering, construction technology, or building economics

Grade: Professional

Duties:
- Assist Town Engineer in formulating and implementing development control policy for the Municipality
- Direct, supervise and control all building control operations under the overall supervision of the Town Engineer
- Administer the building code and its periodic review as becomes necessary
- Supervise building inspectors and other technical and subordinate staff in the section.
- Liase with the Medical Officer of Health and other relevant heads of departments and sections
- Monitor building activity in the Municipality including subdivisions, changes of user and constructions
- Render technical advice to developers, builders and subdeviders within the limits of available resources and powers
- Initiate enforcement action through the Town Engineer
- Advise the Town Engineer on the recruitment and training of building inspectors
- Compile and maintain a file of relevant statistics on the Section's operations.

APPENDIX 5

2. JOB DESCRIPTION: BUILDING INSPECTOR

Job Title: Building Inspector

Qualifications: City and Guilds Final Certificate or Ordinary Diploma in Building or Planning Technicians Diploma.

Grade: Technician/Sub-professional

Duties:
- Assist Chief Building Inspector or Building Surveyor
- Scrutinise building and subdivision plans
- Inspect buildings under construction
- Issue inspection certificates
- Carry out routine inspections of area asigned
- Initiate action against unauthorised structures
- Advise builders and contractors on acceptable building methods.

DISCUSSION PAPER

DP4.2

LEGAL ASPECTS

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1. INTRODUCTION

1.1. The legal aspects of this study set out specifically to:

A. Detail out the law applicable to low-cost housing
B. State and analyse the administration of the law applicable
C. Relate the law to urban low-cost housing and
D. Advance recommendations, on the basis of the above analysis, on model housing by-laws and building codes appropriate to site and service schemes and other low-cost housing.

In contributing this part of the study the Legal Adviser has consulted closely with Mr. Willy Mutunga, Advocate, Lecturer, Faculty of Law, University of Nairobi. The Legal Adviser, has through Mr. Mutunga, consulted Professor J.P.W.B. McAuslan, Professor of Law, University of Warwick, England, U.N. Consultant on Planning and building legislation to the Capital Development Authority, Tanzania, 1977 and 1978 and the Kano State Urban Development Board, Nigeria, 1979.

1.2 The legislation examined here comprises:

a. Law of Contract Act 1962
b. The Building Codes 1968
c. The Rent Acts - The Rent Restriction Act, Cap.296 Laws of Kenya
d. The Local Government Act
e. The Land Planning Act; the Town Planning Act,1948
f. The Fire Inquiry Act
g. The Housing Act
l. The Street Adoption Act
i. The Water Act
k. The relevant Land Law Legislation

(i) The Government Lands Act
(ii) The Registration of Titles Act
(iii) The Trust Land Act
(iv) The Registered Land Act
(v) The Land Acquisition Act

2. ANALYSIS OF LEGISLATION AS IT RELATES TO URBAN LOW-COST HOUSING

2.1 CONTRACT

The legal requirements are those of offer and acceptance coupled with a consideration. The parties must have capacity to contract, that is, they must be over 18 years old and of sound mind. The contract must also be free from the vitiating elements: duress, coercion, undue influence, mistake, frustration, impossibility and illegality. A contract that is against public policy is unenforceable. There is no point here of detailing the legal ingredients of all these requirements which make a contract valid. 1/

For the purposes of this study, contract law gives a basis of constructing houses. There may be a simple contract between parties or a more detailed contract like the one used by the building industry in East Africa.

The contract defines the terms of construction etc. and it ought simply to state that the Building Codes be complied with. The party constructing the house has therefore, on pain of paying damages, to comply with the Building Codes.

Building contracts are normally standard form contracts and will be interpreted subject to the wording of the contracts.

The Kenya law of contract is the English contract law. This is provided by S.2 of the Law of Contract Act, Cap.23 Laws of Kenya. Contracts can be oral. They govern the legal rights and liabilities to a building contract. A simple contract between a landowner and a building contractor in simple terms is annexed on Appendix A.

1/ Cheshire & Fifood (1972) The Law of Contracts 8th edit. Batterworth, London, R.W. Hodgin, Law of Contract of East Africa Nairobi (1975)

2.2 THE BUILDING CODE AND PUBLIC HEALTH ACT

i. The Local Government (Adoptive By-Laws) (Building) Order 1968 and

ii. The Local Government (Adoptive By-Laws) (Grade II Building) Order 1968.

In the first category of By-laws in the Building Code the relevant By-Laws for this study are contained in By-Laws 215-227. Other relevant By-laws are 246. As for the second category the relevant By-laws would seem to be By-laws 4,9,17,19,21,29 and 32.

By-laws 13-14 provide and allow for temporary buildings and as they are relevant to the study call for consideration. These temporary structures are part of the low cost houses. The By-laws provide:-

13. (1) The council may in writing and upon such conditions as it deems fit, grant permission for the temporary erection and use of buildings which would otherwise not comply with the provisions of these By-laws, to accommodate occasional labour.

(2) A person who contravenes or fails to comply with any of the conditions of a permission granted under this by-law shall be guilty of an offence.

14. (1) The council may in writing and upon such conditions as it deems fit, grant permission to an employer to erect temporary living accommodation for building labourers and watchmen in connexion with a specific building operation.

(2) An application for such permission shall be made in writing to the council signed by or on behalf of the employer and shall state:

(a) the number of the approved plan relating to the operation;

(b) the location of the site;

(c) the estimated duration of the building operation; and

(d) the number of workmen or watchmen to be accommodated.

(3) In the case of watchmen, compliance must be made with the provisions of the Eleventh Schedule to these By-laws.

(4) An employer who accommodates workmen or watchmen on a building site without the written permission of the council or who contravenes or fails to comply with the provisions of the Eleventh Schedule to these By-laws or any of the conditions of a permission granted under this by-laws, shall be guilty of an offence.

These temporary buildings as long as they satisfy basic health and sewerage requirements would function as important low-cost structures.

The first category of the Code can be broken down as:

1. Procedures for approval of building plans, construction and completion: By-laws 4-11, and 16 as read with first Schedule.
2. The Basic requirements:
   For site and space, building materials and sites, Foundations, Walls, Roofs, Floors, Chimneys, Flues, Hearths.
   By-laws 17 122 as read with 3rd 4th and 5th Schedule.
3. Design and erection of certain buildings.
   By-laws 124 - 132 as read with 8th Schedule.
4. Stairs, hand-rails, lifts, Refuse disposal etc.
   By-laws 133 - 142.
5. Ventilation, Drainage, Sanitation conservancy
   By-laws 150 - 166, 167 - 184, 185 - 210.
6. Means of escape in case of fire
   By-laws 211-214.
7. General - By-laws 236 - 259.

The By-laws apply to the erection of buildings and By-law 3 is crucial and provides:-

3. (1) A person who erects a building or develops land or changes the use of a building or land, or who owns or occupies a building or land shall comply with the requirements of these By-laws.

(2) For the purpose of these By-laws any of the following operations shall be deemed to be the erection of building:

(a) the re-erection of any building or part of a building when an outer wall of that building or, as the case may be, that part of such building has been pulled down, burnt or damaged;

(b) the roofing over of any open space;

(c) the alteration or extension of a building;

(d) the erection, alteration or extension of a chimney shaft;

(e) the changing of the use or uses to which land or a building is put;

(f) increasing or reducing the number of dwellings in an building;

(g) the carrying out of any drainage work;

(h) the installation of any fittings to which by-laws 143 to 149 or by-laws 167 to 179 of these By-laws refer;

(i) the formation or laying out of an access to a plot;

(3) Notwithstanding anything contained in these By-laws these By-laws shall not apply in the case of areas scheduled by the council, with the approval of the Minister by notice in the Gazette, and the areas so scheduled shall be subject to either the Local Government (Adoptive By-laws) (Grade II Building) Order 1968 or By-law 12 of these By-laws as specified in the Notice.

Relating the By-laws to the low-cost housing it can be said that the whole issue of low-cost housing is treated <u>incidentally</u> by these by-laws. The majority of the By-laws are simply <u>irrelevant</u> to low-cost housing. It is also quite clear that by reading section 126 of the Public Health Act and sections 210 and 272 of the Local Government Act, the local authorities can make their own building by-laws to cater for their low-cost housing needs.

Sections 126 and 126A of the Public Health Act gives the Minister for Health very wide powers of controlling the by-laws which can be made by the Local Authorities. Section 15 of the Public Health Act makes it mandatory for the Minister of Local Government to consult the Minister of Health before any by-laws affecting Public Health are created.

It would, therefore, seem that if the building codes were written to the satisfaction of the Ministry of Health then all Municipal and urban councils would be obliged to conform to the new codes. The by-laws of the local authorities would of course have to be available to the Ministry of Health before enactment.

2.3 THE RENT ACTS

The relevant legislation for the study is the Rent Restriction Act, 1959 Cap. 296 of the Laws of Kenya. The Act would protect low-cost houses which in law are dwelling-houses. S.4 of the Act defines dwelling house as under:

> "dwelling house" means any house or part of a house or room used as a dwelling or place of residence, and includes the site of the house and the garden and other lands and buildings let therewith and not as a separate entity or source of profit; a dwelling house let on a service tenancy is not protected by the Act. Nor is a dwelling house which if it were a dwelling house to which the Act applies, would have a standard rent exceeding Shs.800/- per month, or in case of a furnished dwelling house one thousand one hundred shillings per month. The Minister for Housing has by powers given to him under S.4(1) of the Act exempted from the application of the Act dwelling-houses let and owned by the Government, local authorities or the Community, now Ministry of Economic Development Community Affairs (S.4662/1966).

Studies by Mutunga, Stren and Noormohamed show that low-cost housing is rent-controlled if the dwelling-houses fall under the financial ceiling stated. But this is in theory only. These studies show that the urban poor living in low-cost housing are not aware of the Acts. Those who are aware of the Acts avoid using them for fear of reprisals from the landlords. But the persistent housing shortage makes the application of the Acts more or less a dead letter. The majority of the urban poor would not afford the expenses of taking up their claims in the Rent Tribunals. Newspaper columns are replete with many cases of unlawful evictions and few prosecutions of landlords. Mutunga's study has shown that there are not many prosecutions; the fines are low, hence the penal sections of these Acts are not very effective. Tenants in rent-controlled dwelling-houses cannot in law be evicted without recourse to the Tribunals. The grounds for termination of tenancy are set up in S.13 of the Rent Restriction Act. The practice as stated is otherwise.

Because of the housing shortage, the landlords house tenants who are ready to pay more and evict the tenants by illegal means. It has been found that in some cases evictions are done with full knowledge and acquiesence of the police! The root cause of the problem is the housing shortage which is caused by lack of low-cost housing. And this is what the Government has to solve, not the effects of that root cause to the problem.

2.4 THE LOCAL GOVERNMENT ACT AND REGULATIONS

The power to make by-laws by the local authorities is provided by Section 201 of the Local Government Act, Cap. 265 as well as Regulation 201 of the Local Government Regulations, 1963. The relevant Sections and Regulations are annexed as Appendix B. The question as to whether local authorities can make their by-laws to cover low-cost housing situations has been discussed above. The relevant considerations imposed by the Public Health Act have also been discussed above.

As a matter of emphasis we need to dwell on the Public Health Act here. Sections 126 and 126A of the Act give wide powers of controlling the enactment of by-laws by local authorities. Section 15 of the Act makes it mandatory for the Minister of Local Government to consult the Minister for Health before any by-laws affecting public health are approved. Under Section 126B the Minister for Health can approve relaxation of by-laws on application to that effect by the Minister of Local Government.

It would be correct to state that the entire Part IX of the Act is relevant to this study. In the event of any violations of the requirements of the Act, the local authorities can invoke Section 124 and apply to the District Magistrate or the Resident Magistrate for a

demolition order. The Attorney General or "any other person" can under Section 126 of the Act apply for an injunction for the removal or alteration of any work on the ground that it contravenes any by-law or any provision of the Act.

2.5 THE LAND PLANNING ACT AND TOWN PLANNING ACT 1948

The Land Planning Act is Chapter 303 of the Laws of Kenya. The Act makes provision for planning the use and development of land. Its subsidiary legislation sets the Development and Use of Land (Planning) Regulation 1961. The relevant legislation for our study are Regulations 6, 10 and 19 which provide:-

6. (1) A local authority may, after consultation with, and with the agreement of, the Minister, prepare and submit to the Minister for his approval a town plan or area plan, as the case may be, for that part of the area under its jurisdiction to which these Regulations apply.

(2) Subject to the provisions of any rules made under these Regulations for regulating the form and content of area plans and town plans, any such plans shall include such maps and descriptive matter as may be necessary to illustrate the planning proposals as may be appropriate to different parts of the area and any such plans shall in particular define existing development, proposed roads, the different use and density zones proposed and areas (if any) in which no sub-division is permitted for the time being.

(3) The Minister, for the purpose of securing the proper sub-division of land in an area other than of unalienated Government land, may require a local authority which has submitted a town plan or area plan, as the case may be, for approval, to submit to him for approval sub-division and use plans for its area or any part thereof.

(4) An interim planning authority may prepare and submit to the Minister for his approval plans and particulars of any amendment to a town or area plan, as the case may be, which has previously been approved.

10.(1) Subject to these Regulations, no person shall carry out development in an interim planning area except with consent of the authority under these Regulations empowered to grant consent.

(2) Any person who carries out development without consent shall be guilty of an offence against these Regulations and shall be liable to a fine not exceeding five thousand shillings or to imprisonment for a term not exceeding six months or to both such fine and imprisonment.

(3) Any dealing with any sub-division shall, in the event of an offence under these Regulations being committed in relation thereto, be null and void absolutely, and any development in respect of which an offence against these Regulations has been committed shall cease and the land on which the development has taken place shall be returned to its existing use.

(4) For the purposes of paragraph (3) of this Regulation a person shall be deemed to be dealing with any sub-division if:-

(a) he disposes or parts with the possession of a part of the land, or

(b) for himself or on behalf of any other person, he acquires or obtains possession of part of the land, whether, in either case, by means of conveyance, transfer or assignment (by way of sale, gift, exchange, settlement or otherwise), by partition, lease, licence or letting, or by means of succession, or in any other way whatsoever.

19. Any consent to develop granted under these Regulations shall be of no effect unless the development in respect of which consent was granted is commenced within 12 months of the date of such consent and completed within two years of the date of such consent, or within such longer period as the authority which granted consent may, having regard to the nature of the development, decide.

It is quite clear that within these Regulations, plans for low-cost housing can be processed on applications by local authority or a person. Plans for low-cost housing and site-service schemes can be therefore approved. It must be pointed out that for the urban poor or any individual who cannot afford professional services, the Regulations are complicated and the machinery for approval

by plans cumbersome. The approvals cannot even be sought under one roof administratively.

2.6 FIRE INQUIRY ACT - CAP 103

This is an Act designed to give power to Magistrates - First or Second Class, to hold inquiry into the origin or causes of fire. He can only do so after the Attorney General so directs in writing. The only bottle-neck or draw-back is that the effectiveness of this Act is minimal. Considering the many fires that occur in the rural areas, the impression of the study is that neither the Police or Administrative Police are aware of the existence of this Act. Since they are the persons supposed to bring this Act into play, and having noted that it is not used, then its existence should be made known to them.

2.7 HOUSING ACT - CAP 117

This Act establishes the National Housing Corporation and the Housing Fund. It also gives the Corporation the right to approve loansfor the construction of approved schemes either in the local authorities area or outside their jurisdiction.

An important factor is that loans can be given and secured on unregistered land.

The Act provides for the recovery of the loan. It also gives the National Housing Corporation the right to apply to the Minister responsible for local authorities to suspend the operation by any by-law inconsistent with the conditions specified for the Corporation for any scheme. There is no doubt that this Section 19 is a useful Section. The Corporation has undertaken site and

service schemes, but in conjunction with local authorities. Therefore whilst the Corporation have tried to obtain a waiver from the Minister they are, in effect, in conflict with their clients - the local authority.

Our view, however, is that Section 19 of this Act must be read with Section 126B of the Public Health Act. Section 126B as stated above gives local authorities the powers to relax requirements of building by-laws. The overriding consideration is the approval of such an application by the Minister for Health. Such approval reinforces the mandatory requirements of Section 15 of the Public Health Act.

It repeals and vests the powers, privileges and rights conferred or formerly vested in the Local Government Loans Authority by its Act to National Housing Corporation.

2.8 STREET ADOPTION ACT

This is intended to regulate the construction and improvement of streets in certain local authority areas. It empowers the local authority to adopt streets of a satisfactory standard on payment of fees by the land owners. Under the Act any person intending to lay out, form or construct an unadopted street has to make an application to the relevant local authority and submit the necessary plans. This Act cannot be said to be fair to low-cost housing. A provision could be made, however, that the local authorities adopt streets in low-cost areas without any conditions and accept this as an additional infrastructural cost which the local authority must bear.

2.9 WATER ACT

This Act makes provision for the conservation, control, apportionment and use of water resources in Kenya. It sets up Catchment Boards which authorise and regulate the use of water in general, and construction of dams in various parts of Kenya.

2.10 RELEVANT LAND LAW LEGISLATION

2.10.1 Government Lands Act

The Government Lands Act was introduced in Kenya in 1915 to 'make further and better provision for regulating the leasing and other disposal of Government lands, and for other purposes'. This Act replaced and repea ed the earlier enacted Crown Lands Ordinance of 1902. It provides the law which, together with the law contained in the Constitution of Kenya and other legislation e.g. the Trust Land Act, the law of Government Control and State Ownership of Land, governs the relationship of the state and individual dealings with land.

2.10.2 Registration of Titles Act

This Act introduced a form of title by registration commonly known as the 'Torrens System'. It was enacted to provide for the transfer of land by registration of title. It brought with it the various features of an efficient registration of titles system, namely (a) security (b) simplicity (c) reduced cost (d) government guarantee (e) certainty and (f) finality.

Apart from the titles registered under the

Registered Land Act most of the titles in respect of the registered land in Kenya, are registered under this Act.

This Act is much superior to the Government Lands Act and the Land Titles Act from the point of view of land owners and those dealing with land registered under it, because it provides not only all the benefits of registration of the title but also some substantive law touching on the effect of dealings and the rights of those entering into transactions. The registration part of the Government Lands Act has been virtually superseded by this Act, but since the transference to the Register under this Act was voluntary only, there still exists parcels of land in Kenya registered under the Register kept under the Government Lands Act. All fresh grants are issued under this Act but subject to the provisions of the Government Lands Act.

2.10.3 The Trust Land Act

The relevance of this Act has been given below under the section on the Land Acquisition Act. By the relevant constitutional provisions all trust land is vested in the County Council within whose area of jurisdiction it is situated.

2.10.4 Registered Land Act

This Act covers the areas occupied by the Kenya Africans. After land consolidation and demarcation Africans were able to get title to their pieces of land. The Act contains both the law and procedure and it is intended that this Act will eventually replace the Indian Transfer Property Act 1882 which is the law applicable where land is registered under the other Acts.

It is undeniable that in cases of urban low-cost housing and site and service schemes, the question of title to the land on which the house stands is important. Hence the relevance of the Acts dealing with Titles in Land. The other legislation stated above which is relevant to the focus of this study is the Building Code which specifically details out the relevant by-laws. A concrete application of by-laws of 215-227 set out above is the Muthurwa Railway Estate which is an ideal low-cost housing. It is also apparent that what is the law pertaining to low-cost housing is scattered in various Acts which apply to such housing by implication. That is why we recommend below a consolidated statute on low-cost housing and site and service schemes which will detail out the relevant legislation under one Act.

2.10.5 The Land Acquisition Act, Cap 295 Laws of Kenya

Here we will not dwell on the procedures of compulsory Land Acquision but we will focus our attention on the use this Act can be put in acquiring land for low-cost housing. The laws applicable would seem to be:-

(a) Sections 75, 117 and 118 of the Constitution

(b) The Land Acquisition Act

(c) The Trust Land Act, SS.7 and 13 which are similar to Sections 117 and 118 of the Constitution respectively.

(d) The Agriculture Act, SS.185-188

(e) The Registered Land Act, S.30(G). This Section deals with overriding interests.

The constitutional and legal foundations of the

powers of compulsory acquisition in Kenya are in the laws applicable. The nature and justification for compulsory acquisition may be political, economic and moral considerations. The issues of low-cost housing cover these considerations. It is quite clear that there are no difficulties in compulsorily acquiring land for low-cost housing. The process of compulsory acquisition is uncomplicated and issues are normally raised on the determination and payment of compensation. Of course there are restraints. The meaning of 'public purpose' is one of them. Clearly the issue at hand will be for a clear public purpose with the urban poor benefiting. The restraints and relevant considerations which for the purposes of this study need not detain us are found elsewhere! 2/ It must be stated that it is in very rare cases that the Commissioner of Lands will be denied by Courts the right to compulsorily acquire land for genuine public purposes. If the purpose is really private, the magic word 'public' will not make it public. The Courts will entertain the argument whether or not the purpose is public. After all, this is the cardinal consideration in cases of compulsory acquisition.

2.10.6 Judicial Attitude

The cases analysed and studied for this study are given in Appendix C with the appropriate reference. It can be stated categorically that the Courts have interpreted the legislation discussed above strictly and there are no

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2/ See Charan Singh: Nationalisation of private property and the constitutional clauses relating to expropriation and compensation in East African Law Journal, 1971 Vol.7 No.2,85.

indications that the Courts have been invited to address themselves on the question of low-cost housing. There was not a single case decided which involved this problem. It would seem from the cases that the interpretation of legislation has not brought out any uncertainties of law and indeed many of the decisions studied were found to be not strictly relevant to this study.

As for the administrative aspects, it is clear that the administrators of the Act do not fully comprehend the law applicable, partly because it appears in various Acts. This makes the administration of the law difficult. Such acts as the Land Planning Act, the Building Code and the Local Government Act, involve many individuals without very clear evidence of coherence and unity which creates difficulties for their administration.

3. OVERALL CONCLUSIONS ON EXISTING LEGISLATION

These would seem to be:-

3.1 Except for the Building Codes, the Public Health Act and the Local Government Act and Local Government Regulations, the entire applicable legislation is only incidentally relevant to the issues of low-cost housing and site and service schemes. The by-laws which are relevant are pretty few and on application the full force of the Public Health Act would never make such application perpetual.

3.2 The legislation on buildings of whatever nature is scattered in various Acts. This makes the administration of the Acts difficult.

3.3. The problem of low-cost housing shortage has never been catered for by specific legislation.

3.4 The legislation applicable assumes the provision of professional expertise from various fields.

3.5 The Public Health Act contains the overriding law. Whatever changes are made in the by-laws they must not violate the provisions and the spirit of this Act. To facilitate proper implementation of any changes in by-laws, this Act needs to be amended first.

3.6 There seems to be no legal hurdles to compulsory acquisition of land required for the low-cost housing.

3.7 It is possible to provide a workable simple contract which can be used as a basis of legal relations between a builder and a landowner in a low-cost housing scheme.

3.8 The law will have to lag behind other professional requirements in low-cost housing. The lawyer can draft by-laws only after the other professions state what is required.

3.9 There is no reason to suggest that the Courts given the law applicable directly to low-cost housing would adopt an attitude which does not facilitate the implementation of such a law.

3.10 The administrators (non-legal) of the legislation applicable cannot be said to be fully conversant with the laws applicable.

3.11 Law will not solve low-cost housing shortages. Such a solution does not lie in the legal superstructure. The housing shortage no doubt affects the implementation of the laws applicable.

4. RECOMMENDATIONS

4.1 On the basis of the analysis of the relevant legislation, the overall conclusions advanced above, we make the following recommendations:-

4.2 In so far as the thrust of the study is in the direction of simplifying the law in terms of (a) where it is to be found (b) what it contains (c) how it is presented to officials and lay persons alike - i.e. simple manuals and diagrams, then we wholly concur in that aim and would urge that it be made an overriding priority of the study. Our recommendations are designed to the same end.

4.3 It may be helpful as a way of approaching the issue of low-cost housing to adopt what may be called a 'bottom-up' perspective rather than a 'top-down' perspective to it. By this we mean that rather than look at low-cost housing as a 'problem' of how to fit such housing into the existing legal and architectural framework of the cities - a framework created and still geared to maintain very high standards for a tiny fraction of the urban population - one should consider the realistic factual alternative to official low-cost housing; viz unofficial low-cost housing in uncontrolled urban settlements. One should determine what its strengths and good points are and build a framework of legislative and administrative controls on them so as to facilitate the transfer of shelter from the unofficial 'illegal' developments to the official legal ones. The criterion for legislation in this area then should <u>not</u> be how close is the legislation to that governing upper-income

housing but should be how close it is to the actual practices, experiences, technology and finances of the uncontrolled urban settlements because those more closely represent the actual capacities of the people to whom the legislation is to apply.

4.4 Taking that as the criterion it follows that the minimal legislation there is should be straightforward, clearly written, easily administered and capable of being translated into simple diagrams, charts, Swahili and other national languages.

4.5 Any suggestions by legal draftsmen that this is not possible should be met with the greatest suspicion, for they will be looking at such legislation through a 'top-down' perspective - i.e. will such legislation cover all the loopholes, meet the challenges of crafty developers advised by sharp lawyers and obtain the 'correct' interpretation from judges who are totally ignorant of building technicalities and therefore must have everything spelt out for them. A 'bottom-up' perspective on the other hand will appreciate that there will be virtually no litigation on the legislation, no loopholes and a much greater likelihood of observance of legislation if it is couched in language which can be easily understood and requires actions to be taken which are clear and perceived to be sensible.

4.6 The perspective adopted here also suggests that a very high priority should be given to (a) the production of simple manuals, design guides, non-binding codes of advice and practice (recommended indeed by the U.N. in its publication of proceedings from a seminar on Design

and Technology for low-cost housing 1975), simple standard forms of applications and approvals for building permission and planning permission (these should be combined into one form dealt with in one office if both in fact have to be obtained), (b) automatic approval of applications to build houses to officially approved designs (of which there should be a variety), (c) adequate programmes of training for building inspectors, (d) the establishment of advisory services or the creation of a statutory duty on building inspectors to provide advice and assistance in low-cost self-build areas so that the official input into these areas and programmes is seen to be positive and helpful, something to welcome and use and not negative and obstruction, something to avoid and circumvent. In short, the law should not be seen as the means of 'enforcement' of building 'control' but as one of a number of important tools available to the Government for facilitating and encouraging the majority of the urban population to better their provision of shelter.

4.7 We would strongly support the view that a long overdue revision and consolidation of Kenya's urban laws is necessary both from administrative and lay points of view. Administrators however well trained and dedicated cannot administer laws they cannot find and do not understand; developers large and small are inhibited from lawful development and thereafter are vulnerable to enforcement proceedings with all the problems of demolition, dislocation, corruption that brings. We would however enter a caution here: consolidation and updating of Kenya's urban laws is in a sense a different issue to the application of low-cost housing. The solution to this latter

question might well be a separate code of law applying to defined areas of towns which could be drafted and introduced independent of progress on consolidation of other laws. It is sensible, but not necessary, for the two exercises to proceed together.

4.8 Turning now to the possible content of any building legislation for low-cost housing, it was the opinion of the Chief Planning Officer of the Kano State Urban Development Board that the irreducible minimum for such legislation was (i) plot ratio and density control and (ii) sewage and drainage control. These were needed in the interest of public health, the long-term upgrading and expansion of houses and the ultimate provision of public services. Kano is a densly populated city in a semi-arid part of Nigeria and these demographical and geographical factors must be taken into account but even when allowance is made for them, that irreducible minimum might be thought to have considerable application in Kenya. It is difficult to take exception to - it is easy to frame in legislative terms - it would be easy to administer - and it leaves a great deal of constructional freedom to the owner-builder.

4.9 Should any more content be regarded as part of the irreducible minimum? Where one is dealing with single storey buildings erected for purposes primarily of accomodation by persons who intend to live therein, it is suggested that the answer is no. Such people usually know what will and what will not stay up, keep them dry and cool (or warm), what is a comfortable size and height and usually have a realistic assessment of what they can afford. To impose, as a matter of statutory duty, standards of building and uses

of materials will merely result in a house, adequate in fact, becoming illegal in law and no useful purpose is served by that. Those matters are precisely the ones best dealt with by advisory guides, diagrams and on-the-spot advice from building inspectors.

4.10 The matter is different where one is dealing with two or three storey buildings and buildings erected for rental accomodation. Public safety requires some regulation of roof and wall strengths, possibly some regulation of layout and material from a fire hazard angle and in respect of rental accomodation, some control over room size and of occupancy rates.

None of these are unreasonable demands to make of the developer who, if he can afford a larger than average development out of which he may intend to make an income, should afford the higher than average standards required in connection with that development.

4.11 Any reform of building control for low-cost housing has an unfortunate legacy to overcome- summed up by the following quotation from the SCOPE publication "Shelter Provision in Developing Countries" (a publication supported by U.N.E.P.):

"For the majority of people, who cannot avail themselves of governmental assistance in the provision of their accomodation, the set of standards operated by local authorities constitutes the single most important obstacle to their settled existence in the urban areas to which they have migrated. The local authorities, providing no help to the urban migrants in their search for suitable shelter, nevertheless assume the right and power to destroy as substandard, the modest and admittedly unattractive efforts of the migrants to construct shelter for themselves. The issue of standard-setting, therefore seems to be at the centre of the problem of environmental conditions in the human settlements of developing countries."

4.12 What has to be reversed then is a situation where inappropriate standards, backed by law, are inexpertly and often unfeelingly enforced against persons many of whom are already doing the best in respect of the provision of their own shelter. The new approach should be one of assistance and encouragement via finance, advisory services, minimal legal regulation and fair administration. The law should cease to be used as a substitute for positive policies on low-cost housing and become instead one aspect of positive policies. Unless such a new 'bottom-up' approach is adopted towards questions of legal standards and their enforcement, reform of the law will be of little help to greater provision of low-cost housing.

APPENDIX A

THIS AGREEMENT is made the .....

day of .....19.....

BETWEEN .....

.....

.....

of (or whose registered office is situated).....

.....

.....

.....

(hereinafter called 'the Employer' "Landowner") of the

one part AND

.....

.....

.....

.....

.....

of (or whose registered office is situated).....

.....

.....

.....

(hereinafter called "the Builder/Contractor")

of the other part.

WHEREAS the Employer is desirous of

.....

.....

.....

.....

.....

at .....Estate,

in the Municipal/Urban/City of.....

1. The consideration will be K.Shs. .....
The Contractor/Builder acknowledges receipt of
K.Shs. ..... at the execution of this Contract.

2. The completion date will be the ..... day of
.....19..... or any other date as
the parties will mutually agree subject further to such
conditions as the parties may agree.
SUBJECT always that the variation of completion date
will be done upon reasonable grounds on the part of the
Builder/Contractor and upon giving the Employer/Landowner
reasonable notice.

3. This Agreement is subject to the following conditions:-

(Here will be set out conditions on the following)

- Builders obligations
- Statutory obligations (the applicable by-laws, codes, law etc. on low-cost housing)
- Materials, goods and workmanship etc.
- Insurance
- Determination by either party
- Arbitration etc.

AS WITNESS the hands of the said parties.

Signed by the said

.....

.....

in the presence of

.....

.....

Signed by the said

.....

.....

in the presence of

.....

.....

APPENDIX B

LOCAL GOVERNMENT ACTS AND REGULATIONS

201. (1) Subject to Section 202, a local authority may from time to time make by-laws in respect of all such matters as are necessary or desirable for the maintenance of the health, safety and well-being of the inhabitants of its area or any part thereof and for the good rule and government of such area or any part thereof and for the prevention and suppression of nuisances therein and, more particularly, but without prejudice to the generality of the foregoing -

(a) for controlling any of the things which it is empowered by or under this Act to do, establish, maintain or carry on; and

(b) for controlling or regulating any of the things which, and any of the persons whom, it is empowered by or under this Act to control or regulate; and

(c) for prohibiting or preventing by prohibition any of the things which it is empowered by or under this Act to prohibit; and

(d) for requiring or compelling the doing of any of the things which it is empowered by or under this Act to require or compel.

(2) A local authority may, by law, prescribe all or any of the following penalties which may be imposed for breach of any by-law made by it under this Act, that is to say -

(a) a fine not exceeding two thousand shillings in respect of a first offence and not exceeding three thousand shillings in respect of a second or subsequent offence, or imprisonment for a period not exceeding nine months in respect of a second or subsequent offence, or both such fines and such periods of imprisonment; and

(b) in addition to the penalty provided in the preceding paragraph, in the case of continuing breach of any such by-law, a fine not exceeding twenty shillings for every day during which the offence continues:

Provided that any by-law which under this paragraph prescribes a fine for each day

during which an offence continues shall also provide that the aggregate of any such fines imposed shall not, in the case of any one continuing breach of the by-law in question, exceed two thousand shillings;

and a local authority may, by by-law, further prescribed that, in addition to any such penalty as aforesaid, any expenses incurred by the local authority in consequence of the breach of any by-law made by it under this Act or in the execution of any work directed by any such by-law to be executed by any person and not executed by him, shall be paid by the person committing such breach or failing to execute such work.

(3) Any by-law made by a local authority under this Act may -

(a) require acts or things to be performed or done to the satisfaction of a specified person to issue orders to any person requiring acts or things to be performed or done, imposing conditions and prescribing periods and dates upon, within or before which such acts or things shall be performed or done or such conditions shall be fulfilled; and

(b) confer on the officers of such local authority such powers of inspection, inquiry and execution of works as may be reasonably necessary for the proper carrying out or enforcement thereof.

(4) Where a local authority is empowered to make by-laws controlling the doing to any act, and such by-laws require any person to obtain a licence from a specified authority before the doing of such act, such by-laws may require the deposit of such sum or the execution of a bond with or without sureties, as may be prescribed in such by-laws, in addition to any fee which may be prescribed, such sum to be refunded or such bond to be void, as the case may be, if the person to whom such licence is granted complies with all the conditions of such licence.

Section 202-211 deal with the various aspects of the making of by-laws.

These sections are reproduced as Regulations 201-211 of the Local Government Regulations.

Other relevant provisions of the Act as pertains to this study are SS.144, 264 and 272. These sections provide:-

144. (1) A local authority may, for the purpose of any of its functions under this or any other written law, by agreement acquire, whether by way of purchase, lease, exchange or gift, any land, whether situate within or without the area of the local authority, notwithstanding that the land is not immediately required for that purpose; and where land is so acquired notwithstanding that it is not immediately required for the purpose for which it was acquired, it may, until so required, be held and used for the purpose of any other functions of the local authority.

(2) A local authority may, subject to the approval of the Minister, apply to the Government or any other authority having power to acquire land for any land required for the purpose of any of its functions to be acquired compulsorily for and on behalf and at the expense of the local authority; and any such purpose shall be deemed to be a public purpose within the meaning of the Land Acquisition Act, or any enactment replacing the same.

(3) Any land belonging to a local authority and not required for the purpose for which it was acquired may, with the approval of the Minister and subject to such conditions as he may think fit to impose, be appropriated for any other purpose for which the local authority is authorized to acquire land:

Provided that the appropriation of land by a local authority shall be subject to any convenant or restriction affecting the use of the land in its hands.

(4) On an appropriation of land under subsection (3) of this section such adjustments shall be made in the accounts of the local authority as the Minister may direct.

(5) A local authority may let, or grant to any person a licence to occupy, any land which it may possess -

(a) with the consent of the Minister for any term;

(b) without the consent of the Minister, unless such consent is required by Section 177 or by any other written law, for a term not exceeding seven years, and may, in respect

thereof, charge rents, stand premium or fees.

(6) Subject, in the case of land acquired in pursuance of subsection (2), to the provisions of the Land Acquisition Act, or to any written law replacing that Act, a local authority may, with the consent of the Minister -

(a) sell any land which it may possess and which is not required for the purpose for which it was acquired or being used;

(b) exchange any land which it may possess for other land, either with or without paying or receiving any money for equality of exchange.

(7) Capital money received from the sale or exchange of land by a local authority shall be applied in such manner as the Minister may approve towards the discharge of any debt of the local authority or otherwise for any purpose for which capital money may properly be applied; and where capital money is applied under this subsection for a purpose other than that for which the land the subject of the transaction was held, such adjustment shall be made in the accounts of the local authority as the Minister may direct.

(8) Nothing in this section shall authorize the disposal of land by a local authority, whether by sale, lease or exchange, in breach of any trust, covenant or agreement binding upon the local authority; and where under any written law conferring on a local authority a power to acquire land, the power is expressly limited to acquire land by agreement, nothing in this section shall confer on the local authority power to acquire land compulsorily for the purposes of that written law.

(9) For the purposes of this section references to the functions of a local authority shall be construed as including any such functions as are exercised through a joint committee appointed by such local authority in concurrence with any other local authority or authorities, and any such functions as are exercised through a joint board in relation to which such local authority is or is deemed to be an interested local authority within the meaning of Section 105.

(10) Nothing in this section shall be construed as requiring the Government or other authority acquiring land for a local authority to grant to the local authority the actual or entire interest acquired.

264. (1) All charges due for sewerage, sanitary and refuse removal shall be recoverable jointly and severally from the owner and occupier of the premises in respect of which the services were rendered.

(2) When any such charges as are mentioned in sub-section (1) have remained unpaid for a period of six weeks from the date on which written notice has been given by a council to the owner or occupier of his indebtedness, the council may at any time within twelve months from such date take proceedings against such owner or occupier or both for the recovery of such charges together with interest thereon at such rate, not exceeding on per centum per month or part thereof, as the council shall fix.

(3) Where any such charges are recovered from -

(a) the owner, he shall in the absence of any agreement to the contrary, be entitled to recover from the occupier for the time being any sum paid by him as charges in respect of any period during which such premises were in occupation of such occupier;

(b) the occupier, he shall be entitled to deduct from any rent or other sum payable by him to the owner of the premises any portion of such charges which he could not lawfully have been required by the owner to pay, and the production of any receipt for such portion shall to the extent of the amount thereof be a good and sufficient discharge for the payment of the rent or other sum.

(4) Where any such charges which are normally recorded by a local authority from the occupier of the premises in respect of which the services were rendered remain unpaid for a period of six weeks the local authority shall notify in writing the owner that such charges have so remained unpaid.

272. Subject to Secton 273, nothing in this Act shall be deemed to over-ride the provisions of the Public Health Act.

APPENDIX C.

1. Walji Jetha & Other v Elias Freed 1959 EA 1071
2. E.A. Power & Lighting Co. Ltd. v Dandora Quarries 1967 EA 728
3. Ngambo Estates and Saw Mills Ltd. v Sikh Saw Mills (Tanganyika) Ltd 1957 EA 537
4. City Council of Nairobi v Maharaj K. Bandari 1957 EA 481
5. The A.G. v Ivan E.K. Mambule 1959 EA 666
6. Uta VL v Nairobi City Council 1967 EA 18
7. Uganda Electricity Board v Electricity Board Workers Union 1974 A EA 243
8. Mumias v R. 1967 EA 430
9. In the matter of a petition H. Kasenha 1967 EA 455
10. Mohamed Ahmed v Rex (1957) EA 253
11. Bazanyamaso & Another v A-b' - of Uganda 1960 EA 292
12. Chhaganlal & Others v Kericho Urban District Council 1965 EA 370
13. Tanganyika Electric Supply Co. Ltd v S.Ahmed Omar 1965 EA 29
14. Mulla Alibin Ismail v Rex 1963 EA 4
15. Standard Vacuum Ltd v Planning Board 1959 EA 235
16. Jasyke v Attorney General 1971 EA 423
17. Gardfuvres v Tabes Co. 1969 EA 619
18. Vaz v Rutafufuco & Others - 1967 EA 686
19. G. Kazi v Nairobi City Council 1959 EA 862
20 C.D. Patel v Rex 1961 EA 79
21. Abdul Hassein v Red 1959 EA 105
22. E.A. of Kenya v Block & another 1959 EA 180
23. City Council of Dar v Trentsche Ltd & others 1967 EA 224
24. Municipal Council of Dar-es-Salaam v Jao Franco paps 1957 EA 729.

SECOND WORLD BANK/GOVERNMENT OF KENYA URBAN PROJECT

KENYA LOW-COST HOUSING BY-LAW STUDY

DISCUSSION PAPER
DP2

ENVIRONMENTAL HEALTH

NOVEMBER 1979

SAAD YAHYA & ASSOCIATES
KITOLOLO & PARTNERS
HALCROW FOX AND ASSOCIATES

F O R E W O R D

The Discussion Papers are prepared to enable members of the Steering Committee to fully contribute in the preparation of this Study. Therefore they are not final reports but evolving stages in the process of preparing the Manual/Handbook and the Draft Final Report. As such it is intended that their contents should receive the fullest attention of the members of the Working Parties and, subsequently all members of the Steering Committee.

INTRODUCTION & STRUCTURE OF THE PAPER

This is the first draft of the Discussion Paper on Environmental Health. The work on which it is based is ongoing and, from time to time, the text indicates the areas of work for which this is the case.

The paper is structured as follows:-

Section 1 discusses the historical background of environmental health knowledge and standards and shows how little is actually known about many of the relationships between housing and health. It concludes that the more certain health benefits of housing accrue not from the physical, design aspects of the dwelling but through the effects of housing on socio-economic variables that, in turn, have a positive influence on health. It is claimed that standards which focus only on the physical dwelling are mis-directed and that by maintaining high cost levels their effect is socially devisive.

Section 2 looks more directly at the situation in Kenya and shows that standards have precisely this effect in the low-cost housing market. Our studies indicate that whilst it is by no means simply the 'letter of the law' which produces this effect (other causes are discussed) the legislation does predispose to the maintenance of irrelevant standards and unaffordable costs and acts as a major inhibitor in the search for alternatives.

Section 3 summarises the ways in which housing, its associated services and its linkages through socio-economic variables may be employed as an intervention in relation to specific groups of diseases. This summary is based on the more detailed disease-by-disease discussions of Appendix I. It is concluded that a new emphasis is indicated that moves standards and guidelines away from the convenient preoccupation with physical aspects of the dwelling and more towards a selected group of services that housing is associated with and, ceteris paribus, more towards the responsibilities of authorities to either perform in relation to

these services or to remove restrictions and allow the needy to find their own solutions.

Section 4 outlines very briefly the implications of our findings for legislative change. These will be detailed more precisely in the final version of this Discussion Paper.

Appendix I provides an in-depth discussion of the more important diseases and causes of ill-health relevant to housing in Kenya. It forms the basis of many findings summarised earlier in the Paper.

Appendix II provides a summary for a number of the more important technologies of housing. In particular, since we have found little appreciation in the country of the alternatives to conventional solutions, we have gone into some depth about a number of these - particularly sanitation - reproducing evidence from other sources. We have not at this stage made specific recommendations about their relevance to Kenya. Our work on this is continuing, including some detailed feasibility studies and costing exercises.

Appendix III provides an outline review of some of the more important present legislation related to environmental health in the housing field.

It is sincerely hoped that this draft Paper will promote meaningful dialogue, debate (and indeed disagreement!) and will form a focus for directing the undoubted talent and knowledge of individuals and authorities in the country towards improving the housing environment of the poorer urban wananchi.

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Section 1

FREEDOM TO BENEFIT

1.1 Standards as History

1.2 Cause or Coincidence?

1.3 Simon was Right!

1.4 Standards for Who?

1.5 Summary

1.1. STANDARDS AS HISTORY

A great deal of existing public health legislation depends for its justification on historical precedent rather than on rigorous scientific knowledge.

Its origins can be traced immediately to social events in Northern Europe in the late eighteenth century when rapidly increasing urban populations and higher urban densitites were soon followed by alarming rises in infectious disease rates - particularly in pneumonias, measles, typhus, smallpox, tuberculosis and gastro-intestinal diseases.

It was at this time - and largely in response to the unhygienic and degrading conditions of the new urban poor - that the social aspects of medicine began to attract attention (Briggs 1974). This interest was given added impetus by the fact that disease outbreaks were not always confined to the poor slum areas but, like the great cholera epidemics of 1831 and 1848, affected the richer classes too.

However, higher disease incidence was generally related to certain areas within the urban connurbation and this gave rise to the theory that disease was associated with certain environmental and behaviour factors. In the early decades of the nineteenth century, the high morbidity and mortality rates experienced by the urban poor were attributed to the 'bad air' or miasma theory of Sydenham and others. This in turn, was attributed by many to what was seen as "the immoral, indecent, inept and unclean behaviour of the labouring classes" (Unit for the Study of Health Policy, 1979).

The latter notion was challenged by the pioneering work of Edwin Chadwick, who as Secretary to the Poor Law Commission, undertook extensive studies into the circumstances of the urban poor. The Commission's work was

published in 1842 as the 'Report of an Inquiry into the Sanitary Conditions of the Labouring Population of Great Britain'.

"Chadwick contended that disease was transmitted among the labouring classes by environmental pollution resulting from filth, overcrowding, lack of drainage and inadequate water supply. Instead of reprimanding the victims for their lack of cleanliness, Chadwick argued that the environment in which the labouring population lived was intrinsically unhealthy. Thus concern to lower the death rates would best be focussed on improving the quality of drinking water and air. It was contended that decent sanitation would encourage a reduction in airborne infection and lead to a fall in the mortality. Warning of the dangers to social stability of overcrowding and disease, it is said that Chadwick 'drew his respective hearers to the edge of the pit and bade them observe the monsters they were breeding beneath their feet.'(quoted in Cartwright,1977).

"It took years of skillful diplomacy to secure the legislation necessary to tackle these problems, in large part because of the enormous public expenditure required to implement it. Entrenched opposition, particularly to central government interference in local affairs, also delayed change. Eventual success owed a great deal to appeals to the 'enlightended self-interest' of the industrial and manufacturing classes. Improved health, it was argued, would increase the efficiency of labour." (Unit for the Study of Health Policy, 1979).

The first Public Health Act was established in 1848 and clearly owed a great deal to the work and successful influence of Chadwick. This Act established the 'General Board of Health' which was given the power to establish Local Boards of Health to enforce the Act covering the necessity to construct houses with drains, pave streets and to cleanse water. These Local Boards could appoint Medical Officers of Health whose duties covered searches for infectious diseases; smallpox vaccination of known contacts; investigating housing, school and factory conditions; etc. His employment or dismissal under the Act was subject to the approval of the General Board of Health not to the local authority.

In 1862, Henry Roberts (Fellow of the Royal Institute of

British Architects and Honary Member of the Academy of Fine Arts in Florence) published his "Essentials of a Healthy Dwelling and the Extension of its Benefits to the Labouring Population" (Roberts, 1862). Roberts sought to apply the thinking of that time to the construction of dwellings and specified the requirements for "a free circulation of pure air; a good soil; an efficient drainage; an ample supply of pure water; a genial aspect" etc.

Like that of Chadwick, Roberts work was based on the prevailing miasma concept of disease in which it was thought that infection occured from the bad air and impure vapours associated with lack of ventilation and drainage.

"High and dry situations, having a free circulation of air, whether occupied by groups of buildings, as in towns, or by isolated dwellings, as in the country, are proverbially healthy; whilst those which are low and damp, or surrounded by confined air, are the opposite. Experience, afforded by the state of troops when encamped, or when in permanent barracks, or in hospitals, is conclusive on this point. It is a known fact that the mortality of troops in Jamaica has been diminished from 120 to 20 per thousand by their removal from the plains to the hills; and it is well ascertained that ague, dysentery and fever prevail in localities where the surface of the ground is naturally wet and insufficiently drained, or where there exists an accumulation of decaying matter, of which one sure indication is the presence of an abundance of flies. Dampness of situation is also productive of mental depression and bodily feebleness, which excite a craving for intoxicating drink." pp2,3.

The concept was thought to explain observations of the distribution of cholera in the London epidemic of 1848 and 1854.

"The lower levels on either side of the Thames, where the drainage has been most inefficient, were much more severely visited by cholera than the higher parts of the metropolis." p.4.

And in an accompanying footnote:-

"I have the authority of Dr. Farr for stating that, if the mean of cholera epidemic of 1848 and 1854 in London be taken, nearly 11 per 1000 of those living under 10 feet of elevation died, to 1 per 1000 of those at the highest elevation; and that if London be divided into terraces of different degrees of elevation, the mortality from an epidemic of cholera is, in round numbers, inversely as the elevation." p.4.

It was at this time that the basic philosophy of public health was being established as it has since been applied to housing. Thus the basic conerns, and in large part the remedies of public health were established before the existence of a germ theory of disease* and before the techniques of epidemiological method were beyond their infancy largely in the pioneering efforts of William Farr.

Ellison (1979) has traced the development of those early public health notions through to modern times.

"..... these basic criteria (Roberts 1862) for a healthy dwelling persist in the public health approach to housing, even after the germ theory of disease was well established, in so far as this theory now explained, at least partially, the mechanism of the relationship between the housing environment and disease. Indeed, public health descriptions of housing in England from 1862 (Roberts) through to 1917 (Williamson) all apply these basic criteria, although with varying emphasis on different aspects. Examples from official reports and memoranda from this period (Russell 1887; Beachcroft 1893; Evans 1896; Fyfe 1899 and 1900; Mathieson 1914 and Sharpe 1916) while illustrating increasing sophistication in the use of census data, show no difference from Roberts (1862) in the acceptance of the assumptions and concerns of the Sanitary Movement in their application of criteria for healthful housing." p.10.

However, progress was being made. The early epidemiological work of William Farr was employed by various people - notably Sir John Simon in Britain - to place ill-health in a wider context than that of simply stagnating air and inadequate sanitation. It was seen

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*Although as early as 1840 Jacob Henle had formualted conditions for the experimental verification of a germ theory (Rosen 1937), it was not until the 1860's that Pasteur demonstrated the existence of micro-organisms and allowed Koch in 1876 to demonstrate that anthrax was a specific disease entity.

to be statistically associated with occupational, nutritional, housing and educational factors and, indeed, it was Simon's attempts to initiate more public control, to allocate government finance for public health measures and to push for legislation on factories, sanitation, housing and local government organisation that led eventually to the more significant Public Health Act of 1875.

For the most part, however, and certainly as regards housing, the earlier ideas continued to exert influence - not only in Britain. Robert's earlier work (Roberts 1850) was having some impact in France, Germany and North America. Events in North America are particularly well documented and important (Rosen 1972; Shapio and Sheps 1965).

Towards the end of the nineteenth century public health workers were concerned with the clear association between the levels of housing of the working classes in New York and the incidence of disease. This work largely paralleled that occuring in the United Kingdom. These ideas led to further attempts to apply minimum standards to dwelling construction and improvement.

Following Ellison further:-

"This approach became the core of public health activity in housing in America, for example, with the promulgation of the principles contained in the American Public Health Association document 'Basic Principles of Healthful Housing' (1939 reprinted 1946)."(Ellison 1979 p.11).

This document:

"Consists of thirty basic Principles, with Specific Requirements and suggested Methods of Attainment for each. The Principles and Specific Requirements are believed to be fundamental minima required for the promotion of physical, mental and social health, essential in low-rent as well as high-cost housing ...." (APHA 1939, 1946, p.4).

This is hardly surprising since the transmission of cholera has absolutely nothing to do with "cubical space" or ventilation. Continuing:-

"As mistakes with regard to space tend to create imaginary difficulties, and either impede sanitary reform, or cause a serious unnecessary expenditure, I think it of use to notice two recent errors on this point which have come under my observation - one in the Quarterly Review, where, in an article on "Labourers' Homes", it is stated that "The Lodging-house Act requires an allowance of 700 cubic feet per person", another in a publication by Dr. Druitt, entitled "The Health of the Parish", where it is said that "It has been decided at Bow-street that every inmate of a family ought to have 400 cubic feet of space." On inquiring at Bow-street as to the latter decision, I learned that the magistrates have no power to determine the space, and was referred to the Assistant Commissioner of Police, who informed me "that 30 feet superficial is the space allowed to each lodger in the metropolitan common lodging-houses, the rooms averaging 8 feet high, which is equal to 240 feet cube, and that 50 feet superficial is allowed to each police-constable lodged in a station or section-house, the rooms on an average being 9 feet high," which is equal to 450 cubic feet. The Poor Law Board, without laying down any fixed rule applicable to all circumstances, adopts as a basis of calculation an allowance of 500 cubic feet for every person in sick wards, and 300 cubic feet for every healthy person in the dormitories. The Sanitary Inspector in Dublin requires in registered lodging-houses an allowance of 308 cubic feet to each person." p.12-13.

One can but wonder at by what means the Sanitary Inspector of Dublin obtained his allowance of 308 cubic feet per person.

Much of the basic approach and many of the specific 'standards' put forward in the APHA (1939,1946) document and other similar publications have been continued up to the present day - indeed in many countries the public health acts and rules still in force originate from around that time or even before. (Those of Kenya go back to 1948).

Ellison (1979) points out that as recently as 1972, a World Health Organisation Scientific Group on the Development of Environmental Health Criteria for Urban Planning (WHO 1972) published a Technical Report listing

"a comprehensive range of criteria that characterise a healthful residential environment" (WHO,1972) that is strongly reminiscent of the APHA publicatiions of the late 1940's (the Standards for Healthful Housing Series discussed earlier) - indeed that is precisely where they come from and are referrenced as such in the Report. (WHO,1972 p.24).

To be fair, however, the Report also notes that "existing environmental health criteria for residential planning are still inadequate and much study and research are needed to make up the deficiency and to develop new ones." (WHO,1972 p.24).

It is important to emphasise that all that has been said here so far is not aimed at unfairly criticising the work and efforts of the nineteenth century reformers. Theirs were valient and indeed greatly successful attempts to bring an evil and degrading situation under control at a time when the state of knowledge was extremely limited. Our criticism is rather leveled at the way the conclusions of these early efforts have been largely perpetuated until the present day. The subsequent lack of really scientific inquiry (and the difficulties involved in undertaking such inquiry) are discussed later but the point at issue here concerns the uncritical adoption of early approaches and conclusions based on unscientific method.

Public health authorities have largely been content to apply simplistic rules and standards that have little more scientific substance and credibility than the space allowances exployed by the Sanitary Inspector of Dublin in 1862. Whilst these authorities may be excused for their inability to scientifically discover more real inter-relationships between housing and health (a tremendously complex and difficult field) they may not be excused for the way they have used inadequate knowledge as the basis for law, standards and restrictive practices.

When something is genuinely unknown, to pretend that it is known is not only unscientific but is basically fraudulent and the truth is that minimum standards of housing sufficient to guarantee improved health are unknown.

A more realistic attitude has recently been adopted by many people including certain groups associated with the World Health Organisation. A recent WHO Expert Committee on Housing and Health states that:-

"It is difficult to put forward convincing epidemiological evidence that the house itself is directly responsible for ill-health." (WHO,1974 p.9).

"With improved standards of living, social and medical services, and education, healthy families are frequently found in apparently unhealthy environmental conditions where they appear to have adapted themselves to the conditions without serious effects on their health."p.10.

Other statements in this Report are noteworthy:-

"Strictly speaking, however, there is little quantitative knowledge available on (a) the effect of various features of housing (air-space, ventilation, the disposal of excreta, the construction of floors and walls, etc.) on specific diseases, and (b) the exact extent to which these factors affect the spread and incidence of infections." p.12.

"Poor housing has been shown to be associated with poor nutrition and a lack of hygiene which are known to predispose to tuberculosis. If a single Mycobacterium tuberculosis organism inhaled in a droplet nucleus can provoke a primary infection, as has been experimentally demonstrated (Lurie, 1950), it is unlikely that the members of a family will avoid infecting each other, even in the most spacious houses." p.13.

"Numerous techniques have been used for the detection of airborne bacteria and certain minimum requirements have been proposed for dwellings and working premises, small surgeries, dressing rooms, and operating theatres (Bourdillon,1946). However, it is difficult to demonstrate a direct correlation between the number of airborne bacteria and the incidence of infection." p.13.

"The degree of crowding can be expressed in terms of air-space per capita or by using other indices of airborne

infection. However, it is difficult to express quantitatively the actual degree of effective inter-human contact that determines the transmission of disease. Moreover, droplet infection can spread in many ways other than through the air." p.14.

Another aspect of the unjustified credence attached to the supposed health benefits of housing and its associated services has been the unquestioned transfer of philosophies and technologies from the richer industrial countries to the developing ones. Sanitation provides an example. The public health acts and rules of developing countries lay down strict requirements for water-borne sewage specifying details down to the level of approved materials, pipe joining methods, dimensions of traps etc. (see for example the Public Health (Drainage and Latrine) Rules of Kenya 1948 revised edition 1972). These acts and rules carry the implication that water-borne sewage is the safest from a health point of view and that alternatives (pit latrines for example) are not only very much a third rate alternative but are only to be allowed when water-borne sewage is infeasible. In Kenya it is illegal to construct a pit-latrine (or indeed any sanitation arrangement other than a water-closet) within 200 feet of a sewer (Public Health (Drainage and Latrine) Rules (1948) 1972 Section 91 (1)). Similary, local authorities may demand that any non-water closet latrine be converted into a water closet and connected to any sewer that runs within 200 feet (Section 8 (1)(2)).

Yet there is no evidence whatsoever that (except at high densities) a well-maintained pit latrine is any worse from a health point of view than well-maintained water-borne sewage. Certainly it is better than a badly maintained water closet. In fact water-borne sewage is tremendously expensive, resource consuming and creates treatment problems that many countries cannot deal with.

Many specific aspects of minimum standards for sanitation have been questioned by Feachem and Bradley et al (1978)

in their recent definitive study of the health aspects of excreta and waste water management prepared for the World Bank. In a parallel component of these studies (Mara and Kalbermatten et al,1978) the authors state:-

"In industrialised countries, the standard solution for the sanitary disposal of human excreta is water-borne sewerage. Users and responsible agencies have come to view the flush toilet as the absolutely essential part of an adequate solution to the problem of excreta disposal. However, this method was designed to maximise user convenience rather than health benefits.

..... In fact, conventional sewerage is the result of slow development over decades, even centuries, from the pit latrine to the flush toilet, and the present standard of convenience has been achieved at substantial economic and environmental costs." p.2.

"Where high cost systems developed in industrialised countries have been used to solve waste disposal problems in developing countries, access to the facilities has been limited to the higher income groups who are the only ones able to afford them.

..... A major effort is needed to identify and develop alternative sanitation technologies appropriate to local conditions in developing countries and designed to improve health rather than raise standards of user convenience." pp 2-3.

Up to this point it has been attempted to show that current thinking about the inter-relationships between housing and health and the standards associated with that thinking are based more on historical precedent than scientific fact. It has also been suggested that some of the standards adopted by countries like Kenya have been inappropriately transferred from industrialised countires - though, of course, this too is a product of history.

We now turn to look briefly at the state of knowledge currently prevailing and to review whether this is adequate for the specification of new standards.

1.2 CAUSE OR COINCIDENCE?

Some clues as to the current state of knowledge relating

specific housing features to disease may be obtained from the quotations from the World Health Organisation above (WHO,1974). These and many other findings in this Report show quite clearly that this Expert Committee was convinced that the state of knowledge is very poor.

Very many available studies that have attempted to show cause - effect relationships between housing variables and health are inconclusive and contradictory.

With early studies of tuberculosis for example, Chalmers (1913) and Britten (1942) found an association of mortality and morbidity rates with poor housing. Whereas Benjamin (1953) could not distinguish satisfactorily the contribution of housing as opposed to income, nutrition or occupational hazards. Mackintosh (1934) found that of 400 sputum-positive cases, 50% were from 'good housing' and only 9.5% from 'slum type' dwellings. Neither McKinlay (1947) nor McMillan (1957) could find any association.

With other respiratory diseases, Kopezynski and Sawicki (1971) found that social stratification has an influence on frequency of respiratory symptoms but could find no association with the quality of dwelling. However, several studies have indicated that the degree of crowding in dwellings is associated with respiratory symptoms. (Wilner 1962, Monto 1968).

Feachem (1973) showed a significant correlation between coughing in 0-4 year olds in Saka Raiapu and the number of people with whom they cohabit but no correlation could be found for other age groups. He concluded, in fact, that other variables were more important than crowding in influencing respiratory disorders.

Other studies have found little or no significant association between overcrowding and upper or lower respiratory infection. (Buck 1956, Dowling 1971, Essen 1978).

Certainly these and countless other studies provide no basis for the adoption of standards on overcrowding or ventilation. The situation is summarised by Williams (1967).

"The latest hey-day of airborne infection was ushered in by Wells, in the 1930's, who looked to a development of 'sanitary ventilation' that would eliminate respiratory tract infections in the way that purification of drinking water has virtually eliminated the enteric fevers. That this hope remains unrealized is presumably because so few of the respiratory diseases are like tuberculosis in apparently requiring deposition of the microbe in the lung alveoli, and which, therefore, can be conveyed only by the very small proportion of 2-3 micron particles that are liberated during coughing and other expiratory activities. No dramatic control of the spread of the larger, shorter-range droplets could be expected from any of the methods of air sanitation in common use, and none has been observed. Some effect might be expected with the particles of intermediate size and there are some hints that streptococcal infections (Med. Res. Council, 1954) and staphylococcal infection (see Williams, 1966) may be affected to some extent. But it appears that with most of the infections we encounter, transfer by routes susceptible to 'sanitary ventilation' constitutes only a small part of all the transfer that takes place and the reduction in dosage that we can achieve in practice is often too small to have a detectable effect on the incidence of infection." p.282.

Similar apparently contradictory evidence can be found in the field of sanitation and health as summarised by Feachem and Bradley (1978). With ascariasis, for example, and indeed various other helminth infections:-

"Studies have failed to show the anticipated impact of latrine programmes. Some show no impact, some show an impact on intensity of infection only, while others suggest that the latrines have concentrated previously scattered faecal disposal and have provided new intense foci of transmission." (Feachem and Bradley 1978, p.99).

Potable water supply may not lead to a reduction in the incidence of cholera (Bang, 1977).

Whilst sanitation may be a necessary condition for achieving a reduction in enteric disease, it is certainly not sufficient.

"The mere availability of sanitary facilities is not sufficient to control the incidence of enteric infections if the population does not know how to make proper and full use of such facilities." (WHO 1974).

Commenting on their extensive compilation of references on this subject Feachem and Bradley (1978) remark:-

"Almost none of the studies reported reaches the standards of epidemiological demonstration that would make the study conclusive ...." p.35.

Pointing out the tremendous difficulties associated with studies to assess the health impact of sanitation change the authors remark:-

"..... it is not surprising that studies of the benefits of excreta disposal as assessed by health changes in the field are almost all of an insufficient standard to be convincing. Very few indeed could be described as scientifically impeccable and producing results to inspire confidence. This discussion of methodology could perhaps be considered over-precise and academic if most of the published studies gave concordant results, but this is far from the case and some studies are frankly contradictory." p.35.

As to whether the actual structure of the house has any measurable impact on health, the literature may be searched in vain for any convincing and conclusive study.

Whilst it is often held that bad housing or more precisely overcrowding has a negative effect on mental health, studies do not bear this out. Authorities on the subject (e.g. Cassel) maintain that it is not crowding but 'disordered relationships' between individuals that cause stress and susceptibility to disease. (Tyroler and Cassel 1964, Scotch 1963, Syme 1965).

In summary, there is extremely little specific evidence that improved housing causes improved health and even less evidence to indicate the nature of minimum housing standards whereby such improvement might be brought about.

Indeed there is some evidence that contradicts accepted principles of public health. For example:-

"The assumption that the relocation of a population in improved housing conditions would automatically bring about an improvement in health was shaken in 1933 by M'Gonigle (1933) who found that the health of a rehoused population had deteriorated after a period of 3 years, an effect that he attributed to the increased financial strain placed on the rehoused population at a time of severe unemployment." (WHO 1974, p.10).

Similarly Don (1966) reported on the rehousing of a slum population in Britain in which the increased rents (necessary to cover the costs of a legal, 'healthy' dwelling) and transport costs resulted in increased malnutrition and decreased use of health care services.

Similar evidence was found by Furguson and Petigrew(1954).

Nearer home, a parasitological survey undertaken in Masaku found that total parasite rates were higher in a new housing development than in a nearby 'majengo'. The only parasite for which higher rates were found in the 'majengo' was E. Histolytica (amoebiasis).(HRDU 1976).

The tremendous difficulties involved in studies aiming to determine associations between housing and health are easy to appreciate. Because housing is invariably associated with many other socio-economic and behavioural variables it is difficult to separate the effects of income levels, education, nutritional status, medical care, social behaviour etc.

"..... one of the major difficulties in the epidemiology of housing is that a given level of socio-economic status, associated with given ranges of nutrition, literacy, family size, and access to medical care, is often associated with a given level, or kind of housing. Thus comparisons between different kinds of housing often involve comparison between different levels of socio-economic class and its attendant factors that affect health, and the latter comparison can confound an association found between housing and disease transmission." (Ellison 1979).

Studies on which more substantial conclusions can be based are now being attempted using controlled field experimental design (e.g. Gove and Galle 1976, Booth and Cowell 1976) but as yet these are largely undertaken in the richer industrialised countries with their more chronic, 'modern' diseases. Where the factors inducing spurious relationships can be identified, their effects can be excluded by their statistical control and although this still will not 'prove' a causal effect, it significantly increases the confidence with which an association can be maintained. (see Susser 1973 for a review of this).

A good example of such statistical control was recently completed in Germany (Manton and Myers 1979). The factors employed to control the association between urban density and mortality were certain socio-demographic measures of the populations studied including such measures as % of dwellings built before 1900, average rental per square metre, % women in labour force etc. It was shown that density did maintain its association with mortality from certain diseases.

The difficulties attached to studies like this in the housing field should not be underestimated. It should be remembered that each of the variables can themselves be disaggregated. In the above study (Manton and Myers 1979), 10 components of 'density' were considered. Not only is 'housing' not homogenous (i.e. it consists of many components) but each of its components can equally be broken down. To investigate a relatively simple association between say water supply and improvement in gastro-intestinal infection requires the disaggregation of water supply itself into such components as water quantity consumed, water quality, position of the tap, use to which that water is put etc. etc.

It is highly unlikely that populations in different housing circumstances can be accurately matched for control purposes and equally unlikely that identical

housing conditions can be found in different populations. Well designed studies are by no means impossible but they are extremely difficult and rely often on chance events occuring that can then be studied.

The point is that there are today insufficient, adequate epidemiological studies on which to base firm conclusions about associations between specific housing variables and health. For the most part associations are and, at least in the short term, will continue to be based on judgement.

It is as well to say a little more about the subject of judgement since that is what we shall inevitably resort to in certain sections of this report. The discussions above have been, rightly, sceptical of the conclusions of many studies. This is because we should always aim to avoid 'false positive' findings about causality between housing variables and health conditions when, in fact, none exists.

Nevertheless decisions have to be taken in planning: judgements have to be formed about appropriate action. In this context, being over-sceptical and doing nothing is as bad as basing decisions on the intuition of the Sanitary Inspector of Dublin. Planners are fond of pointing out that taking the 'do nothing' option is not in fact doing nothing but rather opting for a definite decision under which conditions will continue much as before.

In an excellent discussion of the role of judgement Susser (1973 Chapter 11) proposes five essential criteria for assessing causal relationships. These are:-

- Time Sequence: the temporal relations of associated variables must be known if one variable is to be established as the cause of another;
- Consistency and Replication: results must be replicated in many studies or (since this is a rather high ideal in the social sciences) must at least be consistant;
- Strength of Association: the stronger an association the more likely it is to be causal;

- Specificity of Association: the degree of precision with which the occurance of one variable will predict the occurance of another;
- Coherent Explanation: the coherence of an association with other known facts (or strong associations) about the variables under study.

Judgements about associations between housing and health used as a basis for standards should give serious weight to these criteria.

Although we are today in no position to hold many firm conclusions about causality, we are in a position to make some informed judgements. Thus despite their comments on the failure of studies to provide conclusive evidence on the positive effect of sanitation on the prevalence of ascariasis quoted earlier, Feachem and Bradley (1978) are willing to conclude that:-

"This disappointing impact must be due to insufficient use of the latrines, or to poor hygiene in the latrine or to transmission continuing to occur away from the home....." p.99.

Judgements such as this are not based solely on epidemiological evidence. They include another dimension, essential in the health and housing field, namely, a knowledge of the transmission routes of the disease agent or more strictly of the ecology of host, agent and environment. This is possible wherever identifiable disease agents are known (e.g. Ascariasis lumbricoides) and where evidence is available about its behaviour, survival characteristics, host susceptibility etc. Often these are reasonably well known since their study is more amenable to controlled observation and measurement than are social or housing variables.

One final word of warning is necessary before concluding this section. So far we have not made great distinction between on the one hand knowing or making a judgement about an association between housing and health variables and, on the other, using that knowledge or judgement to

establish standards.

Knowledge and judgement are in principle scientific in the sense that a given action will result in a consistant, predictable outcome. Standards are entirely subjective.

Suppose that we can know the association between a housing variable and a specific health outcome and suppose that we wish to maximise that outcome. Assume for convenience that the relationship is a coherent, linear one. How do we set a 'minimum standard' for the housing variable? All we can really say is that providing an additional increment of the housing variable will produce a corresponding increase in the health outcome. Fixing a minimum standard is, therefore, dependent on making a value judgement about how much 'health' is desired and is conditioned by what other outcomes provision of that amount will produce, whether or not each of a range of interested parties would want those outcomes or not, and how much that provision will cost in terms of money or resources, and, who is paying.

Standards are, therefore, intrinsically and inevitably political in nature. More will be said about this in a subsequent section.

1.3 SIMON WAS RIGHT!

This is not the place to discuss many of the wider issues of housing - its potential role in the economy, its effect on urban form and infrastructure efficiencies, its inter-relations with employment in the construction industry and its linkage effects etc. The principles have been widely discussed elsewhere (Beier 1976, Koenigsberger 1975, Grebler 1973, Strassman 1970, Grimes 1976 and many others).

However, it has been mentioned above that as far as health

is concerned, housing is one of a complex set of factors involved. There exists widespread if not universal association between low-incomes, low levels of education, inadequate health care services, poor housing and the incidence of infectious diseases and general low levels of health.

We have argued that not a great deal is known with confidence about the direct relationships between specific physical housing features and specific health outcomes.

However, almost all studies (I can think of no exceptions*) have shown a strong association between health and socio-economic grouping - even though the studies may have aimed to show correlations between health and housing or other specific factors. In the absence of more understanding of precisely which components of socio-economic improvement contribute most effectively to improvement in health (and vice versa), we are in practice left with the aim of doing what we can to improve all aspects of socio-economic circumstances if our overall objective is to improve health. Inasmuch as housing is such an aspect, we aim to improve housing not solely because specific physical features of the house may cause improved health but because housing will interact favourably with or through other socio-economic factors to improve health in ways which are specifically unknown but where the overall associated outcome has been shown in all available studies.

We can speculate on what some of these favourable interactions might be. Important contributions of housing to socio-economic improvement and thereby to health may occur:-

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*The evidences of M'Gonicle (1933) Don (1966) Furguson and Petigrew (1954) and others are not exceptions. There was no overall socio-economic uplifting in these cases because the family resources required to gain and maintain a new dwelling were removed from other outlets for disposal. On the contray those studies reinforce the thesis above - that the physical, design attributes of the dwelling per se may be insufficient to guarantee improved health.

i) Through its location:
The location of a dwelling affects a family's socio-economic status in a variety of ways. It affects
- access to an income through distance, time and financial factors. If the house is located too far from a job so that access becomes infeasible through the time or transport costs involved in the journey to work, income will suffer and so therefore will spending on health-essential goods and services like food. Conversely, if the house is located within affordable access then it makes a contribution to income and therefore to health.
- access to services. If the house is located too far from health care delivery points, then the family will be unable to benefit from them or at least will experience disincentives to do so. Conversely, if the house is located within access, it makes a contribution to the consumption of such services.

ii) Through the terms of its tenureship:
If a family's tenureship of its house is secure, it is provided with an incentive for improvement of its own environment
- because nobody can suddenly take away those improvements: they belong to the family.
- because they are an investment that can be materialised subsequently and that will enable a family to achieve further ambitions.

Secure tenure therefore, acts as an incentive to maintain an income so that those improvements and investment can be achieved. Under conditions of insecure tenure where eviction or unachievable rent increases can occur, these incentives disappear.

iii) Through its price:
If the price of a dwelling is too high either it cannot be gained or it can be gained only at the

expense of other goods and services. In the former case, no housing-related benefits are achieved either indirectly through socio-economic variables or more directly through any physical attributes of the house. In the second case, the benefits are achieved at the expense of some disbenefits and it depends on particular circumstances whether or not the benefits exceed the disbenefits.
Conversely, if the house can be achieved without reduction in other essential spending then (all other factors like location being constant) all the benefits are positive.

iv) Through its contribution to income:
Apart from the contribution of location to income, the dwelling provides other contributions. Particularly it may itself be a source of income through its sub-rental potential and/or it may provide an input to income by constituting a place of work.

There are then, reasonably coherent explanations of how housing may contribute to improved health through its effects on other socio-economic variables. It must be emphasized that although these may not be precisely the mechanisms involved, the unasailable fact remains that all available evidence is consistant on the overall effect - namely that improved health is always associated with raised socio-economic circumstances.

It may well be then, that the route to better health lies not primarily in the physical qualities of the dwelling but in raised socio-economic circumstances, the achievement of which requires amoungst other things improved housing circumstances. It may be that security of tenure, access to employment and services etc. are the principal healthful aspects of housing rather than any physical or design aspect of the house. And if this is the case and assuming our real objective is to improve health, then we would do better to concentrate on providing security of

tenure, access to employment and services etc. to as many people as possible regardless of the standard of the dwelling.

The ideas of Chadwick, expanded and developed by Sir John Simon, William Farr and John Snow, may well have been right. (Chadwick 1842, Simon 1855, Simon 1890, Farr 1885, Snow 1855). Simon in particular maintained that improving the drains was not enough. He argued that occupational, nutritional and educational factors were all important. Modern epidemiology was born at this time alongside the development of public health. It is unfortunate indeed that environmental health went on its own 'rule book' path and is only now returning again to the science that owes those brilliant men such a legacy.

Many of the likely benefits of housing have, of course, no direct bearing on health but some of these benefits may well indirectly influence health and general well-being. Security of tenure of even the most basic house located within affordable access to employment forms the fundamental basis for family development. Having such a house already satisfies one of the most basic social needs - that of having a house. It provides the most important means of capital formation for the urban worker however small that investment may be.

In his review of some social effects of poor housing Schorr (1963), highlighted difficulties of household management, child rearing, sexual relations, cynicism about other people and organisations (e.g. political and governmental institutions) poor health and general state of dissatisfaction and passivity. Of course he was unjustified in attributing these problems specifically to housing rather than to the whole socio-economic circumstances of the populations concerned - of which housing is a difficult-to-extricate component.

It is probably more justified to claim that subject to certain levels of other socio-economic factors being achieved, a securely sheltered and employed family provides the best possible environment for the healthy development of children and this includes much more than the absence of disease. Given security and a basis from which to aspire to further ambitions, parents are more likely to create surroundings conducive to child development - from child-birth to adulthood. Parents will work to improve their house and its environment and children will see some examples of effort being rewarded and indeed will see the satisfaction their parents obtain from being more in control of their own environment. Babies and toddlers will have a yard - however small - for play, physical and mental development protected from the stagnant water, mud and rubbish endemic in the squatter areas and protected from major accident risk. School children will have a place to do their homework. The house and its services raises their pride and dignity - they can go to school cleaner and with cleaner clothes and shoes. Parents who value the home they are creating will impose a degree of discipline on their children. If their homes are adequate they will want their children around them in the home rather than gladly pushing them outside to play in the slum streets. Where there is a basis and some hope for better things parents and their children become more responsible citizens.

These and other likely benefits from housing are relatively intangible and to relate them directly to health would be a forlorn hope.

Clearly, however, they are aspects of socio-economic improvement in their own right. Inasmuch as a secure, affordable dwelling contributes to these benefits, then housing is a desirable component of socio-economic progress. Housing is <u>one</u> of the steps in the ladder towards a better life.

We can probably say with a degree of confidence that measures to upgrade the socio-economic circumstances of the urban poor should include assistance with housing.

However, whether housing fulfills this function in proportion to the physical standards of the dwelling is an entirely different issue.

1.4. STANDARDS FOR WHO?

It has been noted that because housing factors are invariably associated with other socio-economic conditions, it is immensely difficult to separate the effects of poverty, poor education, low nutrition and inadequate health care services from those specifically due to housing. Although we can speculate on the form of these linkages, we simply do not know the strenth of the inter-relationships and, specifically, we do not know quantitatively the influence that improved housing may have on any one of these socio-economic factors and in particular on health.

This is unfortunate because if we did know more about the nature and strength of these inter-relations we would be able to assess the most effective point in the complex chain at which to intervene to achieve any given objective e.g. to improve health. Intervention programmes could be planned and implemented to achieve maximum benefits with minimum resource input.

We assume that an improvement in housing can achieve an improvement in health both through its contribution to general improved socio-economic conditions and through its more direct physical attributes - although we may not know the causal route through which those benefits acrue and although we may not be able to quantify precisely which aspects of the house are implicated or the degree to which health improvement would result.

However, this assumptiom may not be true in the real world. Since the provision of housing is not free from influence on socio-economic variables, we must admit that it may entail costs as well as benefits in any number of them. Examples have been given earlier (M'Goicle 1933, Furguson and Petigrew 1954, Don 1966) of where improved housing resulted in a negative effect on health through the assumed effect of housing on related variables - namely, disposable income, food intake and the use of health services.

Houses cost their occupiers money that is not then available for other goods and services. If new houses are offered at a given rental or loan repayment level then there will be:-

i) potential occupiers who can afford that level without reduction in their expenditure on other essential services (i.e. people with savings).

ii) potential occupiers who can only afford that level by reducing expenditure on other essential services (i.e. people who would have to make a choice).

iii) people who could not afford that level even by eliminating completely their expenditure on other essential services.

Assuming that some at least of these other essential services are beneficial to health, then it can be easily seen that the price of a house is every bit as important an influence on health as is its physical attributes like walls, roof or sanitation system.

In making decisions for action, therefore it is meaningless to include only those judgements about the impact on health of physical housing improvement. If those physical improvements cannot be afforded then the assumed health benefits will not be captured. If they can be afforded only by a reduction in other essential expenditure then the assumed health benefits may be outweighed by health disbenefits introduced by that reduction.

Similarly, standards produce a health stratification - a clear demarkation between those who do receive the health benefits housing may theoretically bring and those who do not. Potential health benefits are being denied those who cannot afford the minimum legal standards. Or to put it another way, they are being guaranteed the ill-health that slum housing (or homelessness) is associated with.

Thus at some level of minimum legal standards, housing has an overall negative impact on health when the sum of ill-health of those excluded from the potential benefits exceeds the sum of the health gains of those included. As we shall argue later, this is presently the case in Kenya.

This argument is given additional weight when the suggestions in the preceding section are emphasised. The only consistenly known relationships to improved health are those involving improved socio-economic levels. Housing is hypothesized as being one of the socio-economic variables. Inasmuch as this hypothesis is true, then, housing provides its main contribution to improved health through its effect on other socio-economic variables. It does so by providing a secure location for the wage earner within affordable access to a job or a market for his productive activities; by providing a secure location for his family within affordable access to essential services including education etc. Houses do not have to be of a very high standard in terms of physical structure for these effects to be achieved but they have to be legal.

The frequently heard argument for the maintenance of standards is that, without them, housing could be of such a low standard as to create positive health hazards. The fact is, of course, that it is precisely those standards which, by placing improved housing beyond the reach of so many, have created the slums we are all so

familiar with.

1.5 SUMMARY

The conclusions of this introductory section can be stated briefly as follows:-

i) Standards are based more on historical precedent than on scientific knowledge.

ii) The current state of scientific knowledge about the effects of housing variables on health is inadequate to draw many hard and fast conclusions.

iii) In any case, legal minimum standards are never objectively determined. They represent deliberate policy and are therefore subjective.

iv) Much stronger evidence exists to associate improved health with change in socio-economic variables and housing can therefore be said to exert a more predictable health improvement through its effect on such variables.

v) Legal minimum standards are in practice a means of influencing which social groups receive the contribution housing makes to health and therefore which social groups do not. Their nett effect may be to reduce the level of health benefits in a population.

In the following sections we shall look at how some of these conclusions are relevant to Kenya.

Section 2

HOUSING & HEALTH BENEFITS IN KENYA

2.1 The Population & Housing Needs

2.2 Housing Costs

2.3 Who can Benefit?

2.4 Some Complications

2.5 Tentative Conclusions

2. HOUSING & HEALTH BENEFITS IN KENYA

2.1 The Population and Housing Needs

Broad urban population figures and current estimates are shown below in Table 2.1. These indicate that the population in 1979 will be around 15.7 million, of whom about 15% (or say 2.3 million) are living in urban areas of greater than 2000 population.

	Population ('000's)		
	Census 1969	Estimated 1978	Projected 1983
Total Population	10,943	14,732	17,470
Rural Population	9,860	12,627	14,470
Urban Population	1,083	2,105	3,000
Nairobi	509	959	1,334
Mombasa	247	401	504
Kisumu (Urban)	57	115	169
Smaller/Urban Areas	270	630	993
Number of Towns (2,000+)	48	68	108

(Source: National Development Plan 1978-83)

Unless present natural population increase is curbed to some extent, by the year 2000 the population will be around 30 million, of whom 8-9 million can be expected to be in urban centres. It is always worth bearing in mind with such population trends that projected urban population is based on assumed rates for rural development. If these rates do not materialise, urban populations will be that much greater. Certain areas of the country - notably western areas including Kakamega - are already at such high population-to-land ratios that the limits of agricultural absorbtion are now being approached.

The toal urban housing requirement has been estimated

at some 290,000 units including a current shortfall of 140,000 and a requirement of 30,000 units per annum to meet the expected increase in household formation from 1978-1983. (National Development Plan, 1978-83).

This is in addition to an estimate need for rural housing of some 90,000 units per annum.

Of course, 30,000 urban units have not been constructed during each of the years 1978/79, so that the above figures are now already underestimates.

In Nairobi it is estimated that something like 10,000 units are needed each year to accomodate the city's rate of household formation. But in fact public housing programmes have been averaging less than 600 units per year. Actual house completions - public and private - have never exceeded 3,000 units per year.

As a result self-settled areas continue to grow. In Mombasa and Kisumu the situation is worse. It is estimated that over 50% of all households in each of these cities are housed in squatter areas.

2.2 Housing Costs

Aspects of housing costs and financing are dealt with in another Discussion Paper but it is necessary here to look briefly and approximately at the costs of a basic house conforming to the legislation in relation to incomes so that an assessment can be made of who is and who is not receiving the assumed health benefits of housing in Kenya.

A minimum dwelling under the Grade II by-laws is defined as one habitable room, kitchen, ablutions and privy for the exclusive use of the occupants of

the house (Section 9).

Approximate construction costs, using inexpensive but legal materials, are as follows:-

- wet cores Shs. 850-900/m^2
- rooms Shs. 320-350/m^2

These are mid-1978 prices and assuming self-help construction (World Bank Second Urban Project Staff Appraisal Report, March 23, 1978).

Minimum legal habitable space is 3.72 m^2 per person accommodated (Grade II By-laws, Section 10(2)).

Taking an average family size of 5.4 persons, the minimum legal accommodation is 20.1 m^2. Assuming building costs in the middle of the range above i.e. Shs. 335 and adding 10% for inflation* this gives a building cost of Shs. 7,407 (1)

Taking an average wet core area from sites-and-services schemes of 6 m^2 and again mid-point construction costs plus 10% gives a construction cost of Shs. 5775. (2)

Minimum legal kitchen size is 2.325 m^2 with a "satisfactory outlet for smoke and fumes" (Grade II By-laws, Section 11). No comparable cost estimates are given for kitchens, but assume these are around Shs. 500/m^2, giving a total cost of Shs. 1162. (3)

Infrastructure costs can be estimated very roughly from recent schemes that provide only infrastructure connections to the individual plots.

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* From March 1977 - March 1978, The Residential Building Cost Index rose 10.6% for materials. (CBS, Statistical Abstract, 1978).

e.g. Kayole/Villa Franca (Nairobi) Shs. 5165/plot*
Mathare Site & Service Resettlement (Nairobi) Shs. 6439
(World Bank Second Urban Project Staff Appraisal Report, March 23, Table VI-I).

In view of the footnote below and since these costs are more precisely attributed in Table II of the World Bank Report, we will take that figure here. Then average infrastructure costs from these two schemes plus 10% inflation gives a cost of Shs.7370.(4) This gives a total sites-and-services house development cost of Shs. 21,714 summing (1) - (4) above.

Given the total self-help component, this is likely to be the cheapest form of house development.

Schemes which include contractor built wet cores and kitchens give individual house development costs of:

e.g.	Migosi (Kisumu)	Shs. 29,163
	Chaani (Mombasa)	Shs. 28,909
	Mikindani (Mombasa)	Shs. 29,614

again assuming 10% inflation from World Bank Second Urban Project costs plus minimum legal space allowances as above.

Without cross-subsidisation, this minimum house development cost of Shs. 21,714 will require a repayment of around Shs. 274 per month including infrastructure mortgage and building loan repayments over 30 years at 8.5% with a 5-year grace period and including utilities at about Shs. 45 per month, land rent, rates, etc.

Assuming that 30% of income is spent on housing then the minimum income required to afford this repayment

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* In fact this figure does not appear to tally with the Cost Estimate Details for this project (World Bank Project Implementation File Volume I, Document I, Urban Projects Department, May 12,1978 Table 11) which suggest a figure around Shs. 6961.

schedule is Shs. 913 per month. Assuming 25%, minimum income is Shs. 1,096 per month.

It should be noted that to maintain the legal status of such a house in terms of space allowance per occupant, there is no sub-renting potential as a contribution to income until a further room is built above that allowed for in these costs.

2.3 Who can benefit ?

It has been estimated above that loan repayment for this legal house requires an income of Shs. 913 - 1096 per month assuming 30 - 25% of income can be spent on housing.

Detailed income distribution figures are not available at the time of writing but in 1973 it was estimated that only 27% of the urban population had an income exceeding Shs. 750 per month (National Housing Corporation Guidelines for Sites-and-Services Schemes, 1976).

The World Bank Second Urban Project Staff Appraisal Report (March 1978) estimated that in Nairobi only just over 30% of households had an income less than Shs. 700 per month, i.e. the reverse of the NHC estimates. Obviously incomes are considerably higher in Nairobi than elsewhere and even if this World Bank estimate were accurate, it would be unjustified to base national urban affordability estimates on Nairobi incomes. Nevertheless, this is what appears to have been done in the World Bank Report.

In fact it is difficult to believe that this World Bank estimate can be correct even for Nairobi. Figures for wage income for 1977 indicate that the proportion of the urban population earning less than Shs. 800 per month and less than Shs. 1,000 per month is as follows:

e.g. Kayole/Villa Franca (Nairobi) Shs. 5165/plot*
Mathare Site & Service Resettlement (Nairobi) Shs. 6439
(World Bank Second Urban Project Staff Appraisal Report, March 23, Table VI-I).

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Schemes which include contractor built wet cores and kitchens give individual house development costs of:

e.g.	Migosi (Kisumu)	Shs. 29,163
	Chaani (Mombasa)	Shs. 28,909
	Mikindani (Mombasa)	Shs. 29,614

again assuming 10% inflation from World Bank Second Urban Project costs plus minimum legal space allowances as above.

Without cross-subsidisation, this minimum house development cost of Shs. 21,714 will require a repayment of around Shs. 274 per month including infrastructure mortgage and building loan repayments over 30 years at 8.5% with a 5-year grace period and including utilities at about Shs. 45 per month, land rent, rates, etc.

Assuming that 30% of income is spent on housing then the minimum income required to afford this repayment

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* In fact this figure does not appear to tally with the Cost Estimate Details for this project (World Bank Project Implementation File Volume I, Document I, Urban Projects Department, May 12,1978 Table 11) which suggest a figure around Shs. 6961.

schedule is Shs. 913 per month. Assuming 25%, minimum income is Shs. 1,096 per month.

It should be noted that to maintain the legal status of such a house in terms of space allowance per occupant, there is no sub-renting potential as a contribution to income until a further room is built above that allowed for in these costs.

2.3 Who can benefit ?

It has been estimated above that loan repayment for this legal house requires an income of Shs. 913 - 1096 per month assuming 30 - 25% of income can be spent on housing.

Detailed income distribution figures are not available at the time of writing but in 1973 it was estimated that only 27% of the urban population had an income exceeding Shs. 750 per month (National Housing Corporation Guidelines for Sites-and-Services Schemes, 1976).

The World Bank Second Urban Project Staff Appraisal Report (March 1978) estimated that in Nairobi only just over 30% of households had an income less than Shs. 700 per month, i.e. the reverse of the NHC estimates. Obviously incomes are considerably higher in Nairobi than elsewhere and even if this World Bank estimate were accurate, it would be unjustified to base national urban affordability estimates on Nairobi incomes. Nevertheless, this is what appears to have been done in the World Bank Report.

In fact it is difficult to believe that this World Bank estimate can be correct even for Nairobi. Figures for wage income for 1977 indicate that the proportion of the urban population earning less than Shs. 800 per month and less than Shs. 1,000 per month is as follows:

	% < 800/month	% < 1000/month	
Nairobi	56	65	
Thika	78	84	
Mombasa	69	77	
Meru	65	78	
Kisumu	69	78	
Nakuru	67	75	
Webuye	68	75	
Kakamega	65	72	
Machakos	77	83	
Total (a)	62	71	(22 towns)
Total (b)	71	78	(21 towns excluding Nairobi)

(CBS Statistical Abstract, 1978).

Apart from Nairobi then, about 71% of urban wage earners receive less than Shs. 800 per month. These figures do not include casual or informal sector workers. If these were included the percentage earning less than Shs. 800 per month would no doubt rise substantially. We might estimate that something like 65 - 70% of households in Nairobi and 80% of those in urban centres elsewhere cannot afford the legal house described earlier.

Of course this does not allow for more than one household member employed, but in view of the youthful population and high rates of maternity, many families will have no more than one income earner.

Recalling the arguments of Section 1.4 then, it is these kinds of proportions of the urban population that cannot afford the legal minimum standards for housing as they are currently applied. For the most part, these people occupy single rooms in the slum areas and cheaper rental areas and are effectively denied many of the supposed health benefits of housing discussed in Section 1.

2.4 Some complications

The above arguments and those in Section 1 are rather abstract and various simplifying and unjustified assumptions have been admitted. The reality is infinitely more complex.

In particular, amongst a number of qualifications should be included the following more important ones:

- the minimum legal standards (Grade II By-laws) are already not being applied in some components of the public houses now being constructed. For example, no sites-and service scheme allows 3.72 m^2 per occupant. Rooms of 3 m^2 in total are frequent regardless of occupancy rates.

  Using the same cost basis, it can be seen that the saving achieved by doing so is Shs. 4,090.5 (i.e. Shs. 368.5/m^2 x 9 m^2 = Shs. 3,316.5 as opposed to Shs. 7,407 for an allowance of 3.72 m^2 per person and an average family).

- Sub-rental is allowed (a consequence of the relaxation of 3.72 m^2 per person thus allowing a second room to be built and rented).

  Using the same cost basis, two 9 m^2 rooms will achieve an overall saving of Shs. 774 over the room costs when allowing 3.72 m^2/person.

  Total house development costs are therefore Shs. 20,940 instead of Shs. 21,714, requiring an income of Shs. 887/month assuming repayment conditions as used earlier, including a 5-year grace period and 30% of income spent on housing.

Given that sub-rental will bring in anything between Shs. 100 - 300/month depending on where the house is, the minimum affordable income falls to Shs. 787 - 587/month. Taking the worst (but more numerous cases, i.e. those outside Nairobi) an income of Shs. 787 is still required. This will not greatly increase the proportion of urban population that can afford such a development. Something like 70% of the urban population outside of Nairobi will still be excluded.

- Slum dwellers are not getting no health benefits. They are not capturing many of the physical health benefits of the house but as has been argued earlier, with the exception of water and sanitation, those benefits do not amount to much. They are not capturing the benefits of security of tenure (capital formation or incentives for environmental improvement) or the benefits of many community services associated with controlled legal housing. In addition they are invariably paying more than legal citizens for their rent and utilities. However, slum occupants frequently capture the health benefits of location since their settlements are often economically better sited than legal low-cost housing from the point of view of access to income and reduced transportation costs.

- apart from the matter of room sizes, public low-cost housing schemes are being planned and developed at standards much above the minimum allowable under Grade II By-laws. This is particularly true of infrastructure. Most new sites-and-services schemes are not within 200 feet of a local authority sewer and they are, therefore, not obliged to be provided with water-borne sanitation systems under the Public Health (Drainage and Latrine) Rules 1948, 1972 even if

these rules are interpreted to apply to Grade II By-law housing.

Other cheaper infrastructure standards are allowed under Grade II By-laws and yet the World Bank Second Urban Project Loan Agreement and Staff Appraisal Report, 1978 mentions not a word about alternative sanitation.

Similarly with standards for roads. The World Bank Second Urban Project includes bitumen surfaced external access roads, primary distributor roads, local distributor roads and pedestrian paths. Only the minor access roads serving individual plots are sand sealed. The Grade II By-laws impose no such standards.

Roads and sewerage reticulation constitute of course the largest components of low-cost housing schemes apart from the materials loan. Each is typically several orders of magnitude greater than any other component e.g. Shs. 2,695 per plot for roads and Shs. 2,143/plot for on-site sewerage reticulation for Kayole and Villa France; Shs. 1,676/plot for roads and Shs. 2,571/plot for sewerage for Mathare; Shs. 3,477/plot for roads and Shs. 1,989/plot for sewerage for Migosi; Shs. 2,413/plot for roads and Shs. 2,095/plot for sewerage for Chaani, etc.

Of course this does not include off-site infrastructure costs. Trunk sewer mains for Chaani, Mikindani and Miritini plus necessary extensions to the sewage treatment capacity amount to an additonal 16 million shillings.

House construction materials are also invariably significantly above those permitted under the Grade II By-laws minimum - namely "wattle or similar timber

adequately framed together and filled and covered with mud" (Grade II By-laws, Section 19).

- building costs are rising rapidly and will continue to do so. They are also rising out of proportion to incomes. Between March 1977 and March 1978, the Residential Building Materials cost index rose 10.6% whilst that for labour in the construction industry rose only 4.4%.

In particular, it is now widely accepted that infrastructure costs of Shs. 7,370/plot employed earlier are no longer realistic and that figures in the region of Shs. 9,000 - 10,000 may be more appropriate.

In very brief summary then, given current levels of building costs (even with a maximum self-help component) it is clear that already a majority of the urban population cannot afford the officially approved standards of housing now being constructed. This is so even allowing relaxation of minimum legal space standards. As prices will continue to rise faster than incomes, this situation will become worse.

Nairobi may be something of an exception to this since building costs are lower (materials), incomes are higher and the sub-rental contribution to income is greater than those for other urban areas.

If the above is correct, then it is to be expected that (outside of Nairobi) the rational choice for slum dwellers is to stay where they are unless (like Nairobi) the house plots they are offered will through very high sub-rental potential render the whole venture financially feasible. Alternatively, it is to be expected that many allottees will default on their repayments or sell their allotment.

2.5 Tentative Conclusions

This Section attempts to review the implications of Section 2 as a whole in relation to the arguments put forward in Section 1.

i) It appears that although the arguments put forward in Section 1 are over-simplistic, essentially they hold true for urban Kenya. Low-cost housing standards are too high and majority sections of the urban population cannot afford the costs they entail. As a result, a majority of people do not receive many of the health-related benefits of legal housing. The nett effect of housing policy and practice, therefore, has a negative outcome for the health of the urban component of the nation. This statement should be qualified, however, by the observation that many illegally housed households do receive health benefits arising from the location of their dwellings which are often better sited than legal low-cost housing.

ii) The present maintenance of standards that are too high cannot be conveniently attributed solely to legislation. Firstly, the standards set by that legislation are already relaxed in some aspects and secondly standards adopted in practice invariably exceed significantly the legal minimum.

It is necessary then to look elsewhere for an explanation for the maintenance of standards that are too high. Our investigations suggest several sources :

- the expectations and concepts of housing planners, designers and related agencies and those of enabling and approval-giving authorities.

It is clear that many planners, architects and engineers do not understand the socio-economic functions of housing or the relative value of its services to the poor urban household. For those living at the margin of economic viability in urban areas, most physical aspects of their dwelling are of minor importance compared with the services it delivers. Important amongst those are access to markets for their own services including the labour market; security of tenure and the gaining of a legal status; access to basic goods and services; the provision of water, and the direct income that housing provides through sub-rental or as a place to work; more habitable space, etc. When these basic criteria are satisfied then house owners may look to the cultural or social status aspects of their dwellings as reflected in its physical structure - as is occurring in Dandora, for example.

These priorities have been demonstrated time and time again in very low-income populations all over the world. That is why the urban slums exist. With the exception of a legal status and the provision of sufficient water at affordable costs and accessibility, the slums generally provide most of the important services from the point of view of the urban poor. "The cheapest form of shelter at minimum standards of acceptability have already been discovered by the slum dwellers themselves"(Rosser, 1973).

In addition to these self-selected priorities by low-income households, it is possible for authorities to impose certain other services because "it is good for them" or for the population as a whole. It has been argued in this paper that from a health point of view the only justified such additions concern a sanitation system and the provision and utilisation of health services combined with appropriate

education in their use and with adequate maintenance.

Planners and local authorities do not generally see it this way. Their mental images of housing are rather conditioned by their own cultural standards and by their desires to create neat and ordered housing environments. They often still aim to achieve the kinds of subsidised developments that characterised earlier times when a few lucky beneficiaries received houses of a standard that could not possibly he replicated on the required scale. This approach to housing planning and design is of course most professionally satisfying for those professions involved.

It would be a superfluous discussion to attempt to divide responsibilities between design agencies on the one hand and approval authorities on the other. The professional groups involved are similar and strong inter-relationships exist between the two functions. Apart from their own cultural attitudes and expectations, design agencies will tend to do what they know is more likely to be approved.

- a widespread lack of appreciation of the scale of the housing problem in relation to levels of affordability.

Whilst the concepts of sites-and-services and upgrading may be fully appreciated by certain individuals especially those at central levels, it is not widely appreciated or even understood by many local authorities. In our investigations we have frequently heard the view that "more money should be made available" in the form of subsidies. Quite how much money would have to be raised to solve the problem in this way appears to have been given little thought. Alternatively we have heard views

that "these people" should be discouraged from coming to the towns; they should certainly not be subsidised as this is only a disincentive for them to work.

These views are found not only in local authorities but also in central government agencies. The answer to the issue of affordability is seen to be that if people cannot afford to provide "healthy accommodation" for their families they should not come into the towns at all. A view widespread amongst health authorities is that they would prefer the illegal expansion of the slums (rather than a reduction in standards for new dwellings) because as long as they remain illegal, they can in theory be got rid of some time in the future.

It is clear then, that the views of many authorities and individuals quite apart from being ill-informed are seriously at odds with national development policy.

- the fragmented involvement of the various relevant authorities and professional 'protectionist' attitudes.

A good example of this is provided by the role of local public health authorities in housing development. Typically, housing designs are produced by the National Housing Corporation for a scheme within a particular local authority. Public health aspects are initially vetted by central level authorities and by the time they are seen by the local authority public health officials, schemes are virtually decided. Little contribution can be made at the local level.

More important than this, however, when scheme design is virtually completed at central level before being sent to local public health authorities for approval, the inevitable role assumed by local

public health officers is that of critic. He sees his performance - his professionalism - being judged by how many things he can find wrong with the scheme - what else is he there for ? Legislation that is open to interpretation as all legislation is to some extent but as the Public Health Act and Grade II By-laws are especially, will inevitably be used to support that role as critic.

Local public health officials are, therefore, rarely part of the problem solving exercise. They are, therefore, not aware of the objectives and constraints, for example the need for cost containment and therefore the need for finding innovations.

- the lack of knowledge about alternative housing technologies

This of course is related to the point above. Knowledge about alternative solutions and ways of doing things will only be actively sought when dissatisfaction is felt with conventional technologies. This dissatisfaction is not felt by those who only see a small part of the total problem. They will not fully appreciate the overall cost constraints and will not see why their particular component - public health, roads, water and sanitation or whatever - should adopt solutions any different from the "tried and tested" answers they are familiar with.

Attitudes like this have become firmly entrenched. When it is pointed out that what is being demanded is absolutely unaffordable the response is to look to the easy answers - more subsidisation; keep them out of the towns; these standards are absolutely inviolable to protect the public health (why ? - because we have been saying so for a long time !) etc.

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Constructive change in this situation is not served by the World Bank Second Urban Project documentation which nowhere suggests the need for new technologies or approaches. It has been mentioned before that in the field of excreta - disposal particularly, viable alternatives exist to water-borne sewerage that through their lower costs can extend sanitation benefits to poorer sections of the community. But from the evidence available in these documents no efforts are being made to create dissatisfaction with the conventional methods. The Second Urban Project is thus more of the same old thing - pass on to the urban poor the costs that result from the authorities' inability to come to terms with the problem.

- unjustified assumptions about the causal relationships between physical housing elements and health.

We have detected a very strong reluctance on the part of public health authorities to relax their interpretation of standards under the Public Health Act, the Public Health (Drainage and Latrine) Rules and the Building Codes Grades I and II subservient to them. Perhaps partly as a result of their traditional role as 'guardians of the public health' and their relative autonomy (that goes back to the creation of Medical Officers of Health in 1848), public health officers have often found themselves in confrontation with other authorities. Such confrontation naturally tends to increase the strength with which views are held and it may be that this explains to some extent the extreme identification that public health authorities appear to have for the legislation that, in their view, justifies the strength with which they hold their views.

A second possibility is that because the substance of environmental relationships to health are so complicated and nebulous, it is extremely difficult

- indeed largely impossible - for public health officials to appeal to scientific evidence in any dispute in which they may be involved. It is very tempting in this case, to fall back on something that is much more reliable (i.e. legislation) and to believe that this is based on scientific findings.

It should be pointed out, nevertheless, that it is not necessarily the 'letter of the law' that constrains housing development in this area, but rather its interpretation by the public health authorities and the power with which they are invested to make that interpretation stick. This attitude is not confined to the public health profession. Many other professional groups attach undue credibility to the interpretation of health related legislation. They believe, perhaps, that because it is so well established it must be based on completely sound principles. This view is no doubt reinforced by the complexity of the environmental health field - when faced with such a difficult subject, people like to feel that 'the experts' know the answers.

We have tried to show that much about environmental health has not been adequately studied. The evidence does not exist to justify such strong views. Even if it did, the setting and maintenance of standards and their embodiment in law will always be subjective.

Public health is now at a difficult time in its historical development. Many of its basic rules are being questioned all over the world. New epidemiological tools are being developed that will assist the subject in getting nearer to basing its activities on a firmer scientific footing. As far as low-cost housing is concerned, it may be that constructive development may be aided by finding a more active problem-solving role for public health as mentioned

earlier. Involving public health authorities as 'designers' rather than as 'critics' may go some way towards this.

There is no doubt that public health authorities and individuals have a tremendous amount of practical experience to contribute in finding new solutions to housing problems. Many active public health staff would like to be able to lay aside their 'rule books' and ancient legislation in order to approach problems afresh; to start from basics; to design, innovate and evaluate. But they cannot do this if they do not relinquish their principal role as critics or if design and implementing agencies do not involve them.

These then are some of the more important reasons why housing standards remain at unaffordable levels. Many of these reasons are not, however, inseparable from the effects of legislation. Legislation legitimises the conventional view and technology. Legal standards avoid the need to examine and evaluate. The law makes difficult decisions easy.

In short, although in the health field it is difficult to show that legislation per se causes the maintenance of unaffordable standards, this legislation does provide a convenient 'frame of reference' that makes new approaches and solutions more difficult to develop. The standards and practices embodied in this legislation did not appear overnight. They are the result of long evolution and a two-way relationship between themselves and the conventional technologies and codes of practice of various professional interest groups. It is not surprising then, that the ways of doing things that engineers, say, know best fit naturally and comfortably into this 'frame of reference'. It just seems that the law is there to sanctify what they would do anyway. And of course 'what they would do' is conditioned by a whole process of education and experience that developed in conformity with those laws.

To break this circle is not easy. Professionals would find themselves a bit exposed and without guidance and, of course, they would not like this. They would have to start thinking ! But that of course is precisely what we want them to do.

We believe then, that a change in the legal standards is called for if a genuine redistribution of the health benefits of housing is desired. Such a change would set the scene for the entrance of new solutions. The danger, of course, is that new legal standards would create a new establishment that would, in time, be equally resistant to change. We believe also, therefore, that not only must the content of legal standards be changed but that their whole nature must undergo fundamental revision.

(iii) In summary then, in view of our findings about

- the relative unimportance of the physical design aspects of housing to health (except for water and sanitation);

- the existence of viable, alternative, cost-reducing technologies for water supply and sanitation;

- the fact that the principal health benefits of housing accrue through its socio-economic effects;

- the increased control of ill-health intervention opportunities that legal housing offers through preventive and curative health care;

- the role of standards in preventing access to the health benefits of housing to large and perhaps majority sections of the population;

We believe that legal minimum standards should be

changed to allow more people to be housed legally and thereby to increase the overall health benefits to society.

In addition, we believe that slum settlements should be legalised and sanitised in order to maximise the health benefits of these populations.

Thirdly, we believe that a number of other changes should accompany this legislative change in order to overcome some of the other areas of constraint outlined in (ii) above.

Section 3

HOUSING: THE POSSIBLE CONTRIBUTION TO HEALTH

3.1 Housing and Specific Disease

3.2 Operational Conclusions

3.3 A New Emphasis for Standards

3. HOUSING: THE POSSIBLE CONTRIBUTION TO HEALTH

3.1. Housing and Specific Disease

Appendix I presents the broad epidemiological data we have been able to collect to date (this is continuing). It also presents discussions, under each main disease heading, of the relevance and likely effectiveness of interventions.

This present section attempts to structure and summarize the findings of Appendix I in a simple way that will make them of more practical use in assessing the contribution of different aspects of housing to improved health. We have concentrated here only on those aspects that are of significant importance to health. It can be argued, of course, that thousands of small aspects of the environment (of which housing forms a part) are related to health in some small way or through some contorted route or other. Quite apart from the fact that evidence on such connections is non-existant, spurious or contradictory, it is important to keep our discussion focussed on the major issues.

For discussion purposes here, the various diseases are aggregated under the broad overall headings under which they appear in Appendix I i.e.

1. Arthropod-borne diseases
2. Airborne/contact diseases
3. Excreta-related diseases
4. Maternal & Child Health and nutrition
5. Accidents
6. General acute & chronic disorders

Figure 3.1 summarises the brief discussions which follow by showing the main housing-related interventions for each disease group.

FIGURE 3.I SUMMARY CHART: THE POSSIBLE CONTRIBUTIONS OF SPECIFIC HOUSING ASPECTS TO HEALTH

	Location	The Plot	The House	Sanitation Choice	Management	Preventive Health	Curative Health	Socio-economic status	Behaviour
ARTHROPOD BORNE	*	*		*	*		*	*	*
Malaria	.	.			.		.	.	.
Filariasis	.	.		.	.		.	.	.
Viruses		.			.			.	.
Plague					.		.	.	.
AIRBORNE/CONTACT				*		*	*	*	*
Upper respiratory				.		.	.	.	
Measles				.		.	.	.	
Tuberculosis				.		.	.	.	
CSM							.	.	
Skin & Eye				.		.	.	.	.
Venereal						.	.	.	.
EXCRETA-RELATED	*	*		*	*	*	*	*	*
Diarrhoeas				.	.	.	.	.	.
Poliomyelitis						.			
Hepatitis A				.	.	.		.	.
Salmonelloses				.	.	.	.	.	.
Shigelloses				.	.	.	.	.	.
Cholera				.	.	.	.	.	.
Amoebiasis				.	.	.	.	.	.
Giardiasis				.	.	.	.	.	.
Ascariasis				.	.	.	.	.	.
Ancylostomiasis				.	.	.	.	.	.
S.haematobium	.	.		.	.	.		.	.
S.mansoni	.	.		.	.	.		.	.
Enterobiasis							.	.	.
MATERNAL & CHILD	*			*		*	*	*	*
ACCIDENTS		*	*			*	*	*	*
GENERAL ACUTE/CHRONIC						*	*		*

* *indicates a more significant contribution*

. *indicates diseases specifically involved in this contribution*

1. Arthropod-borne diseases

These are diseases transmitted by a vector - a mosquito, types of biting fly, ticks etc. Infections in this category of particular importance are malaria, filariasis (on the coast), plague and mosquito-borne viral infections. Principal housing interventions include:-

Location

The choice of location for housing is important. Sites should not be chosen in the vicinity of undrained or swamp land where mosquito breeding occurs.

The Plot

Where the location for development is unavoidable or where existing sites are being upgraded, site drainage should be undertaken to reduce mosquito breeding risk. Surface drainage should follow principles outlined in Appendix I.

The House

Although insect screens etc. are widely recommended in mosquito areas, we do not think there is sufficient evidence that these are effective. There is evidence from the coast that screens, by reducing ventilation encourage outside sleeping. Windows and doors have to be open at some times during the evenings.

Sanitation choice

Choice and design of excreta and waste-water disposal technology is extremely important. Pit-latrines should be of the improved, mosquito proof type. Soakage pits for waste-water or other arrangements should be used.

Other types of sanitation technology should be designed to exclude mosquito access or successful breeding (see Appendix II).

Management by authorities

Control programmes - for adult mosquitoes and larvae - will always be required for effective reduction in disease transmission risk. Rodent control may also be necessary. Solid waste disposal is essential on a regular basis to reduce vector breeding sites and rodent encroachment.

Preventive health

Little effective intervention available at this level, perhaps more community education.

Curative health care

Treatment is effective for all but viral disease.

Housings contribution to socio-economic improvement

These infections tend to be diseases primarily of poor socio-economic groups for the simple reasons that environmental risks are higher, and incomes, with which to do something about them, are lower.

Behavioural change

Community action can be effective in reducing vector breeding. Regular site inspections by community representatives could be used to remove many vector breeding sites - drainage/filling small waterlogged areas, disposal of water-containing rubbish etc.

2. Airborne/contact diseases

These are primarily a large group of respiratory disorders but also include skin and eye disease and sexually transmitted infections. Interventions include:-

Location

Only relevant aspect is to ensure access to health care services.

The Plot

No special relevance.

The House

No special relevance. Ventilation and space factors are often assumed to effect respiratory disease rates but there is no evidence that this is really the case (see Appendix I). Ventilation factors certainly have more to do with human comfort and the removal of odours etc. than they do with reducing infection.

Sanitation choice

Appropriate water supply and excreta disposal technologies are important both for reduction in skin and eye diseases (increased quantities of water for washing) and for reduction in infant (and other age) diarrhoeas etc. which may through sub-nutrition predispose to some airborne infections and certainly makes their contraction a more serious episode.

Management by authorities

Only relevant if sanitation system requires management. Solid waste management may reduce fly populations which may assist spread of

certain eye infections but this is a small point.

Preventive health

This is extremely important. Immunization is available for several very important airborne/ contact diseases and this should be made available and forcefully encouraged in the course of the community contacts made during new housing occupation or upgrading schemes - no lease without an appropriately filled-in vaccination chart for all the family? Health education provided through health care points, schools etc. can at least encourage the earlier reporting of disease especially tuberculosis and venereal disease.

Curative health care

Effective for most of this group of diseases.

Housings contribution to socio-economic improvement

Access to employment, higher and regular incomes etc. will enhance child nutrition, the use of water and health services. All these have some impact on the prevention and reduction in severity of these diseases. Family stability might be expected to reduce sexually transmitted disease.

Behavioural change

Relevant mainly to skin and eye disease (use of more water for washing) and to venereal disease. Health education may help to induce such changes.

3. Excreta-related disease

This group includes many virus, bacteria,

protozoa and helminth (worm) diseases that are almost all passed in the human faeces at some point in their life cycles.
Interventions include:-

Location

This is only really of significance for Schistosomiasis. Housing locations should not be located within convenient access to a water course containing the infected snail hosts of this disease - or even near watercourses containing uninfected snails. Every effort should be made to avoid doing so.

The Plot

Where other locations are not possible (or where upgrading is being undertaken in infested areas, e.g. Mathare), the advice of Schistosomiasis experts should be sought. Sight layout should make it unnecessary and difficult for water contact to occur and/or chemical control programmes should be introduced. Usually these measures do not meet with acceptable levels of success, however.

The House

No special relevance.

Sanitation choice

This is of major importance to almost all diseases in this category. There are a number of alternative sanitation technologies available and selection and detailed design should be appropriate to the situation. Soil conditions, affordability levels, site densities, degree of water availability etc. are all relevant design criteria. Some of the main alternative

technologies are described and reviewed in Appendix II.

Appropriate sanitation choice and provision provides the necessary basis for reducing excreta-related disease but a great deal of evidence shows that it will not be effective without two other measures:-

i) the availability of sufficient water quantities to facilitate personal hygiene - it appears that water to the house is immensely more effective than that from central collection points.

ii) Education on the use of water and the sanitation technology employed.

Management by authorities

This is very important. No sanitation technology can be left without some degree of maintenance by authorities or at least some on-going instruction and assistance in maintenance.

Solid waste management is also important in attempts to reduce fly populations which are often implicated in transmission of excreta-related disease - but this will not be successful without effective sanitation.

Preventive health

Health eduction in the use of sanitaiton is vital. Similarly, education on the dangers of water contact is essential for Schistosomiasis. Immunization is available for poliomyelitis and in view of the increasing improvement in sanitation (delaying the age at which exposure to the

infection occurs and therefore increasing its seriousness), this is a vital preventive measure.

Curative health

Curative health is effective for many of these diseases - especially helminths - and should go hand-in-hand with sanitation improvement to be really effective. Treatment reduces the infection and therefore the numbers of pathogens excreted and the risks of transmission but is of little use where treated patients must then return to high risks from inadequate sanitation.

Housing contribution to socio-economic improvement

Higher incomes and education levels contribute to better nutrition and therefore reduce the seriousness of some of these enteric diseases.

Behavioural change

This is one of the most vital components. Health education is necessary to realise the potential benefits of improved sanitation.

4. Maternal & Child Health (MCH)

Certain special considerations apply to maintaining the health of (well) mothers and children especially during and after the maternal episode. Housing can make some contribution to this as follows:-

Location

Important inasmuch as housing should be located within especially convenient access to MCH services.

The Site

Only important as it affects other health conditions.

The House

Not especially relevant. It is tempting to emphasise the high rate of home deliveries and to conclude that spatial and privacy factors are important but in view of actual family sizes and the range of affordability, it is difficult to make any real recommendations.

Sanitation choice

Important as it affects other health conditions especially child cleanliness and infant gastro-intestinal disease and also creates more hygienic conditions for childbirth.

Management by authorities

Not relevant - except the increased possibilities housing control offers to more effective intervention by health care authorities.

Preventive health

This constitutes the core of effective MCH services by providing pre-and post-natal services to well women including advice and assistance with child spacing. Similarly, it provides the basis for monitoring child growth and development including nutrition advice and immunization services.

Curative health

Also very important and related to preventive health. The latter can identify women at high risk of pregnancy complication and pre-select them for special treatment.

The contribution of housing to socio-economic improvement

Higher incomes, family stability, education etc. all contribute to MCH. Mothers who are not pressed to work every minute of the day are able to take up MCH services more regularly and if transport (or opportunity) costs are involved, are more able to pay and more appreciative of their benefits. Nutrition also benefits.

Behavioural change

Health education will help mothers appreciate the importance of MCH services to themselves and to their young children and, indeed, other family members.

5. Accidents

Accidents take an increasing toll of urban populations. Housing is related mainly to accidents in and around the home and to some extent to street accidents. Intervention includes:-

Location

This is not really significant in urban areas where street accidents may occur anywhere.

The Site

This can be important and traffic control measures should be considered at design stage. There is no reason for low-cost housing sites to have any internal fast roads and from this point of view, lower grade roads are a benefit. All possible means should be taken to reduce vehicle speeds e.g. with 'sleeping policemen'

if roads are surfaced or by routing open surface drains across roads to achieve the same purpose. Designers are accustomed to design for the vehicle but on housing estates this objective should be reversed. No roads should have long stretches without frequent right-angled bends (not curves) to reduce speeds. Recreational space/childrens playgrounds are nice ideas but all-too-often are left derelict. Children will always play in streets and have a right to without undue danger.

The House

Major accident risks exist in any dwelling including mainly burns, scalds etc. from food preparation activity, falls, carbon monoxide poisoning and, at higher income levels, electrocution.

House design should give attention to some of these particularly kitchen-type activity and to house heating. If families will cook in single rooms that fact must be recognised. Small chimneys must be allowed together with elevated stances for cooking stoves beyond the reach of smaller children. Where it is traditional to cook outside, semi covered verandah space will be favoured if this is made available and some degree of protection can be built in, for example with elevated stances between two short walls.

Sanitation choice

No relevance.

Management by authorities

No relevance.

Preventive health

Simple health education about burns risks to children may help but, in general, accident prevention programmes are not greatly effective. Immunization is available for tetanus and should be part of vaccination programmes in low-cost housing areas.

Curative health

This is very important particularly for minor accidents. Hospital care is essential for major accidents and is related to adequate ambulance services and communications. Some creative thought should be given to the provision of at least one telephone within access to low-cost housing developments - they are after all work places for many.

The contribution of housing to socio-economic improvement

Many accidents do seem to be related to socio-economic status. Parental care of children will obviously be affected by income and social attitudes and is known to affect accident rates.

Behavioural change

Obviously in theory related to accident risk but evidence is too nebulous to draw conclusions.

6. General acute and chronic disorders

These include a wide range of diseases which are included for completeness rather than their relevance to housing. They include musculo-skeletal and genito-urinary disorders, digestive diseases, neoplasms, circulatory disease etc. the causes of which are too varied to be mentioned here.

The only relevant interventions in the format used above are:-

Preventive health

Some of these diseases are detectable and are better treated at early stages. Increased health knowledge and awareness can improve intervention effectiveness through earlier reporting of symptoms.

Curative health

Many of these diseases can be treated with primary and hospital care.

Behavioural change

Dietary change, smoking, alcohol consumption, sugar consumption etc. etc. are related to some of these diseases and in theory, health education can induce favourable change in consumption patterns and lifestyle. In practice this rarely occurs.

3.2 Operational Conclusions

From the summary in Section 3.1 certain operational conclusions can be drawn. It is also necessary to point out certain aspects of housing and health that are not adequately covered in this form of summary.

3.2.1 Curative health services are seen to be required for all major disease groups. Preventive health services are required for all but one. The observations serve to highlight one important aspect of low-cost housing: the need and the opportunity that housing offers to improve health through community health care services.

Legal housing - of whatever standard - brings communities under a higher degree of official recognition, organisation and control. It thus provides a more defined population and identifies a clear need. This aspect should not be underestimated. The essence of effective preventive and curative care is positive intervention by health services rather than the passive response to ill people who present with symptoms. It involves the active assumption of responsibility for the gaining and maintenance of better health. Progressive health services should know the likely problems of the population with whose health it is entrusted. Those responsible should know the health risks to which this population is exposed and the likely outcome in terms of specific case load. It should actively seek better health through education and the reduction in those risks.

The needs of low-cost housing populations are greater than the urban population at large. They therefore indicate a higher than average allocation of health resources - assuming of course that this allocation is effectively employed.

All major low-cost housing efforts should include an appropriately designed health care component. In practical terms this should include the provision of health education, preventive health services and primary health care. The provision and organisation of these services rests with the health care authorities but low-cost housing programmes (sites-and-services and upgrading) should include early provision for the simple accommodation of such services in the form of health centres.

of more importance, the administration of low-cost housing - its allocation, rent collection, loan repayments etc. - provides excellent opportunities for the registration of families with health care agencies and these opportunities should be exploited to the fullest possible extent to achieve good coverage with immunization and MCH programmes.

Community development staff associated with low-cost housing schemes also have a role to play in promoting the acceptance and regular use of health services.

3.2.2 The discussion and summary in Section 3.1 also emphasises the importance to health of general improvement in socio-economic circumstances. This has no specific implications for low-cost housing design but highlights the importance of geeting people housed legally in their own houses in appropriate locations and in a manner that they can afford without undue financial sacrifice. It should be emphasised again that it is these factors that are important rather than the physical quality of the dwelling.

3.2.3. Behavioural change is seen to be extremely important particularly as it affects the ability of communities to maximise the otherwise only potential benefits of housing - especially the appropriate use of sanitation and the wise use of health services.

One important aspect of behavioural change concerns house occupancy rates. Over-occupied houses exert undesirable pressure on the services housing provides - particularly sanitation - and also on other health-related aspects of behaviour

(e.g. privacy, marital and child wellbeing). How many people can be expected to utilise one toilet before its health benefits start to decline? What kind of occupancy patterns start to inhibit normal sexual relations or prevent a child doing its homework?

These are not, as is commonly thought, primarily design issues or dependent on actual room sizes etc. If incentives remain unchanged, bigger rooms will simply occupy more people and no health improvement will result. They are primarily behavioural issues.

The big, unanswered questions concern how that behavioural change is best produced. Health education clearly has a role to play but a difficult-to-quantify one given experience almost everywhere in the world. Undoubtedly, however, low-cost housing provides serious educational opportunities through the degree of community-authority contact that occurs for housing administration. Community development now appears to be an accepted role of the housing authorities in low-cost schemes and this should provide the vehicle for much basic health education related to behaviour and the use of facilities. It has all too often been assumed that the simple provision of housing and its associated services is sufficient. However, evidence strongly indicates otherwise. Many of the health and social benefits of housing have to be <u>learned</u> by communities not familiar with them and community development services can assist in the learning process.

However, education is not the only way behaviour may be changed and this may be particularly

true with the subject of behavioural change in relation to house occupancy rates raised above. The recent philosophy of low-cost housing in Kenya, whilst recognising the ideal of single family occupation, has also acknowledged financial realities. Housing cannot be afforded by low income groups in terms of infrastructure and loan repayments, without recourse to sub-letting. This principle is fully accepted here. However, the question is how much sub-letting is reasonable given that over-occupation brings health disbenefits. If a plot allottee is allowed to build and rent, say, six rooms there could easily be in excess of eighteen people using one toilet. At such a rate of utilisation two things can be expected to happen. First, responsibility for cleaning and maintenance becomes blurred with the result that it is not done. Second, the problem of sheer access becomes difficult particularly at peak periods of defaecation in the mornings. Allowing that average occupancy time is only say 2-3 mins/person, this could entail unacceptable waits of 30-60 minutes! Children with diarrhoea can be expected to seek other solutions.

We recommend then that there has to be a balance between sub-letting as a means of affordability and house occupancy rates. Allottees should not be allowed to construct more rooms than necessary to ensure loan repayments. The object of low-cost housing is not to create a generation of idle landlords.

3.2.4 As far as more direct physical housing design and services aspects are concerned, we conclude from Section 3.1 (and the evidence on which it is based) that sanitation choice is by far the most important assuming that its provision is accompanied by appropriate education on its use

resulting in appropriate behaviour and adequate management on the part of authorities. We conclude from discussions in Appendices I and II that:-

- water to the household is infinitely preferable to water from central collection points. Where the latter is the only feasible system, it should be regarded as a step towards the former and planned for with that in mind;

- the most important use of that water (apart from obvious minimum bodily consumption) is in regular hand washing after toilet use or contact and before all food contact. Provision should therefore be such as to make this very convenient. It follows that the quantity of water available is more important than the quality and, therefore, expensive efforts to achieve unnecessary levels of purity above basic pathogen security are not a high priority;

- designers must give more attention to the inter-relationships between water provision and excreta disposal. In areas where water is scarce, it is more important that what is available is used for personal hygiene than for flushing toilets and, therfore, conventional water-borne sewage is inappropriate in such areas - other safe excreta disposal technologies are available;

- sanitation choice must be realistic in terms of affordability, health performance, water availability, self-help construction potential, cultural factors affecting use and especially anal cleansing practice, site and soil constraints etc. A range of choice is available

aspects may be provided - they can be given the benefit of the doubt as it were. But if there is insufficient money, they come a long way down a priority shopping list in favour of the other aspects discussed in 3.2.1-3.2.4.

We have noted, however, one aspect of house design that may bear an important relationship to health - namely, cooking and heating arrangements. We conclude that more attention must be given to simple, cheap designs for safer cooking space in or outside of each room in a low-cost house and not just in a defined kitchen space which evidence proves will be used by only one family living on the plot.

3.2.6 Management by authorities is seen to be important - and this excludes management by health care authorities discussed under 3.2.1. It is particularly important for maintaining the operation of sanitation systems - all sanitation technologies (except pit latrines in ideal conditions) require some degree of maintenance by authorities.

Solid waste disposal is also important although the degree of importance may vary from place to place.

It has to be realised, of course, that urban public authorities are already under severe pressure of high demand and limited resources. Again, however, the principle should be borne in mind that low-income housing areas should be given high priority.

In addition, as we have suggested elsewhere these authorities must seek newer, less expensive

technologies (ways of doing things) to meet these growing needs. We have suggested that more community involvement may be appropriate in terms of 'barefoot' sanitary workers etc. (see Appendix II).

3.3 A new emphasis for standards

What we are recommending therefore is an important shift of emphasis in priorities as far as housing and health are concerned. We are arguing that with the exception of sanitation technology choice (and its detailed specification) concepts of housing standards must move away from their present exclusive focus on physical, design aspects of the dwelling because these are not the really important health-related things.

Health interests are better served by satisfying guidelines (standards if that is what is desired) on:-

- preventive and curative health services;

- improving occupants socio-economic status by legalising their existance, improving their incomes and education etc;

- housing-related behavioural change induced by education (e.g. sanitation use) and by design/financing arrangements (e.g. occupancy rates);

- sanitation choice;

- housing location;

- site design and control;

- management by authorities;

than they are by construction and design standards for the actual dwelling.

It will be noted that, many of these important aspects are outside the control of the individual household. Criteria or standards for housing must therefore be focussed more on the performance of authorities than on the performance of the house.

This will no doubt be an unpopular recommendation as far as authorities are concerned. But if health is the objective, we see no option. Why should financially disadvantaged social groups be held responsible for meeting certain standards of things that are (in theory) under their control when in fact these things are by and large peripheral to the public health?

If public authorities cannot meet their responsibilities (which <u>are</u> health effective) why should the urban poor be expected to compensate (in ways which are largely ineffective).

The public health is better served by enabling these people to gain a foothold in society from which they may increase their socio-economic status and eventually their health. We have argued that the only really important <u>constraints</u> on communities in connection with housing change are concerned with sanitation choice and house occupancy rates. In fact, it is doubtful if even these things should be allowed to stand in the way of families in gaining a legal dwelling. However, this would be largely an academic discussion since, providing appropriate sanitation choice is made, neither of these two factors need inhibit the acquisition of a house. Part of the definition of appropriate sanitation is that it is affordable and many cheap, safe technologies are available. Similarly, controls on occupancy rates are achievable whilst maintaining the principle of sub-letting within limits sufficient to guarantee housing loan repayment levels.

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Section 4

DIRECTIONS FOR CHANGE

4. DIRECTIONS FOR CHANGE

In the final version of this Discussion Paper, this Section will present our specific recommendations for change. We feel that it would be unproductive to present those prematurely without discussion of the main arguments made in this first draft of the Paper.

Nevertheless it is perhaps useful at this stage to outline briefly some of the directions in which our arguments take us and what broad implications these may have for proposed change.

We believe these include the following:-

- the broad philosophy of legislative control should be such as to enable many more people to gain the health benefits of housing;

- it should not be unduly restrictive and impose unnecessary burdens on those most in need of those benefits and who are least able to respond to those restrictions;

- legislation should recognise that most of the strongly health-related aspects of housing are largely outside the control of the individual poor urban household and rest instead with various authorities. If those authorities are unable to respond appropriately, large concessions should be made to the urban poor to enable them to find their own solutions without the imposition of restrictions referred to above;

- the approach to legislation should assume that given the opportunity the poor urban family will work to improve its economic, social and environmental circumstances. Legislation should aim to maximise that opportunity;

More specifically :-

- it is not possible rigorously to or even usefully to define many performance standards for housing or its associated services as far as health is concerned;

- instead, legislation should aim to state the broad objectives that it aims to achieve and should illustrate these on a 'deemed to satisfy' principle;

- such legislation should be supported by further illustration of objectives in terms of guidelines explaining the intention of the law, the technologies that are known to meet that intention and as comprehensive as possible a description of circumstances and conditions for which each technology is suitable or unsuitable;

- absolute restrictions should be kept to a minimum and should be limited to subjects about which a substantial amount of knowledge exists;

- a mechanism should be established with which decisions can be taken about new entries in the 'deemed to satisfy' technologies;

- in the course of planning and design of public housing developments, responsible agencies should be obligated to demonstrate that they have considered cheaper 'deemed to satisfy' technologies and solutions than those incorporated in the final design. They should be obligated to demonstrate why these technologies are unsuitable in the circumstances. A precedent exists for this approach to legislation in the form of compulsory Environmental Impact Statements that perpetrators of major physical change are obliged to prepare in the USA. These demonstrations need not be elaborate, time consuming documents.

- whenever and wherever municipal or local authorities refuse planning permission for a public, low-cost housing scheme, they should similarly be obliged to demonstrate precisely why the proposals do not conform with the intention of the law and/or with 'deemed to satisfy' technologies;

- public low-cost housing development agencies are to demonstrate the suitability of site selection from the points of view of:

    - absence of vector borne disease risk and/ or to show actions taken to reduce these risks;

    - access to known employment centres and/or to show actions taken to facilitate on-site informal sector employment opportunities;

    - access to health care services and/or actions taken to facilitate such services;

- where water is not to be provided to the household, the housing authorities to demonstrate:

    - that cheaper ways of doing so have been considered and rejected and reasons are to be shown;

    - the extent to which standards of other aspects of the scheme would have to be reduced to make household water affordable;

- responsibilities for nuisances to be clarified in the low-cost housing legislation and in plot allocation/lease agreements. Allottees will be made responsible for their occupants and real measures are to be available to enforce this responsibility;

- standards are to be worked out to balance maximum permitted occupancy rates with affordability (need for sub-renting) in new housing developments.

APPENDIX I

EPIDEMIOLOGY

1. Arthropod Transmitted Diseases

2. Airborne/Contact Diseases

3. Excreta-Related Diseases

4. Maternal & Child Health and Nutrition

5. Accidents

6. General Acute & Chronic Disorders

7. A Note on Health & Vital Statistics

Conversely, new housing settlements that are developed (or that have developed spontaneously) without regard to these diseases, risk creating favourable conditions and an increase in local vector densities.

NAIROBI		Altitude thought to ensure that little or no transmission occurs but city is sited on edge of a 3-6 months transmission zone so occasional outbreaks not impossible.
THIKA	*	As above but higher risk of localised outbreaks.
NAKURU	*?	Only very rarely along stream courses.
MACHAKOS	**	Mesoendemic area - spleen rate 10-49% (Roberts 1974). There have been epidemics (e.g. 1972); transmission period 3-6 months. Should be considered as a real risk here.
ISIOLO	**	Probably as above, lower spleen rate on average but with higher localised risk depending on altitude.
MERU	*	Not much of a risk in the township.
MOMBASA	*** endemic	High prevalence - spleen rate 75% (Roberts 1974) - more than 6 months transmission period. 'Clinical' rate from Weekly Notifications 1962-72 is 60/100,000.
LAMU	*** endemic	As above.
KAKAMEGA	**	Risk of epidemics. Probably localised.
WEBUYE	**	As above.
KISUMU	*** endemic	Second highest prevalence after coastal area - spleen rate 50-74% (Roberts 1974).
KAJIADO		Very small risk and even then only near water.

* denotes risk of occasional epidemic (i.e. seasonal transmission)

** more serious risk epidemic

*** endemic situation

MALARIA

The Disease and its Transmission.

Malaria is a parasitic disease transmitted by infective mosquitoes.

The most important form of the disease in Kenya is Plasmodium falciparum. The most important vectors are Anopheles gambiae and Anopheles funestus.

A. gambiae tends to breed in temporarily sunlit clear pools often those resulting from human activity. Where such pools or other collections of water maintain high temperatures breeding can occur in as little as 5-6 days but usually takes longer. Breeding and therefore larger vector populations, therefore tends to occur at the beginning and during rain seasons. A. gambiae is a night-feeding mosquito.

A. funestus prefers clear shallow water with vegetation especially swamp land, quiet lakes or ponds fringed with vegetation as well as some clear streams. A. funestus is primarily a day-feeding vector.

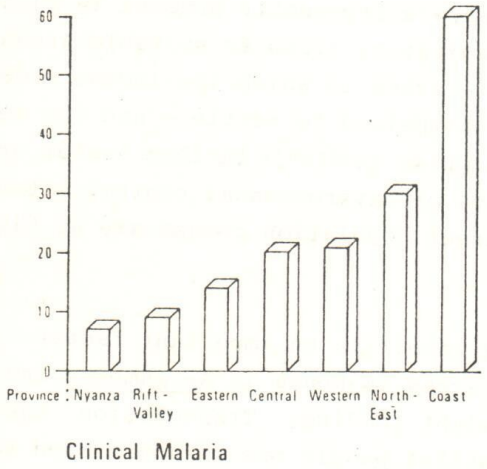
Thus apart from the case where housing development is situated adjacent to swamp land or comparable natural habitats of A. funestus, the main malaria vector of concern to urban populations is A. gambiae.

Distribution.

Large scale malariological surveys are unavailable so that data is very approximate and mostly confined to general regional variation. Furthermore, reportings of the disease in Weekly (or Monthly) Notifications of Infectious Diseases from the district medical offices are more often than not based only on clinical diagnosis unsupported by parasitological confirmation.

Nevertheless, wide regional variation is evident as illustrated in Figure I,1.

Figure I,1. Rate/100,000 population (for median year 1969) for years 1962-1972 from Weekly Notifications of Infectious Diseases, MOH.



Source: Diesfeld, 1978.

More specifically for present purposes, age-specific spleen rates* reported by Roberts (1974) provide the following:-

Location	% Positive	Comment
Coast	75%	Known endemic area including Mombasa and Lamu.
N.Nyanza/Bungoma	50-74%	Probably includes Kakamega, Webuye and parts of Kisumu.
Machakos/Thika	10-49%	
Meru/Isiolo	10%	Very dependent on altitude and probably higher than this in parts of Isiolo.
Masailand	Variable	Probably includes Kajiado

* The rate at which an enlarged spleen is detected in a survey of children from 2-9 years. Note, however, that an enlarged spleen can be caused by disease other than malaria.

At a more micro level, malaria is not a disease that can be directly associated especially with the target populations of this Project - all social groups are at risk. However, micro ecologies are all important determinants of malaria transmission and populations frequently present in such areas are at higher risk. Habitation close to suitable areas of natural water or swamp - areas in which low-income groups are often economically compelled to settle - and the tendency for low-income housing areas to create further vector breeding sites through their lack of environmental control often do ensure that Project target population groups are at higher risk.

The quality of housing itself is an important factor. The major vector in urban areas in Kenya is A. gambiae and this particular vector is night feeding. Transmission, therefore, occurs predominantly whilst people are in and around their houses during the evening and sleeping at night. Low quality structures permit easier access for mosquitoes and additional hiding places for them during daylight hours. Similarly, over-crowded and difficult to-ventilate structures encourage doors and windows to be left open at night and, particularly in the coastal and Lake Victoria areas, encourage people to sleep outside thus exposing themselves to maximum risk.

Furthermore, where a reservoir of plasmodia is present in a population (for example a population migrating from a poorer rural area where malaria is endemic), an increase in the vector population following excessive rainfall can be sufficient to create epidemic conditions.

Intervention.

Decisions relating to intervention in malaria transmission are notoriously difficult. In areas where the disease is

endemic a stable situation arises in which, through constant infection from childhood, populations gain a degree of immunity. Of course this immunity is maintained at the cost of high infant morbidity and mortality before immunity is gained. The problem with intervention in endemic areas is that unless the intervention programme is very effective and maintained over some years, it can replace continual infection with occassional infection (i.e. at periods of seasonally high rainfall) between which much of the populations immunity is lost and adults (as well as infants) will experience increased morbidity and mortality rates. Unless, therefore, a serious public health commitment to a sustained eradication programme is planned, piecemeal tinkering with malaria control can introduce more problems than it solves.

On the other hand, in areas that are at risk of occassional epidemics, the undesirable situation described above already exists and everything possible should be done to reduce the size of the vector population and the risks of transmission.

In particular housing should not be located in areas where the surrounding natural environment is known to be conducive to mosquito breeding and where large mosquito populations exist i.e. in undrained land with shaded vegetation.

Housing as an intervention itself (in sites-and-services or upgrading schemes) should emphasize drainage aspects of mosquito control rather than protection through window netting etc. The latter reduces ventilation considerably and, particularly in the coastal area, may be itself an added incentive for people to sleep outside thus putting themselves at maximum risk of infection from A. gambiae.

Adequate surface drainage is important in high risk areas but it should be noted that the mechanisms of drainage can themselves constitute mosquito breeding sites particularly for A. gambiae. Drainage channels should aim to achieve fast water flows, rapid drying out performance and if this is not possible, frequent changes of water level.

also the use of insecticides. For example, Abate added to water storage containers and to ground pools is particularly effective against A. gambiae and A. funestus. However, this is expensive over the periods necessary to break transmission cycles and, in any case, should never be carried out without the supervision of the national authorities (the MOH Division of Vector Borne Diseases) for risk of introducing insecticide resistance in the vector population.

NAIROBI	*	No very recent outbreaks but should be considered high risk area.
THIKA		
NAKURU	*	There have been various outbreaks in Rift Valley towns.
MACHAKOS		
ISIOLO		
MERU		
MOMBASA		
LAMU		
KAKAMEGA		
WEBUYE		
KISUMU		
KAJIADO	*	Centre of outbreak in 1978 moving through Masailand to Nairobi.

* higher risk than elsewhere

PLAGUE

The Disease and its Transmission.

The agent for the disease is Yersinia pestis.

Transmission occurs by the vector Xenopsylla cheopis (flea) and the disease has a reservoir in rodents.

Although rare in humans in Kenya, a natural reservoir exists in the large rodent population and large epizootics can occur but be unnoticed until man is involved. Indeed the geography and ecology of the country appear to be well suited to rodents and condusive to the flourishing of large populations in which such enzootic and epizootic states of plague almost certainly exist.

Exceptional climatic change (flood and drought) can cause rapid encroachment of the rodent populations on human settlements and plague should, therefore, always be considered as a constant threat.

Distribution.

The importance of the latent threat of plague was emphasized as recently as 1978 when an outbreak originating in Kajiado area spread to the outskirts of Nairobi - declining again for no obviously apparent reason. This outbreak was certainly a result of the dramatic increase in the wild and domestic rodent populations and the effects on population distribution following the unusually heavy rains in recent years.

The scanty data on the distribution of plague in rodent populations does not allow particular urban sites to be ranked in terms of risk. In 1968 a survey of 20,000 rodents in different parts of the country discovered significantly high antibodies in 2.5-10% of the sera. (Davis et al 1968).

Past outbreaks have occured at Rongai (1953), Murang'a (1963) and in Masailand centred on Kajiado (1978). If any Project towns can be singled out as higher risk they are probably Nairobi, Nakuru and Kajiado.

Slum areas in any town obviously present much higher risks than other areas.

Intervention.

Strong efforts should be made to control rat-human contacts not only for plague but for a wide range of health risks associated with rodents.

Control measures are mainly:-

- effective and regular disposal of solid waste to deny rodents access to food in human settlements. Container stands should be designed to reduce spillage and to deny access to rodents. Community education is important but must be supported by municipal action on a reliable basis.

- house construction which prohibits the entry of rodents and the maintenance of plot cleanliness and the regular disposal of unwanted materials etc. that provide hiding and shelter for rodents.

- rodent control measures by the public health authorities in high risk areas.

NAIROBI		
THIKA		
NAKURU		
MACHAKOS		
ISIOLO		
MERU		
MOMBASA	*	Should be considered a high risk area for outbreaks particularly chikungunya/ o'nyong nyong complex and Bunyamwera.
LAMU	*	As above.
KAKAMEGA		
WEBUYE		
KISUMU	*	As above.
KAJIADO		

O'nyong-nyong - vector Anopheles spp. A massive outbreak of this occured in the early '60s.

Bunyamwera - vector Aedes spp.

Distribution.

A serological survey to detect antibodies to a range of arbroviruses was completed in 1966-68 in three selected districts - Malindi, Kitui and Siaya in Central Nyanza. It was found that 50% of people examined had antibodies against the chikungunya/o'nyong nyong complex (they are immunologically indistinguishable) in Siaya and Malindi whilst in Kitui they were virtually absent. In Siaya and Malindi antibodies were present even in the 0-4 age group indicating that the infection was still present at that time. (Geser et al 1970).

In 1973 a study of the lakeside area south of Kisumu detected antibodies to chikunyunya/o'nyong nyong in 60% of school children. (Bowen et al 1973).

In the 1966-68 survey, Bunyamwera antibodies were found in 26% of the Malindi sample but only 5-6% from Siaya or Kitui.

Dengue-1 antibodies were similarly distributed with 47% positive in Malindi but with no clinical evidence of dengue.

An examination of 147,000 mosquitoes from seven areas of the country succeeded in isolating arbroviruses including Semlimi Forest, Banzi, Bunyamwera and Beliefe. (Metselaar et al 1974).

An arbrovirus of importance elsewhere is yellow fever but this appears to be almost entirely absent from Kenya. Nevertheless, antibodies are found indeed the 1966-68 survey found yellow fever antibodies in more than 50% of the tests in Malindi. However, unequivocal identification of many arbrovirus anti-

bodies is very difficult from serological tests alone since cross-reactions to other antibodies can occur. It was suggested that these Malindi findings were attributable to such cross reactions (or to yellow fever vaccinations!). The concencus view is that Kenya is effectively almost free of yellow fever.

In summary, the major risks from arbrovirus outbreaks in Kenya are from the chikungunya/o'nyong nyong complex and from Bunyamwera. It is probable that these virus are circulating at low levels and that outbreaks could occur from time to time. Major epidemics would, however, probably require a quite substantial ecological change such as climatic change favouring the vectors or the introduction of a larger reservoir of infection through population movement etc.

The vectors of major importance are therefore Aedes spp. especially Aedes aegypti and Anopheles spp.

Intervention.

For the most part these arbroviruses are not sufficiently serious to the individual to justify costly control measures. However, major epidemics do take a quite serious toll in terms of debilitating effects albeit temporarily.

Levels of endemicity are probably not sufficiently high to provide much in the way of natural immunity in either of the two main foci and, in any case, the need for constant population mobility would still expose many non-immune individuals to risk of infection.

Efforts should be made therefore to reduce the vector populations in these areas and, to do so, much that has been said about mosquito control in the sub-sections on malaria and filariasis applies also here.

Environmental control in the urban and peri-urban areas is

potentially important. Aedes aegypti is known to flourish in domestic and semi-domestic habitats (as well as more natural conditions including forests) wherever breeding sites are available in water storage containers, discarded tins, pots, tyres, plastic containers etc.

Site drainage, surface drainage, solid waste disposal, covers for clean water storage containers etc. will all assist in the reduction of Aedes spp. and Anopheles spp. within access to the site population.

House protection with netting etc. is likely to be counter-productive as mentioned with malaria control measures.

ONCHOCERCIASIS

NAIROBI

THIKA

NAKURU

MACHAKOS

ISIOLO

MERU

MOMBASA

LAMU

KAKAMEGA

WEBUYE

KISUMU

KAJIADO

General Comments:-

For all practical purposes this disease has been eradicated from its original foci in Western Kenya.

It is a rural disease and of no relevance to urban housing.

ONCHOCERCIASIS

The Disease and its Transmission.

A parasitic infection transmitted by the Simulium fly.

Parasite form Onchocerca volvulus.

Vector in Kenya Simulium neavei.

Distribution.

Whilst there were earlier a number of foci of onchocerciasis in Western Kenya, the disease has been almost certainly completely eradicated. However, extensive infestation exists on the Ugandan side of Mt. Elgon and a small focus may remain on the Kenyan side at Malakisi.

In any case, onchocerciasis is of little or no interest for urban housing development. Simulium spp. require ecological conditions that severely constrain their distribution. For breeding purposes they are restricted to fast-flowing streams and rivers usually in mountainous terrain. S. neavei has the additional requirement for a certain freshwater crab - the larvae live in the shells of these crabs to obtain a rapid flow of water and oxygen.

The major risks of reintroducing onchocerciasis in the Western Region comes from man-made irrigation and hydro-electric schemes which, without adequate consideration may extend suitable breeding sites for Simulium.

NAIROBI		
THIKA		
NAKURU		
MACHAKOS		
ISIOLO		
MERU		Transmission confined to coastal areas in Kenya.
MOMBASA	*	Remains an important risk around Mombasa but probably little transmission on the island itself.
LAMU	**	Remains a serious problem here.
KAKAMEGA		
WEBUYE		
KISUMU		
KAJIADO		

FILARIASIS

The Disease and its Transmission.

A parasitic disease transmitted by infective mosquitoes.

The form of parasite of major importance in Kenya is Wuchereria bancrofti.

The vectors are:-

- in urban areas Culex fatigans
- in rural areas Anopheles gambiae and A. funestus

Culex fatigans is essentially a domestic mosquito breeding in pit latrines, waste water pools and any collections of water in discarded domestic rubbish - tins, tyres etc.

A. gambiae (also the vector of malaria here) is also known to accept water pools etc. resulting from human activity as suitable breeding places and occasionally breeds in clean water storage containers. It prefers temporarily sunlit, clear pools.

A. funestus (malaria vector) prefers more natural habitats of swampy ground.

The main vector of conern to urban housing development is therefore Culex fatigans but A. gambiae can also be important. Both these vectors are night-feeders and given that Wuchereria bancrofti produces peak microfilaria densities in human peripheral blood at night, both these vectors are likely to be relatively efficient in transmission.

In comparison, A. funestus is not likely to be as important.

Distribution.

Filariasis is confined to the coastal strip of Kenya although

the vectors are present in many parts of the country.

Within the coastal strip itself, the true extent of the disease is difficult to assess. Microfilaraemic carriers can remain symptom free for years and, in general clinical attack rates are thought to be low. But early infections are frequently unrecognised in indigenous populations in endemic areas.

The only consistant measure is the occurence of microfilaria in peripheral blood sample surveys. Such a survey was undertaken recently (Wijers 1977, Wijers and Kinyanjui 1977, and Wijers and Kiilu 1977) of 5,000 males over 14 years old in Kwale and Kilifi Districts. A 'filariasis index' was computed based on microfilaria rate and clinical signs. Four main foci were identified having an index score of above 50%. These were:-

- the extreme south of the coast strip
- west of Mombasa
- just inland from Kilifi
- along the Sabaki river

Lower but significant rates were found at Lamu and just north of Mombasa.

Current opinion is that of the two relevant Project towns, Lamu presents the more serious problem.

Intervention.

Chemotherapy is available and reasonably effective but frequently results in adverse reactions. From a control point of view the treatment is effective in rapidly lowering the density of peripheral blood microfilaria and thus reducing transmission risks but the problem is that many patients fail to complete an adequate course of the drug because of its frequent side effects and because many are in any case

symptom-free.

The use of residual insecticides can be reasonably effective but resistance has developed in many parts of the world. These and antilarval measures depend on a thorough understanding of the behaviour of the vector and the history of control attempts. (WHO 1962, 1967, 1971, 1973).

A recent study in a coastal village in Tanzania (Bushrod 1979) achieved a successful reduction in the vector population by a combination of antilarval and environmental control measures.

These included:-

- adding Dursban to pit-latrines (breeding sites for Culex spp.).
- adding Abate to domestic water storage containers or fitting these with wooden lids with plastic gauze (breeding sites for Culex spp. and occassionally Anopheles spp.).
- weekly checking of small water vessels and rubbish around the village and any water disposed of (breeding sites for Culex spp.).
- treatment of ground water pools within 1 km radius with Abate (breeding places for Anopheles spp. - especially A. gambiae).
- treatment of brackish water pools with paraffin (breeding sites for A. merus - but this is not important in Kenya).

Although control measures were very localised - none beyond a 1 km radius, a substantial reduction in the vector population was achieved and apparently little migration occured.

Similar studies elsewhere have shown that successful vector reduction can be achieved in urban areas by the systematic

drainage or filling-in of pools supplemented by larviciding.

It should be noted, however, that such a programme would have to be sustained over several years (seven years was suggested by White 1971) in order to break the filariasis transmission cycle. The cost of insecticides would be prohibitive on a large scale and their sustained use would be likely to introduce resistance.

Alternative methods of relevance to urban housing development include mainly:-

- the upgrading of pit-latrines (where there exists no realistic time-table for their replacement with water-borne sanitation) to render them mosquito proof. This is discussed in some depth in the sanitation technology section of this report.

- the location of new housing away from natural habits of filariasis vectors i.e. water logged ground, swamps, pools, ponds and lakes etc.

- adequate site drainage (where the above is not possible) and the provision of an adequate surface water drainage system to prevent the collection of rain water and waste water pools.

- protection of clean water storage vessels.

- effective solid waste disposal and environmental management to prevent the use of discarded domestic objects as vector breeding sites.

A fuller discussion of environmental control measures is given under the sub-section on malaria and much of that is relevant here. In general, housing developments should aim at a degree of control through drainage and environmental measures (and through improving latrines in the case of Culex fatigans) rather than through protective design methods such as window

and door netting which will reduce indoor ventilation and in the coastal climate will encourage outdoor sleeping thus putting people at maximum risk of infection from Culex fatigans and A. gambiae.

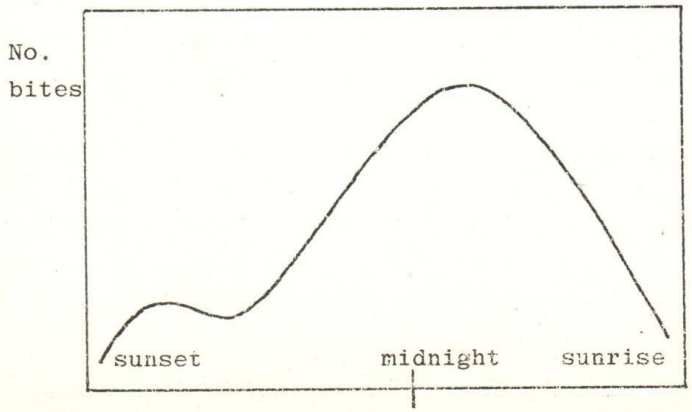
In areas where Culex fatigans is a major problem (e.g. Changamwe, Mombasa is now a major breeding ground) and where latrine upgrading is not yet feasible, other methods of breeding control may be applied.

Chemical larvacides like Dursban are very effective when added to wet pit latrines but - as noted above - will be very expensive over time.

Experiments of adding a layer of small polystyrene balls to traditional latrines have been undertaken with considerable success (personal communication McCrae, International Centre for Insect Physiology and Ecology, Mombasa). This layer of balls floats up and down with the water level thus barring mosquito access whilst not interferring with the functioning of the latrine.

In connection with the improvement of latrines, it should be borne in mind that even a few unimproved latrines in a community will be sufficient to maintain breeding. The breeding densities will simply become higher in these unimproved latrines when access is prevented elsewhere.

C. fatigans feeding pattern tends to follow the following:-



LEISHMANIASIS - Kala azar

NAIROBI		
THIKA		
NAKURU	*	
MACHAKOS	*	
ISIOLO	*	General Comments:-
MERU	*	Primarily a rural disease in Kenya, the only areas of major concern being the North East, the North and some areas to the north of the Rift Valley.
MOMBASA		Project towns reporting cases are indicated but these are almost certainly cases arising in surrounding rural areas.
LAMU		
KAKAMEGA		
WEBUYE		
KISUMU		
KAJIADO		

* towns reporting cases in recent years

LEISHMANIASIS - Kala azar

The Disease and its Transmission.

A parasitic disease transmitted by infective sandflies.

The form relevant in Kenya is Leishmania donovani - kala azar. (Cutaneous leishmaniasis (L. tropica) is extremely rare in the country).

The vectors are sandlies of the phlebotomus group - principally P. martini.

Although in many parts of the world kala azar is transmitted by primarily house-dwelling vectors (e.g. P. argentipes in India), in Kenya P. martini is thought to be largely a rural disease limited to arid and semi-arid areas mainly below 2000 feet. In the past this vector has been strongly associated with eroded termite hills in which the sandflies inhabit the ventilation shafts. It was thought that the vectors only left these hills in warm, calm evenings especially at the beginning and end of rain seasons. However, there is now doubt as to whether this is in fact the case and there are certainly other habitats of the sandflies. There is some evidence that indoor feeding occurs and that anthills may only provide suitable resting places - Mutinga (1978).

Rodents and possibly dogs (Ngoka 1978) provide a reservoir.

Distribution.

Cases reported have been largely confined to the arid and semi-arid areas of the North and North East but including Machakos, Nakuru and Meru. However, these are almost certainly cases arising in rural areas. Population movements recently may be an important factor in the changing and increasing number of cases identified.

A recent study of an outbreak in Machakos District (Ngoka 1978) found an increase in parasitologically confirmed cases from below 10 in 1972 to 130 in 1977. Case follow-up traced these cases to rural homesteads. It was concluded that kala azar has remained at endemic levels in this area and that the recent outbreak results from the increased movement of people in search of food and water following the period of drought.

It is likely that the flight range of P. martini is small so that natural foci of transmission probably occur. Where these are close to rural water sources - river beds, dams etc. - the congregation of people can promote spread of the disease.

Intervention.

The most effective intervention is probably case finding and treatment. Since transmission probably occurs primarily outdoors, residual house spraying is unlikely to be effective.

Where housing developments are planned near to the known foci of transmission, existing termite hills should be destroyed and sprayed.

The control of rodents and dogs should be attempted through the management of solid waste disposal.

House protective measures such as window netting etc. will not be effective and will reduce ventilation performance.

NAIROBI		
THIKA		
NAKURU		
MACHAKOS		
ISIOLO		
MERU		
MOMBASA		
LAMU		
KAKAMEGA		
WEBUYE		
KISUMU	*	Kisumu is the only town under consideration anywhere near the remaining possible foci of transmission in Kenya. This is principally a rural disease and the dangers of transmission in urban areas is neglegible.
KAJIADO		

TRYPANOSOMIASIS

The disease and its Transmission.

Trypanosomiasis (sleeping sickness) is a parasitic disease transmitted by an infective Glossina (tsetse fly).

Forms relevant to Kenya are Trypanosoma gambiense and Trypanosoma rhodesiense.

The principal vectors are:-

- for T. gambiense - flies of the Glossina palpalis group.

- for T. rhodesiense - flies of the Glossina mortisans group.

but recently, T. rhodesiense has been found to be transmitted by Glossina palpalis fuscipes.

The natural habitat of the G. palpalis group has been in the forests of Uganda and western areas of Kenya especially along the streams and coastal areas of Lake Victoria - transmitting T. gambiense. Since the 1940's, however, migrant workers introduced T. rhodesiense into these areas which encountered G. palpalis fuscipes and a new transmission cycle occured.

Distribution.

Restricted to certain areas of South and Central Nyanza and Western Province in favourable local habitats. A serious outbreak of T. rhodesiense occured in parts of Central Nyanza and Western Province in 1964-65 but was rapidly brought under control.

Control measures have been very successful in the past and in

recent years cases have been almost exclusively confined to resettlement areas and farmsteads especially around Lambwe Valley. Under favourable conditions, G. palpalis can spread from its natural habitat to farm vegetation.

Intervention.

Since trypanosomiasis is essentially a rural disease there is not a great deal that urban housing programmes can contribute positively or negatively to its reduction. The only serious concern might be the planned development of settlements in areas where the disease may still exist but these would be agricultural settlements and not the major concern of the present study.

NAIROBI		
THIKA		
NAKURU		
MACHAKOS		
ISIOLO		Not possible to identify relative risks.
MERU		Meru was a focus in the past.
MOMBASA	*	
LAMU		
KAKAMEGA		
WEBUYE		
KISUMU		
KAJIADO		

* previous centre of infection

RELAPSING FEVERS

The Disease and its Transmission.

The agent of the disease is a spirochaete of the genus Borrelia.

Transmission occurs from ticks and body lice of various Ornithodorus spp.

The ticks favour a domestic habitat particularly where dirty surrounding provide cracks in mud and earth walls and floors.

Distribution.

Tick borne relapsing fever is now probably of neglegible significance in Kenya. Previously it was something of a problem around Meru and in cooler highland areas.

Intervention.

No specific interventions are called for in view of the low importance of the disease.

NAIROBI	No specific distribution pattern known.
THIKA	
NAKURU	
MACHAKOS	
ISIOLO	
MERU	
MOMBASA	
LAMU	
KAKAMEGA	
WEBUYE	
KISUMU	
KAJIADO	

RICKETTSIOSES

The Disease and its Transmission.

Rickettsioses are infectious of bacteria-like organisms (Rickettsiae) transmitted by lice, fleas or ticks.

For the most part the infection has a reservoir in rodents and other animals but louse-borne typhus occurs only in man.

Neither louse-borne nor flea-borne typhus is reported in Kenya.

Tick-borne rickettsial disease also appears to be rare but is reported. But it should be remembered that diagnosis requires serological investigation and this is not at the disposal of many hospitals so that false reporting may occur.

In Kenya, tick-borne rickettsioses are:-

- tick-borne typhus (Rickettsia rickettsii but also possibly var. piperi and/or var. conori).
- murine spotted fever (R. mooseri).
- Q-fever (Coxiella burneti).

These are transmitted by a wide variety of ticks and have a reservoir in many rodents.

Q-fever is occassionally diagnosed and reported from Nairobi, Athi River and northern areas. But studies in 1976 (Vanek and Thimm) show that it is present in man (and cattle) everywhere that surveys were made - especially Eastern, Rift Valley and Coast Provinces. It is assumed that most adults are immune.

Unlike the other rickettsioses mentioned here, Q-fever whilst

having a reservoir in ticks, wild and domestic animals, is commonly transmitted by the airborne dissemination of rickettsiae in dust. It can also be contracted by direct contact with infected animals or materials that they have contaminated - wool, straw etc.

Interventions.

No specific interventions are called for in view of the low importance of this infection. Increased skin and general household cleanliness will maintain low or neglegible incidence.

Respiratory diseases are probably the principal causes of morbidity and mortality - especially in the early years of life. They are transmitted from man to man by an airborne route as well as by direct contact or ingestion.

In early life, viruses play a predominant role in the initiation of respiratory infection but with the exception of viral bronchiolitis and parainfluenza, the severity and complications common with respiratory disease are mostly conditioned by secondary bacterial infection. It is thought that these bacteria are already present in the upper respiratory tract where they tend to be relatively harmless until tissue resistance is lowered by the antecedent virus infection. For this reason they are commonly referred to as potential or opportunistic pathogens.

They probably include influenza bacilli, pneumococci, staphylococci, coliform bacilli and Klebsiella.

Primary virus infections are most likely to be contracted by infants and young children in the market-place or at social gatherings. The custom of carrying the child on the back probably contributes to this. Extended families and shared households also ensure that the young child is frequently in contact with other young children and at risk of primary viral infection. Although in very young children the incidence of serious morbidity and mortality from primary viral infection can be high, more often the severity of illness - commonly bronchitis and bronchopneumonia - are caused by secondary bacterial infection from pathogens already present in the upper respiratory tract.

It is not clear from available evidence whether these infections are more prevalent in poor urban communities than elsewhere (prevalence estimates are influenced by illness reporting behaviour, availability of health services etc.) but evidence does indicate that their clinical manifestation is more severe. Whilst severity may be in part due to the late

reporting of illness, it is likely also that the lower nutritional state of poor children reduces their natural resistance.

In contrast to enteric pathogens, the agents of respiratory disease cannot survive for long in the external environment. They are thus largely unaffected by environmental sanitation measures.

A key concept is to distinguish between 'serious' and 'non-serious' infections since there is a need for individuals to build up and maintain resistance. To some extent, therefore, whilst preventive methods should be applied for such serious infection, it is often a disadvantage to avoid the less serious childhood infections as contraction is the only way in which resistance can be obtained (except where immunisation is available). In any case it is highly doubtful if many airborne infections could be prevented even under the most ideal living conditions.

"Even if it were possible by ultraviolet irradiation or other means to insulate the child from contact with the causative agents of 'the diseases of childhood', such a procedure would put the child in undue jeopardy if infection were postponed until his adult years. Almost without exception, primary infections result in more severe disease in the adult than in the child. Therefore, methods of disease control that merely postpone the infection without inducing specific resistance are not only unrealistic, but dangerous." (Kilbourne 19. p.260).

The only acceptable means of control of this group of diseases are therefore:-

- to improve levels of nutrition and general well-being so that the effects of infection are less severe.
- to artificially establish immunity strough immunization.
- to provide specific drugs to reduce the severity of infection.

There remains of course a number of airborne or contact diseases that are not inevitable (or 'desirable' in the sense discussed above), and which may have serious consequences. The most important of these in Kenya are discussed subsequently under individual headings.

Before that an attempt is made to summarise something of what is known about the influence of housing conditions on the spread of airborne and contact disease in general.

Air disinfection by ultraviolet irradiation has been shown to diminish the number of airborne bacteria in schools in the UK (Air Hygiene Committee 1954). However, no decline was observed in the number of streptococcal infections.

"The methods used for the detection of airborne bacteria are more useful as an indicator of the hygienic quality of the air (Cvjetanovic 1950, Bourdillon 1948) than as an index of the actual danger of infection with pathogenic airborne bacteria." (WHO 1974 p.13).

"Numerous techniques have been used for the detection of airborne bacteria and certain minimum requirements have been proposed for dwellings and working premises, small surgeries, dressing rooms and operating theatres (Bourdillon 1946). However, it is difficult to demonstrate a direct correlation between the number of airborne bacteria and the incidence of infection." (WHO 1974 p.13).

Studies from Ghana (Waddy 1954, 1957a, 1957b) have been employed to suggest an association between cerebrospinal meningitis and housing. There, different incidence of the disease has been attributed to different forms of house construction in two areas. In particular the square mud houses of the Dagarti and Lobi tribes have been incriminated because of crowding at night, darkness and poor ventilation contrasted with round huts with thatched roofs predominant in the second area. But these conclusions do not stand up to much examination. Ellison (1979) points out that this difference may not be related to housing since tribal associations are different and this may imply differences in communication with other epidemic centres such as northern Nigeria. Different behavioural patterns

could also easily explain the observed variation. Scott (1965) concluded that direct contact rather than aerosol transmission was the dominant transmission route in which case ventilation is largely irrelevant.

Cvjetanovic (1976) claims that studies from Mali and Upper Volta show the influence of housing on cerebrospinal meningitis transmission.

"There were several times fewer airborne bacteria and cases of meningitis in the modern housing scheme as compared with the traditional African suburban houses, which supports the belief that the crowded and poorly aerated mud houses are a major cause of the disasterous meningitis epidemics in Africa." p.120.

Cvjetanovic gives no reference for these studies in the text but they are assumed to refer to the work of Ghipponi (1971).

WHO (1974) also refers to these studies:-

"It was shown that in certain traditional types of indigenous house where the air-space per inhabitant was only half that available in improved houses the number of S. salivarius and Escherichia coli per unit of volume was twice as high, and the total number of bacteria nearly 10 times as high. The incidence of cerebrospinal meningitis was 5-10 times as high in the poor houses as in the improved ones." p.14.

In fact, however, this is not the whole story. Ghipponi (1971) reports a series of measurements. Firstly, he could detect no difference in aerosol counts of streptococci and coliforms between well ventilated round houses and the flat roofed, poorly ventilated ones. He did find, however, lower counts in round houses with concrete floors suggesting perhaps that these organisms may persist in soil. But as Ellison (1979) points out, this may not be the case for meningococci. In the urban areas where Ghipponi did further studies, again higher counts were obtained in the huts with dirt floors than in the houses with concrete floors and generally of a higher standard. However, the two types of houses are of course occupied by two different socio-economic groups which fact may have more

influence on indicator bacteria counts than does the quality of the floor. Certainly, however, it is difficult to conclude from these studies anything about ventilation!

Poor quality housing has been associated with a higher incidence of tuberculosis but it is invariably also associated with poor nutrition and a lack of hygiene - factors that are known to predispose to tuberculosis.

It has been experimentally demonstrated that a single Mycobacterium tuberculosis organism inhaled in a droplet nucleus can produce a primary infection (Lurie 1950) so that it is highly unlikely that members of a household will avoid infecting each other in any housing at any levels of space standards.

Studies of the natural behaviour of airborne microbes causing disease are inconclusive and complicated by the fact that air is rarely the only route by which such pathogens can spread. Measures of the density of airborne pathogens and dose-effect relationships are complicated by numerous host factors.

Room sizes probably bear little relationship to the degree of transmission (Hughes 1951). Studies of the movement of tubercle bacilli indicate that a single highly infectious case can disseminate some sixty infective particles per hour giving a concentration of one infective particle per $6m^3$ (Rilgey 1962). These extremely small particles can remain airborne for considerable times. Studies in factories indicate that a single infective person is a risk to all other people working in the same space no matter how large the room (Hughes 1951). Studies of staphylococci infection in surgical wards found little difference in the rate at which patients in beds at various distances from the carrier acquired staphylococci (Williams 1967).

However, this may not be true of all airborne bacteria and there is evidence that the acquisition of streptococci declines

with increasing physical separation (Wannamaker 1954). The most straightforward possible explanation for these differences is that of a large variation in the size of particles or droplets and therefore in the times for which they are likely to remain airborne. Many of the larger particles do require very close contact for transmission.

In general, then, airborne and contact infections are only in small part facilitated by housing itself. Far more important is the way of life in the house and outside, the intensity of human contacts, family size and the number of introductions of infection to the household etc.

With many infections, it is doubtful whether people living in normal close contact can avoid infecting each other regardless of housing quality or space per person. In large families with frequent social intercourse there are so many other opportunities for the spread of infection.

Similarly with ventilation:-

"The latest hey-day of airborne infection was ushered in by Wells, in the 1930's, who looked to a development of 'sanitary ventilation' that would eliminate respiratory tract infections in the way that purification of drinking water has virtually eliminated the enteric fevers. That this hope remains unrealized is presumably because so few of the respiratory diseases are like tuberculosis in apparently requiring deposition of the microbe in the lung alveoli, and which, therefore, can be conveyed only by the very small proportion of 2-3 micron particles that are liberated during coughing and other expiratory activities. No dramatic control of the spread of the larger, shorter-range droplets could be expected from any of the methods of air sanitation in common use, and none has been observed. Some effect might be expected with the particles of intermediate size and there are some hints that streptococcal infections (Med. Res. Council, 1954) and staphylococcal infection (see Williams, 1966) may be affected to some extent. But it appears that with most of the infections we encounter, transfer by routes susceptible to 'sanitary ventilation' constitutes only a small part of all the transfer that takes place and the reduction in dosage that we can achieve in practice is often too small to have a detectable effect on the incidence of infection." (Williams 1967, p.282).

SUMMARY

Whilst larger room sizes and improved ventilation may be desirable qualities of low-cost housing, it is not possible to demonstrate a decisive association between them and improved health and it is certainly not possible to use health considerations in a quantitative way to establish minimum physical dimensions or requirements for these housing factors.

Probably the most important influence on the high prevalence of respiratory infections is the overcrowding associated with large extended families and multiple households. Such overcrowding and close physical lifestyles (e.g. bed sharing) present many opportunities for transmission of airborne infection as indeed do social events outside the household - crowded buses and matatus, markets etc.

Host factors - particularly nutrition and general well-being - probably play a decisive role in the severity of childhood respiratory diseases many of which are inevitable. Measles is the best studied example of this.

In short, housing offers few specific interventions with which to reduce the incidence of respiratory disease.

Improvement may come about through rising socio-economic conditions at least through the beneficial effect on nutrition and through the utilisation of more readily available health care services that should accompany new housing developments.

Moreover, better housing services like water and sanitation may - if accompanied by corresponding improvement in socio-economic standards - achieve a reduction in the enteric infections that are a major factor in provoking low nutrition and increasing the seriousness of much respiratory disease.

New housing developments provide the opportunity for organised and effective preventive and curative health care and this is very relevant to respiratory infections. Newly housed families

should be strongly encouraged to accept appropriate immunization for all family members. From the list of respiratory diseases given earlier, immunization is available for:-

Diphtheria
Pertussis
Tuberculosis
Measles

NAIROBI	
THIKA	
NAKURU	
MACHAKOS	Not possible to relate specifically to project sites. Cooler, dry areas are thought to have higher prevalence (e.g. Meru,Machakos,Nakuru, Nairobi,Thika) but this study found high rates at Lamu.
ISIOLO	
MERU	
MOMBASA	
LAMU	
KAKAMEGA	
WEBUYE	
KISUMU	
KAJIADO	

TUBERCULOSIS

Tuberculosis has been one of the greatest health problems in Kenya - as indeed in many other parts of the world.

In 1963 it was estimated (on the basis of a national survey undertaken in 1958-59), that about 110,000 of the (then) 6m population had tuberculosis of whom 40% represented a source of infection. About 38,000 were under 5 years of age.

BCG vaccination programmes were introduced in the early 1960's and during 1962-69 some 3.7m children under 16 received vaccinations. By 1973, a further 2.9m doses were administered and this programme has been continuing. It seems likely that in the coming years all Kenyan children will receive BCG vaccination and, if this programme can be maintained, tuberculosis will be well under control.

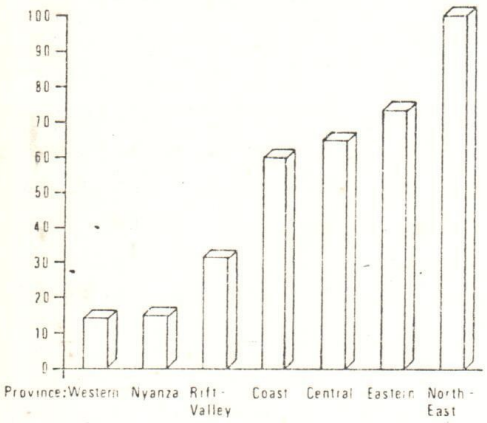
With regard to housing implications, most of the general comments about respiratory disease apply. Infection is introduced frequently by adult males who themselves acquire the infection at work. In households with such an infective member it is highly unlikely that other family members, particularly young children, will not become infected no matter what housing standards they live under.

Apart from effective BCG programmes that most effective control of tuberculosis relies on finding more infectious cases and on finding them earlier. Tuberculosis control is thus very much in the hands of the health authorities but public education to encourage reporting is also a vital component.

Modern therapy for tuberculosis is completely effective and it is worth noting that once a diagnosis has been made and a patient put on chemotherapy, there is no risk of infection to close family contacts from treating even heavily sputum-positive patients at home even under the most unfavourable living conditions and gross overcrowding. Chemotherapy renders patients non-infectious extremely rapidly.

However, therapy can only be effective if the course of drugs is completed. There is great temptation for patients on therapy to discontinue drug regimens as soon as the main symptoms of the disease disappear. This can create very serious drug resistance problems and there is evidence that this is now occuring in Kenya.

It is difficult to comment meaningfully on the national distribution of tuberculosis. However, statistics do indicate higher frequencies in cooler, dry areas than in humid-warm or dry warm regions. This is reinforced by the data below taken from Diesfeld (1978).



Pulmonary Tuberculosis

Rate per 100,000 population of the median year 1969 compiled for provinces from 35 districts for the year 1962-1972 from Weekly Notifications of infectious Diseases, Ministry of Health, Nairobi

CEREBROSPINAL MENINGITIS

NAIROBI		
THIKA	*	
NAKURU		
MACHAKOS	*	Not possible to relate specifically to project sites since outbreaks have been in clustered foci.
ISIOLO	*	
MERU	*	
MOMBASA		
LAMU		
KAKAMEGA	*	
WEBUYE	*	
KISUMU	*	
KAJIADO		

* areas of probable higher risk

CEREBROSPINAL MENINGITIS

An acute bacterial disease. Agent Neisseria meningitidis.

It was previously thought that Kenya was fortunately not part of the 'meningitis belt' - a broad east-west region covering the Sahel through to Sudan (Waddy 1954, 1957(i), 1957(ii), Scott 1965). However, that view may now be due for revision.

There have been small outbreaks in Kenya over recent years but these have so far tended to occur in clustered foci including some urban areas.

The disease occurs mainly in the dry winter months and tends to cease quite abruptly with the rain season.

Highest reported rates have come from the Central Province and these are at least twice as high as those from Eastern, Eastern-Rift Valley and Western Provinces. Although sometimes reported elsewhere, incidence is significantly lower.

Survival time outside the body is very short so that close contact is required for transmission. Infected cases become carriers and can remain so for many months. The disease only manifests in one out of several hundred infected individuals.

There has been much controversy of the role of housing in transmission (see the introduction to this Section on Airborne and Contact Diseases). The evidence is inconclusive but on balance indicates that is probably more crowding, social and family behaviour etc. (e.g. bed-sharing especially by children) rather than the house that promotes transmission.

NAIROBI		
THIKA		
NAKURU		
MACHAKOS		
ISIOLO		
MERU	*	Highest prevalence occurs in areas of western Kenya (especially Kisumu), Mombasa and eastern Meru.
MOMBASA	*	
LAMU		
KAKAMEGA	*	
WEBUYE	*	
KISUMU	**	
KAJIADO		

LEPROSY

Leprosy is still a serious problem in Kenya. Estimates have put the number of cases between 35,000 (Fendall and Grounds 1965) and 60-70,000 (Verhagen 1974). Specific foci occur in the following areas.

Western Kenya: Kisumu, Busia and Bungoma Districts display the highest infection rates in the country (1-3%).

Coastal area: variable frequency but probably highest in Kilifi and Kwale Districts. Significant notifications occur in Mombasa also.

Taveta area.

Central Kenya: foci with frequency rates of 1% or greater occur in Kitui District, Embu District and in the east of Meru District.

Leprosy appears to be much rarer in the Central Highlands and Rift Valley Provinces.

The disease is not particularly well understood in very many aspects. It is thought that transmission occurs mainly through nasal discharge from infected cases gaining entrance through the skin or respiratory tract. Whilst household contact is obviously important, there is little that housing can do to reduce transmission rates.

Treatment is effective and the control programme is now well advanced.

MEASLES

NAIROBI		
THIKA	*	
NAKURU		
MACHAKOS		Although Mombasa reports lower rates, it seems likely that poor communities are especially affected wherever they are.
ISIOLO	*	
MERU	*	
MOMBASA		
LAMU		
KAKAMEGA		
WEBUYE		
KISUMU		
KAJIADO		

* higher reporting rates for measles and kwashiorkor

MEASLES

Measles is an acute, highly communicable viral infection.

It provides one of the best-studied examples of the way in which the seriousness of infection is related to nutritional status (Morley 1973,1976, Forbes 1973).

It also provides a good example of an inevitable childhood disease (as discussed in the introduction to this Section on Airborne and Contact Diseases) that, in disadvantaged nutritional conditions, is too serious to be left to a natural course of immunity. Natural resistance will be achieved, of course, in those infants who survive but mortality rates are high and because of its two-way relationship with nutrition, measles brings serious sequelae including respiratory complications, diarrhoea, weight loss and hence further nutritional decline and lowered resistance to other infection.

Case-fatality rates have been estimated as being of the order of 400 times higher for children in poor communities than for those in good ones (Pan American Health Organisation 1973).

Two main factors explain this: the earlier age at which measles typically develops in poor communities and the low nutritional states prevalent there.

Morley (1976) reports examples of the mean age of infection as 24.7 months for Ghana, 18.0 months for Jordan, 29.7 months for Zambia, Tanzania and Rhodesia, and peak incidence from Nigeria at 12-18 months with over 30% incidence at under 12 months. In Kenya, Muller (1977) has suggested that previous estimates for age specific incidence have been, in fact, too low as findings have been based on hospital outpatient figures rather than all cases - the implication being that hospital cases are the more serious ones and these are likely to be the younger ones thus distorting the figures downwards. Muller's studies in Machakos (Muller 1977) found that the median age was 32 months but with 15-19% at less than 12 months and with about

8-9% less than 8 months.

All this contrasts with the median age of 51.7 months for the U.K. (1966).

Of course, the lower age specific incidence of measles and the seriousness of the infection in lower nutritional states are related factors. Children are growing faster at lower ages - or should be - and this is when malnutrition is most likely to occur.

The typically lower age for infection has been attributed to the many more opportunities offered for infection in poor communities. These include the practice of mothers carrying infants (on the back) to markets and social events etc. and to extended families and shared households.

Measles - or at least severity - is therefore in many ways a disease of poverty. Given that close physical proximity is inevitable in such circumstances, there is little that housing can do specifically to reduce transmission risks. However, measles is an important example of a general principle discussed early of where although housing offers little specific intervention potential, improved housing can make a contribution to raised standards of living and therefore to nutrition. It also provides increased control over and access to populations and thus allows organised immunisation campaigns. These are not cheap with measles and have their difficulties (Hendrickse 1975, England 1978) but at least in controlled new urban communities, they are likely to be cost-effective.

Consistant with the inter-relationships with nutrition noted above, the distribution of measles in Kenya (of cases sufficiently serious to appear in hospital records) shows a correlation with that for kwashiorkor (Diersfeld 1978).

Medium-to-high reporting rates for measles and high kwashiorkor occur in Thika, Meru and Isiolo.

Medium rates for measles and kwashiokor are reported in Kakamega, Kisumu, Nairobi, Lamu, Nakuru and Machakos.

Low rates are reported from Mombasa.

It is worth noting that an interesting phenomenon is now occuring in Mumias where malnutrition has recently risen rapidly (personal observation; no studies are reported). The development of a large sugar processing works has encouraged almost all small farmers around the town to turn to sugar growing. Although families now have more cash as a result, the inflationary effects on basic food produce is having serious consequences for protein-calorie intake.

NAIROBI		
THIKA	*	
NAKURU		
MACHAKOS	*	Largely confined to northern, eastern and some central areas.
ISIOLO	*	
MERU	*	
MOMBASA		
LAMU		
KAKAMEGA		
WEBUYE		
KISUMU		
KAJIADO		

* higher reporting rates

TRACHOMA AND INFECTIOUS EYE DISEASE

Trachoma and other infectious eye diseases display a high prevalence but with quite distinct regional variations.

The greatest frequency of reporting occurs in the north and north-east of the country (including Isiolo and Meru). Lower but significant reporting occurs in central areas and the southern Rift Valley (including Thika and Machakos). Coastal and western areas have very low reporting rates.

Trachoma is transmitted by direct contact with ocular discharge and may be assisted by flies. It mainly affects children.

Risk factors associated with transmission are thus insanitary habits, overcrowding, absence/lack of clean washing water, and large fly populations. The most important of these is water supply. As soon as this is available and used for regular face washing, the incidence of trachoma declines rapidly.

Logically, trachoma is primarily a disease of dry regions.

The implications for housing are obvious. Opportunities are required for regular washing and this is far better achieved with individual plot connections than with community standpipes or central water selling points. Trachoma thus shares with enteric infections, skin and other eye diseases the need for adequate household water supply if significant improvement is to be achieved. Any new housing which provides this at affordable levels will gain a tremendous advantage over the inadequate water supply arrangements typical in the urban slums.

3. EXCRETA-RELATED DISEASES

For the most part, these are enteric infections in which the parasite concerned invades and multiplies in the human gut. Many such infections are acquired by ingestion. Many are able to survive and some to multiply outside the human host requiring no intermediate host in which to do so. However, whilst some of these infections do not conform to these generalisations, all are related to human excreta.

The discussion in this section relies heavily on the recent World Bank publication "Health Aspects of Excreta and Wastewater Management" (Feachem et al 1978). This publication provides the most useful single collection of background information available on the behaviour and survival characteristics of the major excreta-related disease agents relevant to possible environmental interventions.

Detailed discussions and bibliographies are provided under the following headings:-

EXCRETED VIRUSES

Enteric viruses, poliomyelitis and similar viral infections.
Hepatitis A virus and infectious hepatitis.
Viral gastro-enteritis.

EXCRETED BACTERIA

Campylobacter and Campylobacter enteritis
Escherichia coli and gastro-enteritis.
Faecal bacteria indicator organisms.
Leptospira and leptospirosis.
Salmonella, enteric fevers and salmonelloses.
Shigella and shigellosis.
Vibrio cholerae and cholera.
Yersinia and yersiniosis.

EXCRETED PROTOZOA

Balantidium and balantidiasis.

Entamoeba histolytica and amoebiasis.
Giardia and giardiasis.

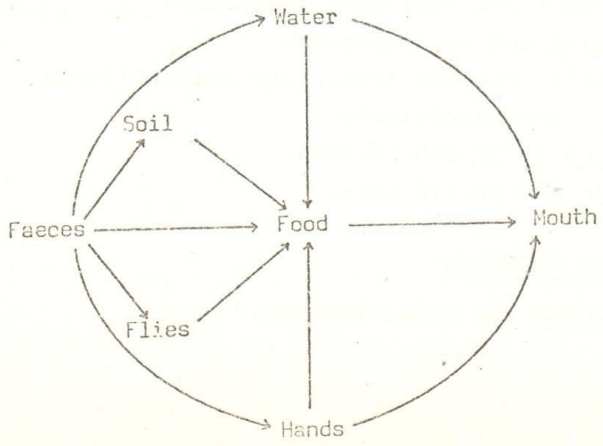
EXCRETED HELMINTHS

Ancylostoma and ancylostomiasis.
Ascaris and ascariasis.
Clonorchis and clonorchiasis.
Diphyllobothrium and diphyllobothriasis.
Enterobius and enterobiasis.
Fasciola and fascioliasis.
Fasciolopsis and fasciolopsiasis.
Hymenolepis and hymenolepiasis.
Minor Intestinal flukes.
Paragonimus and paragonimiasis.
Schistosoma and schistosomiasis.
Strongyloides and strongyloidiasis.
Taenia, taeniasis and cysticercosis.
Trichuris and trichuriasis.

Here we discuss briefly only those of major relevance to Kenya.

For the most part these excreta-related viruses, bacteria and protozoa display similar transmission behaviour although, of course, their precise characteristics and survival rates differ.

In very general terms, the variety of transmission routes available to this group of infections (excluding helminths) can be summarised as follows:-



The various pathogens concerned display different preferences within these available routes although these are not always well understood. Nevertheless, it is clear that if attempts to break these transmission routes are successful, they are likely to reduce the incidence of several infections.

The following sub-sections discuss some of the specific infections of major importance. However, it is a fact that much enteric disease cannot be satisfactorily attributed to specific disease agents. This is particularly the case with diarrhoeal disease affecting infants and children and this is discussed first.

ACUTE UNDIFFERENTIATED DIARRHOEAL DISEASE

NAIROBI	No regional differentiation possible. All poor communities are at high risk and there are special risks for infants.
THIKA	
NAKURU	
MACHAKOS	
ISIOLO	
MERU	
MOMBASA	
LAMU	
KAKAMEGA	
WEBUYE	
KISUMU	
KAJIADO	

ACUTE UNDIFFERENTIATED DIARRHOEAL DISEASE

This category covers a wide range of diarrhoeal diseases of diverse and frequently unidentifiable etiology. It may include specific infectious diseases like cholera, shigellosis, salmonellosis, amoebiasis, E. Coli, or acute viral gastroenteritis but may equally be caused by other viruses, protozoa or helminths. Multiple infection and concurrent disease may be common.

Virus involvement in acute diarrhoeal disease is particularly complicated.

This complex of infections is particularly important in the way and extent it affects infants and very young children particularly during weaning. In areas of low hygiene standards 'weanling diarrhoea' is extremely common and is intimately related to nutrition. Sub-nutrition predisposes to attack whilst the infection itself further reduces nutritional status sometimes resulting in severe malnutrition and growth retardation. Case-fatality rates in infants in poor areas can be extremely high. Infant gastroenteritis represents something like 60-70% of all infant deaths in Kenya (and 80% of deaths of all ages from gastroenteritis).

The high incidence of this disease in poor communities is most easily attributed to the unhygienic conditions in which infants must be fed - with little or no opportunity to sterilise feeding utensils or to boil water etc. There is dramatically higher prevalence among artificially-fed than amoung breast-fed infants. One important control intervention is, therefore, to encourage breast feeding in communities with little hope of achieving sufficiently hygienic conditions for artificial infant food preparation. This implies a serious commitment on the part of the health authorities to combat the commercial advertising drive to promote artificial infant feeding products - a serious problem in many urban areas where artificial feeding has been 'successfully' associated by advertising with increasing modernisation and social status.

Of course, weaning has to occur at some age and although the health risk may reduce with time, it by no means disappears. As far as urban housing programmes are concerned, therefore, a major contribution to control of infant gastro-enteritis can be achieved through the provision of suitable household water supply combined of course with its effective use.

Health services have a major role to play in deprived communities through the early and effective rehydration of affected infants followed by rapid resumption of adequate protein-calorie intake as soon as diarrhoea has been controlled. Maternal education through well-mother-and-child clinics is probably the most cost effective health services intervention providing, as it does, opportunities for early detection, nutrition education and of course opportunities for preventive measures and immunization for many other diseases.

POLIOMYELITIS

NAIROBI	
THIKA	
NAKURU	
MACHAKOS	No meaningful regional variation possible.
ISIOLO	1960 epidemic was centered on Nairobi, Central and Rift Valley Provinces but all areas are at risk.
MERU	
MOMBASA	
LAMU	
KAKAMEGA	
WEBUYE	
KISUMU	
KAJIADO	

POLIOMYELITIS

Poliomyelitis is probably the most important of the large group of enteroviruses including coxsackie and echo. Its behaviour is generally regarded as being typical of these other viruses in most respects.

Clinical poliomyelitis develops in a very small proportion of people infected - perhaps only 1 or 2%. But infected persons can shed large number of viruses in faeces. Transmission is mainly by a faecal-oral route but also by oral-oral routes. It is probable that child-to-child transmission introduces the disease into new family groups. Children are the most susceptible age group since most adults have acquired resistance during earlier infection.

In areas with poor hygiene children frequently acquire immunity whilst very young. The severity of the disease is very dependant on age and young adults who have not gained immunity show the most serious symptoms including, frequently, paralysis.

Rising standars of hygiene, therefore, risk delaying infection until later in life with very serious consequences. The only satisfactory control of poliomyelitis is therefore vaccination since no specific treatment is available.

The 1960 polio epidemic in Kenya clearly reflected this link with rising standards. The numbers of reported cases were higher from Nairobi, Central and Rift Valley Provinces than from Western, Northern and Southern Provinces.

INFECTIOUS HEPATITIS

NAIROBI	*	
THIKA	*	
NAKURU		
MACHAKOS		
ISIOLO		Much higher (x10) frequency of reporting from Coast Province.
MERU		
MOMBASA	***	
LAMU	***?	
KAKAMEGA		
WEBUYE		
KISUMU		
KAJIADO		

Again, severity tends to increase with age. Many cases are mild especially in children. Precise incidence and distribution is difficult to establish because of the high proportion of sub-clinical infections.

Transmission occurs by the faecal-oral route most commonly by person to person contact. Food and water borne outbreaks also occur.

Transmission is therefore most likely to be interrupted by a combination of:-

- sanitary excreta disposal
- household water supply for hand washing after defaecation
- more hygienic behaviour
- adequate sewage treatment

Analysis of the Weekly Notifications of Infectious Diseases indicate that by far the highest reported frequency of hepatitis comes from the Coast Province followed by Central Province, Nairobi and North East Province. Reported frequency at the coast was ten times higher than that for Central Province.

SALMONELLOSES - INCLUDING TYPHOID

Salmonellosis is an infection of the bacteria Salmonella, forms of which (S. typhi and S. paratyphi) are the causative agents of typhoid and paratyphoid.

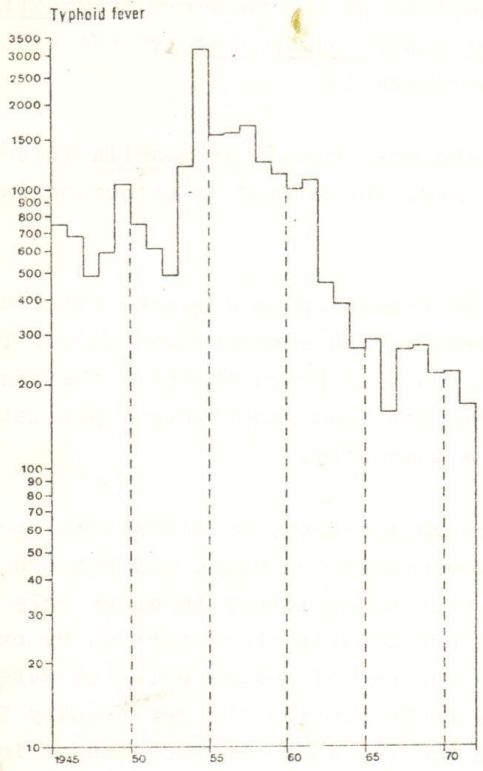
Typhoid remains one of the most common Salmonella infections. Since it is confined to man, the source of infection is the human case or carrier.

Convalescent carriers are common up to 3 months after clinical recovery but chronic carriers can continue to excrete typhoid bacilli for many months (up to a year) whilst suffering no diarrhoeal disease. They can thus constitute a persistant source of infection in a community.

Transmission occurs through a variety of faecal-oral routes both directly by faeces-contaminated hands and through food and water. Waterborne routes are likely to occur only through gross contamination and are usually characterised by explosive outbreaks often through the use of sewage-polluted water in food preparation. Many foods provide the opportunity for typhoid to multiply and thereby increase the risk of infection.

Little is known about the distribution of the infection in Kenya. It can only be assumed to be an ever present risk - see table. Kwamina Duncan (1978) reports that of stool cultures done at Kenyatta National Hospital Laboratories from 1972-1976, 58% of positive findings for Salmonella were for children under 5 years.

"The distribution of these bacterial infections (Salmonella and Shigellae) are known to be concentrated at different foci in shanty areas within and in fringe and peri-urban locations of Nairobi. Houseflies abound in these areas and they are principally implicated in the transfer of Shigella sp. Domestic animals like fowl, goats and sheep contribute to the spread of Salmonellosis." (Kwamina Duncan 1978).



Typhoid - number of annual notifications 1945-1972

Source: Fendall and Grounds, 1965;
Bulletin of Infectious Diseases, MOH 1962-1972.
Taken from Diesfeld, 1978.

Certainly, the rapid growth of the insanitary urban slum areas must increase the possibility that latent infection levels will remain sufficiently high for outbreaks to occur.

The most important housing intervention is likely to be the provision of a water supply suitable for personal hygiene. At the same time, however, community water supplies must avoid risk of contamination from faulty excreta disposal and treatment. There are therefore, obvious dangers in the informal water supply arrangements common in the self-settled urban slums

particularly where self-connections and intermittent supply occurs in soil conditions contaminated by ineffective excreta disposal.

SHIGELLOSIS

Shigellosis is an acute diarrhoeal disease caused by bacteria of the Shigella genus. Its severity is conditioned by nutritional states and age of those infected. Amoungst the many serotypes the group Shigella dysenteriae produces the most severe form of disease - bacillary dysentery. For all practical purposes, man is the most effective source of infection.

The highest incidence occurs in children aged 1-4 years and the disease is invariably endemic wherever poor housing, low nutrition, overcrowding and inadequate hygiene are found.

In a study of the results of stool cultures done at the Kenyatta National Hospital Laboratories during 1972-1976, Kwamina Duncan (1978) reports for Shigella sp. that 58.8% of positive findings were from children under 5 years.

Bacillary dysentery is primarily an epidemic disease but often occurs endemically. Transmission is by a direct faecal-oral route but also food, in which Shigella are able to multiply, can easily be contaminated by fingers of infected cases or carriers. Water borne outbreaks are also possible. Flies are implicated in mechanical transmission from one place to another (e.g. excreta to food). However, the predominate mode of transmission appears to be faeces-hands-objects (especially in and near excreta disposal facilities) - hands-mouth.

Hands become contaminated during anal cleansing and the immediate area of the toilet itself becomes contaminated during the passing of stools. Although use of toilet paper is probably the most hygienic form of anal cleansing, bacteria organisms can easily pass through paper to hands. Thus toilet flushing arrangements, door handles etc. easily become contaminated. The infective dose for Shigellosis is small.

A small proportion of symptomless cases can continue to excrete shigellae thus continuing the endemic state of the disease unless transmission is effectively interrupted. But by far the most

dangerous source of infection is the acute clinical case.

Principal housing interventions are therefore:-

- household water supplies to facilitate regular hand washing. To be really effective in interrupting Shigellae, transmission (and indeed other enteric infections), hand washing should occur after every toilet contact and toilet surfaces should be regularly cleaned.

- excreta disposal that ensures the safe removal of excreta avoiding ground or water supply contamination and that denies access to excreta by flies. Toilet design and materials should be convenient to clean and should avoid possibilities for excreta contact with soil.

It is important to emphasise that it is unlikely that great improvement would be achieved with the provision of sanitary excreta disposal alone. Excreta-hand transmission would still occur. Household water supply combined with hygienic personal behaviour are probably the single most effective intervention.

It is also noteworthy that improved excreta disposal does not automatically require cistern-flush, 'modern style' toilets. These and the artifacts of their superstructure can become as easily contaminated as many other cheaper arrangements.

CHOLERA

Cholera is a bacterial infection caused by Vibrio cholerae which exists in the two forms of classical and El tor. El tor appears to have become more important in the more recent outbreaks around the world and appears to display a higher proportion of mild and symptomless infections than the classical type.

In areas where cholera is endemic, it develops a regular periodicity and epidemic waves occur seasonally.

Cholera is confined to man and the source of infection is therefore the human case and carrier. It displays a high rate of subclinical infection and this, combined with short-lived immunity and a small number of chronic carriers, ensures its endemic maintenance. Even in severe epidemics clinical attack rates are thought to be only 1-2% of the population although inapparent infection rates are much higher.

Transmission has historically been assumed to occur via a water borne route and explosive epidemics certainly occur when a common water source is contaminated. However, there is some more recent evidence that transmission can occur by close personal contact. V. cholerae has been detected in water tanks in the vicinity of carriers and there is evidence of continuity of infection within households. It may be that the El tor type is more resistant to adverse environmental conditions and is less dependent than the classical strain on water as a transmission vehicle. For practical purposes water, food and personal contact can be considered possible transmission routes. The carrier state probably ensures an adequate human reservoir of infection in endemic areas so that transmission can continue largely in a symptomless form.

Cholera is primarily a disease of poor socio-economic groups presumably because of the association with poor environmental sanitation and hygiene but perhaps, since in areas where it is endemic it is predominantly a disease of childhood, also because of the association with large family size. The most simple explanation, however, is probably the association of poor socio-economic groups with poor quality water supplies and poor hygiene

standards.

Active immunization, although available, is of relatively little value as a practical control measure as it provides only partial immunity for a very limited time period.

Cholera has not been a mjor problem in Kenya in recent times. Probably the most important outbreaks have been:

- 1971-73 several outbreaks in the north and north east
- 1975 Nyanza (shown to be mainly a rural disease there)
- 1977-78 some outbreaks on the coast including areas within Mombasa.

These were mainly of the El-tor-Inaba strains.

The risk of cholera should always be considered in poor communities even where it is historically rarely reported. Introduction into areas with poor sanitation and hygiene (e.g. the self-settled urban slums) would bring very high risks of widespread outbreak. Such outbreaks have to be attacked quickly and strongly to avoid the creation of scattered foci which then become difficult to control and eradicate.

Housing interventions of major importance include the provision of uncontaminated water supplies (preferably to the house), sufficient in quantity to facilitate regular hand-washing after daefecation and before eating and handling food. These are certainly necessary conditions for the reliable control of transmission, but sufficiency will depend on their use.

Uncontaminated water supplies depend on safe excreta disposal by a technology appropriate for the circumstances.

AMOEBIASIS

Amoebiasis is a protozoal infection of the large intestine caused by Entamoeba histolytica. The term amoebic dysentery is commonly used for the infection and although other protozoa may be present in such a diagnosis, Entamoeba histolytica is the predominent and probably the only pathogenic agent. Asymptomatic carrier states are probably very common in endemic areas. Whether or not active invasion occurs may be (partly) dependent on nutrition, alcohol and the presence of other parasites.

Transmission occurs when the Entamoeba histolytica cysts produced in the lower large intestine are ingested. Little further maturation of these cysts takes place after they have been excreted. They continue to be excreted as long as a chronic infection is present in the gut. Several transmission routes appear to be available for the cysts. These include via a water-borne route, via food contaminated by the hands of infected persons during food preparation (cysts can remain viable for 5 minutes on the skin and for 45 minutes under fingernails), and also by direct faecal ingestion from contaminated hands. Flies may also assist in spreading contamination since they can harbour viable cysts which can be excreted on food. It may be noted that cysts can survive in water for several weeks and that normal chlorine levels in water supply have no effect.

A recent study in metropolitan Lagos (Oyerinde and Alonge et al, 1979) examined stool samples from 2825 persons in 10 survey areas. They found an overall infection rate of 11.2% but varied between ethnic groups from 0% to 25%. A rate of 18.4% was found for people who had lived in the city continuously for more than 8 years - declining systematically down to 5.2% for those of less than 1 year residence.

Significant associated variables included whether people ate with hands or cutlery (11.9% as opposed to 6.8%); whether people ate frequently outside the home or not (12.1% as opposed to 6.5%); whether people used water for anal cleansing or toilet paper (14.6% as opposed to 9.9%). Occupational groupings

reflecting degree of interaction showed higher rates where interaction was high (17.9% for semi-skilled down to 10.5% for housewives and 6.7% for unemployed). No association was detected with formal educational standards and little conclusive association was found with source of water (12.4% for those with house tap water; 10.9% for those who carried and stored water) with the exception of those who used well water - 23.4% prevalence.

Little association was detected between infection rates and type of sanitation. Rates of 10.7% were found for those using water closets as opposed to 12.1% and 13.4% respectively for those using buckets and pits.

Climate was an important factor with a pronounced peak at times of simultaneous high temperatures and humidity. This might be accounted for by higher cyst survival rates in such conditions and/or higher fly populations.

Little is known about the precise prevalence of amoebiasis in Kenya. In a survey of Nairobi schoolchildren (Wijers 1972), 15.7% of stools examined had Entamoeba histolytica but there is no reason to think it should be any more prevalent there than elsewhere. This survey discovered intestinal protozoa of one kind or another in 75.6% of cases.

Annual Hospital Returns for the period 1962-1973 showed more frequent reporting under the general diagnosis 'amoebic dysentery' from the uplands than elsewhere. Climatic considerations would, however, suggest higher risk in coastal and western areas.

In an analysis of stools examined at Kenyatta National Hospital 1972-1976, Kwamina Duncan (1978) reports on the importance of amoebiasis. From a total of 131,993 stool examination taken from patients with clinical diagnosis relating to the gastro-intestinal tract or to anaemias, 33.4% were positive for some form of amoebiasis (including Entamoeba histolytics, Entamoeba coli etc.).

Stool examinations from road workers in Kwale District (Brooks 1979) gave 29% positive for Entamoeba sp.

Again, appropriate housing related interventions are household water supply and excreta disposal. It is worth noting here that, as with some other infections in this broad group, it is probably only piped water to individual houses that will constitute an effective intervention. There is a lot of evidence that where water is centrally collected and then stored in the household, many opportunities occur for contamination with Entamoeba histolytica. Also, the small amounts of water possible to carry to the house from kiosks and standpipes is never sufficient for effective personal hygiene.

Excreta disposal systems must prevent any possibility of polluting water sources or the distribution network on a community wide scale. At the household level, excreta disposal facilities and the materials of which they are constructed should be such as to minimise fouling, to facilitate cleaning and to avoid access by flies.

Household piped water and its use in regular handwashing after toilet contact will greatly assist in reducing opportunities for ingestion of cysts but in view of the continuing output of these agents from infected individuals, dramatic improvement is not likely to be achieved rapidly. Also many opportunities will remain for infection from outside the family especially from vegetables that have been in contact with polluted water.

Amoebiasis control will probably be most effectively achieved when the above measures coincide with high coverage treatment of infected individuals. Chemotherapy is very effective providing opportunities for reinfection are being diminished by sanitary measures and improved personal hygiene.

Finally, as with many other excreta related infections, effective solid waste disposal can be employed to reduce fly populations in housing areas and thus reduce their contribution to transmission.

GIARDIASIS

Giardiasis is a protozoal infection of the small intestine.

It is particularly prevalent in the 6-12 age group wherever poor sanitation and low quality water supplies are found. It is probable that man is the only host.

Transmission occurs largely as with amoebiasis but giardiasis is probably better able to survive in the environment. Transmission is, therefore, by faecal contamination of food, hands and water supply and perhaps assisted by flies. Transfer by contaminated hands is probably more likely than with amoebiasis.

Housing interventions - as for amoebiasis.

EXCRETED HELMINTHS

Helminths are parasitic worms which may invade man by a variety of routes and inhabit various areas of his body including the digestive tract, liver, lungs and blood vessels.

Some are transmitted from man to man directly, some via soil, and some via an intermediate host. From amoungst the long list of helminths, those of major relevance in Kenya are discussed individually.

In addition to these, Filariasis (Wuchereria bancrofti) and onchocerciasis are helminths but neither are related primarily with an excreta-borne route (though the vector of Filariasis, Culex fatigans, does breed in latrines etc.) and are considered under the category arthropod-borne diseases.

Except for Strongyloides, helminths do not multiply in man. The worm load carried can only be increaed by additional infection. The seriousness of helminthic infection is, therefore, largely related to the quantitative infective load carried. More serious infestation usually results from the cumulative effect of constant reinfection over long periods. This contrasts with the asexually reproducing organisms of viruses, bacteria and protozoa.

NAIROBI	40%
THIKA	25%
NAKURU	45%
MACHAKOS	54%
ISIOLO	60%
MERU	65%
MOMBASA	45%
LAMU	72%
KAKAMEGA	55%
WEBUYE	45%
KISUMU	50%
KAJIADO	44%

Figures show best estimates for site specific relative frequency of positive ascariasis findings from Annual Laboratory Returns 1958-1973.

ASCARIASIS

- roundworm

Ascariasis is a helminthic infection primarily of the small intestine by the roundworm Ascaris lumbricoides. Most infections are in fact more or less symptomless but even a small worm load can be serious. Serious complications can occur especially in children and include bowel obstruciton or death resulting from migration of the adult worm to the liver, gall bladder, appendix etc.

In general, ascariasis infection rates are highest in children. One of the major consequences of the disease is nutritional deficiency. A comparatively small infective load can reduce the effective daily protein intake considerably and in areas where this is already marginal, this can have very serious repercussions.

The transmission cycle starts when fertilized ova (both adult male and female worms are necessary) are passed in the faeces. They then require a period of environmental development for which damp soil is ideal. When the resulting infective eggs are ingested via hands, food, dirt, utensils etc., larvae hatch and after migration via the lungs ascend the trachea and are swallowed and eventually reach the small intestine where after a few months development they live as adults for 1-2 years. As long as male and female adult worms are present, fertilized ova will be produced throughout this period. Excreted ova that do not immediately find a favourable environment for development can retard their development but remain viable for years until more suitable conditions are encountered. Ascaris ova are probably the most resistant to environmental conditions of all pathogens.

Transmission is most likely to occur within the family or families sharing a house plot. A major risk is thought to be uncontrolled defaecation by infants around the house plot or yard. Contaminated soil can then infect other children and adults.

Ascaris ova can pass intact through the digestive tract of domestic animals and chickens and may thus be more widely disseminated in their excreta.

The reported distribution of Ascariasis is characterised by very high rates around Mt. Kenya/Nyeri and also at Lamu. Other important areas are Meru and Isiolo. Best estimates for the relative frequency of positive laboratory findings from Annual Laboratory Returns (over the period 1958-1973) are given on the preceding page for the project site towns.

As with other faecal-oral infections, but perhaps more so with Ascariasis, control depends not only on the provision of sanitary excreta disposal facilities but on their effective use. It has been suggested that poorly used latrines may even increase transmission by concentrating the source of infection.

As has been mentioned, young children are probably the main source of transmission through depositing excreta indiscriminately around the house plot. Although, therefore, the provision of sanitary latrines is a major intervention as far as housing is concerned, Ascariasis is a good example of where this must be accompanied by behaviour modification through family education if positive results are to be achieved.

Household water supply for washing of hands, utensils etc. will assist the interruption of transmission but only if used correctly. If abused, water supply may simply add to waste-water disposal problems and may create even better soil conditions for Ascariasis ova.

NAIROBI	32%	
THIKA	46%	
NAKURU	19%	
MACHAKOS	10%	
ISIOLO	20%	Best estimates of positive Ancylostomiasis findings from Annual Laboratory Returns 1958-1973.
MERU	22%	
MOMBASA	46%	
LAMU	24%	
KAKAMEGA	18%	
WEBUYE	28%	
KISUMU	26%	
KAJIADO	15%	

ANCYLOSTOMIASIS

- hookworm

Ancylostomiasis is an infection with one of the two species of human hookworm Necator americanus or Ancylostoma duodenale.

Whilst infection can be virtually symptomless, in endemic areas it is an important disease because of its frequent cause of anaemia. The most severe effects are usually experienced by older children and by young and middle-aged adults especially iron-deficiency prone groups like pregnant and lactating women. Where infection is intense, however, younger groups can be affected to the degree of mild or severe physical or mental retardation.

Transmission occurs when eggs produced by the adult female worm are passed in faeces. If these eggs are deposited in a suitable external environment they develop into larvae in a matter of 24 hours or more. After two further subsequent larval transformations taking about 6 days, the larvae are able to penetrate the human skin usually between the toes on feet or ankles. Ancylostoma duodenale can also be ingested.

A suitable external environment for survival of eggs includes soil of a light structure and with sufficient organic material, sufficient moisture (but not excessive since both dry and very wet conditions are fatal to the larvae after hatching), a temperature range of 28-32^{o}C (Necator americanus) or 20-27^{o}C (Ancylostoma duodenale). Wider ranges are tolerated but development is retarded and completely stopped outside the range 10^{o}C and 40^{o}C.

Once mature adult worms are established in the small intestine, the infection can be transmitted for up to a period of years.

Ancylostomiasis is widespread in Kenya. Parasitological investigations indicate the usual presence of Necator americanus but Ancylostoma duodenale is found in the coast region. Hookworm infection is highest in this region and around Lake

Victoria. The relative frequencies of positive findings from Annual Laboratory Returns are shown for each project town on the preceeding page.

Whilst the most obvious housing-related intervention must be that of sanitary faeces disposal, there is a great deal of evidence in fact on the ineffectiveness of this measure in areas of high prevalence. As with ascariasis, it seems that only when combined with changed behaviour on the part of the populations at risk will sanitation become effective. Poorly designed, used or maintained latrines will only serve to concentrate transmission risks. Infants and young children who continue to defaecate around the house yard will continue to infect others. Of course, an efficient intervention would be the constant wearing of shoes but this is a futile suggestion in poor communities. Chemotherapy is very effective but is short-lived if those treated must return to high risks of further infection.

Despite the above comments, however, exreta disposal must be considered a necessary if, by itself, insufficient component of hookworm control. Design is likely to be an important factor in housing development. Latrine floors must be surfaced with washable material and raised significantly above surrounding earth yards. Floors should have adequate slope towards the squatting slab so that they can be easily washed and are rapidly self-draining. They should be designed to avoid the spillage of water used for washing down onto surrounding earth - a step under the door for example. Plumbing arrangements should facilitate the washing of latrine floors and surrounds without the inconvenience of having to carry water very far to do this.

Above all, since all of the above will be useless without user understanding, there must be user education.

Urban housing and upgrading programmes provide at least the basis for control. Chemotherapy campaigns are very effective

and can follow the development of health services coverage but they will not succeed without improved sanitation and its safe utilization.

ENTEROBIASIS

Enterobiasis (threadworm or pinworm) is a worm infection of the large intestine which usually has only mild symptoms.

Transmission occurs when eggs are deposited by the female worm. These eggs are not normally passed in the faeces but are attached to the skin in the anal area. These can be transmitted to the mouth by contaminated fingers or soiled clothes and bed linen. Self-infection also occurs when hatched eggs from the anal area re-enter the bowel to mature into adult worms.

Enterobiasis is most common in children. The principle intervention is the provision and use of household water for hand and body cleanliness.

It is certainly widespread in Kenya wherever overcrowding occurs and where personal cleanliness is deficient.

	(S.haematobium)	(S.mansoni)	
NAIROBI	Very little	Very high in places	S.mansoni all along the Nairobi River. 80% positive in children 3-9 years in Mathare; 28% Kibera.
THIKA	Yes	Yes	Mostly S.haemantobium.
NAKURU	No	No	Neglegible
MACHAKOS	Very little	Very high	Highest S.mansoni prevalence in Kenya.
ISIOLO	Little	No	
MERU	No	No	
MOMBASA	High	No	But probably peripheral to town.
LAMU	Yes	No	Probably not in the town.
KAKAMEGA	No	No	But snails are there.
WEBUYE	Some	Very little	
KISUMU	Yes	Yes	S.haematobium in the rivers; S.mansoni along the shoreline.
KAJIADO	Very little	Some	

SCHISTOSOMIASIS

Schistosomiasis is an infection by species of flatworm Schistoma. S. haematobium occupies the veins around the bladder whilst S. mansoni occupies those around the intestines. The main damage of this infection is caused to tissue when eggs escape into the bladder or bowel. The complication this causes and the severity vary greatly. Very serious illness and death can result but mostly, Schistosomiasis is a chronic illness. Even in light infections, however, it can result in retarded childhood growth and much reduced physical abilities.

The transmission cycle is maintained when eggs passed in urine or faeces come into contact with fresh water inhabited by one or other of two quite common species of snail - the intermediate host. The eggs hatch in the water producing a mobile larva (miracidium) which then searches for a suitable snail. It is thought to have a viable period of up to about 6 hours to do this. The larva penetrates the snail where it develops through a series of life-stages. Between 1-3 months later, another form of aquatic larva (cercariae) emerge from the snail. These survive up to 48 hours but if they encounter human skin in this time they rapidly penetrate the body. After further development involving migration via the lungs and liver, they mature as worms and male-female pairing occurs before they eventually move to the appropriate blood vessels.

Heavy infection occurs, therefore, wherever man is frequently in contact with infected water systems. The most favoured habitats for the snail hosts are still or slowly flowing waters including ponds and especially canals. Schistosomiasis tends therefore to be primarily a rural disease but can occur wherever man inbabits land close to suitable water and wherever contact with that water is frequent whether this be for drawing water, personal washing or the washing of clothes, fishing, childrens play etc. For the transmission cycle to continue, urine or faeces must be deposited sufficiently near the water to allow access by the Schistoma eggs.

New irrigation schemes constitute one of the major risks of spreading this infection to previously unexposed populations. Once infection is established, it becomes tremendously difficult and expensive to control.

Both forms of schistosomiasis are common in Kenya and it has been estimated that something like 1 million people are infected. In relation to the proposed project study areas the following distribution occurs:-

S. haematobium:

Very high prevalence along the coastal strip including Mombasa (but no S. mansoni here). Lower but still significantly high prevalence around Lamu and Kisumu. Other important foci exist around Machakos and Thika and possibly some around Kakamega and Webuye - certainly the snails exist there.

S. mansoni:

Very high prevalence around Machakos. Important prevalence around Thika and smaller foci around Kisumu. Heavy infestation of S. mansoni exists in pockets in and around Nairobi especially in Mathare, Kibera and virtually all along the Nairobi River.

As is the case with many excreta related diseases, control is in theory straightforward but in practice very difficult. For schistosomiasis the key points of intervention are the sanitary control of urine and excreta and the removal of water contact. It would seem then that wherever new housing development is implemented, the provision of sanitation would go a long way in reducing transmission. This intervention fails, however, wherever agricultural work patterns allow the passing of urine and excreta away from home or where children continue to use nearby water as play areas. The provision of household water supplies can also reduce the need for much contact with contaminated canals, streams or ponds. To be effective, new housing development must be accompanied by health education about schistosomiasis wherever that risk exists.

Wherever there is a choice, new housing developments should be sited well away from known foci of infection and access to the watercourse made as unnecessary as possible.

4. Maternal & Child Health and Nutrition

5. Accidents

6. General Acute & Chronic Disorders

(Work not yet complete)

7. HEALTH AND VITAL STATISTICS

The previous sections of this Appendix have reviewed the nature and what is known about the distribution of specific diseases in the country.

Here a very brief review is presented of how those diseases and ill-health conditions appear as statistics in terms of morbidity and mortality.

The classical yardsticks of life expectancy, birth experience and mortality rates depend to a great extent upon the collection of information in a systematic way. In Kenya statistics of this kind stem from the censuses of 1948, 1962, 1969 and eventually 1979 results. In addition there is an (incomplete) system of birth and death registration and limited surveys of specific diseases and other conditions going back many years.

Birth and death registration is currently compulsory in areas applying to 65% of Kenya's population but it is estimated that in these areas death registration applies only to 30-35% of deaths. There is no similar published information about the completeness of birth registration. However, it is likely that this is more complete than registration of deaths and completeness is likely to be high since a birth certificate is required for various purposes.

The expectancy of life reported in 1962 was 40 years for males and 45 years for females. This had risen by 1969 to 47 for females and 51 for males.

Life expectancy figures in 1969 showed considerable variation in different parts of the country, the worst experience being that of the North Eastern Province where the figures were 43.9 for males and 46.2 for females. On the other hand, the best figures were experienced in Nairobi where they were 59.9 for males and 63.8 for females with an average figure of 61.8. The average expectancy was high also at the Coast 55.7 and in the Central Province 54.6.

Caution needs to be exercised in making conclusions from these figures, however. Whilst Nairobi and the Central Province have topographical circumstances which would tend to reduce the prevalence of tropical disease, this is certainly not so with regard to the Coast Province. It might be that socio-economic factors are operating particularly at the Coast since it is nowadays practicable to live in a potential hazardous environment if there is sufficient will, knowledge and financial ability to overcome the conditions.

It would be dangerous on the basis of this information to conclude that living in Nairobi was the least hazardous from the health point of view. It is clear that Nairobi's population retains links with other areas and it might well be that the sick and the dying return to their homelands. Nairobi too is the area in Kenya with the greatest range of social classes. It may be that the relatively well-to-do cause a bias in the total figures. It has not been possible to determine quantitatively from past reports to what extent the health experience in the slum areas compares with those living in different housing zones of the city although in earlier sections the risk factors associated with main diseases have been mentioned.

The crude birth rate can only be determined reliably from calculations between census periods. Estimated figures for Kenya as a whole since 1950 are as follows:-

1950-54	48.6
1955-59	47.7
1960-64	47.0
1965-69	48.8

Clearly current trends depend upon the 1979 census returns.

These rates are high and are in line with an estimated population growth rate of 3.3-3.5% per annum. It is interesting that the birth rate for Nairobi in 1969 was reported as being 50 per 1000 population. Again, this latter figure needs careful interpretation. The registration of births particularly in Nairobi

is likely to be high. Since this city has the best maternity facilities, it may be that mothers in fact move into the city for delivery and then move out again having registered birth.

The crude death rate figures are also still on the high side and these were reported since 1950 as follows:-

1950-54	18.3
1955-59	18.2
1960-64	18.3
1965-69	17.5

In 1969 the crude death rate reported for Nairobi was 8 per thousand population. Again, more information is required for these figures to be interpreted. If sick people, particularly small children, are removed from Nairobi when they are critically ill this would tend to reduce the figures. However, Nairobi offers more facilities for hospital and other treatment which would tend to counter this possibility. The pattern of deaths would clearly need considerable analysis before this striking difference in death experience compared with Kenya as a whole can be understood.

There is less information about the important measurement relating to infant mortality. There are no published figures relating to the censuses before 1969 so the trend is difficult to determine. In 1969 the figures were:-

For Males	126 deaths per thousand live births
For Females	112 deaths per thousand live births

Giving a total infant mortality rate of 119.

For the same year, the figure for Nairobi was 50 deaths per thousand live births. Since the infant mortality rate refers to deaths of children under one year it is important to know whether babies under this age remain in Nairobi after birth.

It would seem to be the case that if the life expectancy has risen as reported and the birth and death rates have changed very little since 1950, then there must have been considerable improvement overall in infant mortality. The 1979 Census report when it is available should confirm this.

Whilst, in general, current published information indicates an improvement in the health status of Kenya's population, it is not possible to indicate whether those living in the towns have a better or worse experience. There are indications that Nairobi's population by virtue of its topographical situation and its better facilities has a better health experience than those living elsewhere but it is not possible to determine whether this includes the poorer sections of the community. It is also not possible to determine from published information how people fare in other urban areas. In particular there is no way of determining from present information whether the slum dwellers of Nairobi or those unsuitably housed in other urban areas are suffering ill effects in health terms. It becomes necessary, therefore, to consider the specific risks of people in those areas to see what steps must be taken to minimise them.

Morbidity

Apart from data relating to notifiable diseases contained in the Statistical Digest for 1978, it is necessary to rely upon the Annual Report for 1968 and material analysed from it. It is probable that the pattern of disease has changed little since that data although it appears likely that the number of deaths of children under one year and probably under 5 years have been reduced. There have been no major eradications of disease (except for smallpox), although there has been a marked increase in the study of endemic diseases and the introduction of preventive measures against them and especially the communicable diseases of childhood.

Government hospital outpatient attendances for 1968 provided the following expected ranking for important diseases:-

767,892 Respiratory Disease

295,487	All forms of gastro-enteritis and intestinal parasites
255,525	Skin Disorders
202,434	Malaria
67,473	Venereal Disease
40,647	Measles
39,830	Kwashiorkor (malnutrition)
21,537	Whooping Cough
10,131	Tuberculosis
7,749	Schistosomiasis

It will be noted that the first few diseases account for the majority of attendances. Respiratory disease, as is so often the case, ranks first and is responsible for as many attendances as the next three diseases put together. Malaria is the commonest specific condition causing attendance but these are almost certainly clinical rather than parasitologically confirmed diagnoses and therefore probably an overestimate.

For admissions to hospitals, the ranking of diseases was as follows:-

1.	Pneumonia	10%
2.	Malaria	8%
3.	Gastro-enteritis & Colic	5%
4.	Measles	3.7%
5.	Wounds	3%
6.	Tuberculosis	2.9%
7.	Fractures	2.0%
8.	Whooping Cough	1.7%
	Other Causes	48%
	Childbirth	31%

The high ranking of malaria might be explained by seasonal or epidemic malaria occuring and causing more serious disturbance than usual within highly endemic areas.

Mortality

Leading causes of death reported in hospitals (not from death registration) are ranked as follows:-

1.	Pneumonia	26%
2.	Gastro-enteritis etc.	11%
3.	Malaria	5%
4.	Tuberculosis	5%
5.	Kwashiorkor	5%
6.	Measles	4.3%
7.	Tetanus	3.7%
8.	Whooping Cough	2.3%
	Other Causes	38%

Two major notifiable diseases have occured since 1968. From 1971 to 1973, Cholera entered Kenya first from the Ethiopia and Somalia in the North East and then from the Sudan and to a lesser extent from Uganda in the North West. These were thought to be the first introductions of Cholera in this century. Subsequently, in about 1974, Cholera was introduced into Nyanza Province in the South West. These epidemics were contained and controlled in a comparatively short time.

In 1977-78, a cholera outbreak occured in Mombasa where it proved more difficult to contain in some of the urban slum areas. Cholera could well emerge again in the future.

The second disease which has occured in epidemic proportions is plague. This disease can be regarded as endemic in Kenya though until recently there had been no epidemic since 1963. In 1978, a limited epidemic occured in the Masai areas but did not affect any major township or urban area. This disease remains a threat however, since many urban areas sustain large rat populations.

APPENDIX II

HOUSING TECHNOLOGIES FOR HEALTH

1. Health Aspects & Excreta Disposal Systems

2. Wastewater Disposal & Surface Drainage

3. Water Supplies

4. Ventilation and Climatic Comfort

5. 'Barefoot' Maintenance Technologies

APPENDIX II

HOUSING TECHNOLOGIES FOR HEALTH

1. Health Aspects of Excreta-Disposal Systems

A wide range of different systems exist for effecting the collection, removal and treatment of excreta. It is not the purpose of this Discussion Paper to deal exaustively with all of these nor is it the intention to cover the detailed design and specific engineering features of these alternative types. Some of this will be done in other Discussion Papers in this Study.

In this paper we shall only deal in principle with some of the major variations available and shall comment on each from a health perspective. We shall draw attention to some of the major advantages and drawbacks of these to form the basis for discussion.

One fact that should be constantly kept in mind in this Appendix is that although we refer to a number of distinct variations in sanitation systems, a large range of alternative detailed designs is possible within any one sanitation type. The Appendix thus only illustrates these major types.

Sanitation planning is essentially a problem-solving design exercise not selection from a shopping list of stereotypes. Sanitation engineering is too full of 'rules of thumb' and conventions that are nowadays largely obsolete. Rather than simply applying such rules, the engineer has to ask 'what did they aim to achieve?' 'what are the design constraints for this particular problem solving task' etc.

Later in this Study, we shall undertake a detailed reletive costing exercise for a small number of alternative sanitation designs selected for their possible suitability for Kenya. We shall take a typical low-cost site layout and

a typical standard house design and will show the costs of servicing this with different systems, discussing the pros and cons of each.

The following details are largely taken directly from available publications on this subject, most notably "Appropriate Sanitation Alternatives: A field manual" by D. Mara, J. Kalbermatten et al, World Bank, 1978 from which large sections are reproduced.

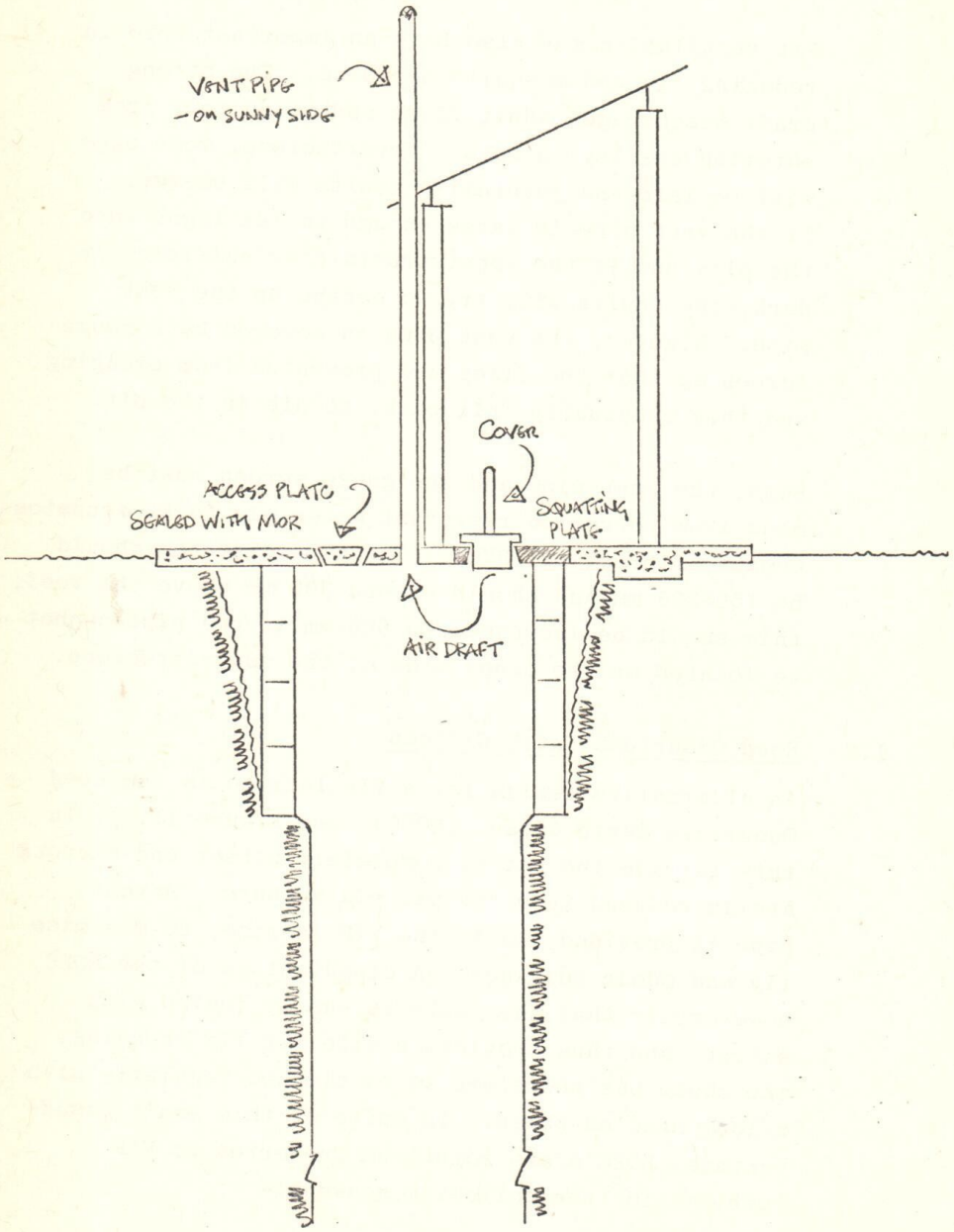
1.1 The Improved Pit Latrine

The simple pit latrine has two major disadvantages: it usually smells, and flies or mosquitoes readily breed in it, particularly when it is filled to within one meter of the surface. These undesirable attributes have led to the rejection of the pit latrine in favor of other, far more expensive forms of sanitation, but they are almost completely absent in ventilated improved pit latrines and Reed Odourless Earth Closets. It is therefore recommended that unimproved pit latrines should no longer be built, and that those that do exist should be converted.

Recent work has provided designs for pit latrines (see Figure II,1 for example), that are odorless and have minimal fly and mosquito nuisance. Ventilated improved pit (VIP) latrines are a hygienic, low-cost and indeed sophisticated form of sanitation, which has only minimal requirements for user care and municipal involvement. The pit is slightly offset to make room for an external vent pipe. The vent pipe should be at least 150 mm in diameter (preferably 200 mm); it should be painted black and located on the sunny side of the latrine superstructure. The air inside the vent pipe will thus heat up and so create a vigorous updraft with a corresponding downdraft through the squatting plate.

FIGURE II.1

VENTILATED IMPROVED PIT LATRINE - BASIC PRINCIPLES



Thus any odour emanating from the pit contents are exhausted via the vent pipe, leaving the superstructure odour free.

Pit ventilation may also have an important role in reducing fly and mosquito breeding. The strong draft discourages adult flies and mosquitoes from entering and laying eggs. Nevertheless, some eggs will be laid and eventually adults will emerge. If the vent pipe is large enough to let light into the pit, and if the superstructure is sufficiently dark, the adults will try to escape up the vent pipe. However, the vent pipe is covered by a gauze screen so that the flies are prevented from escaping and they eventually fall back, to die in the pit.

Both, the vent pipe and the gauze screen must be made from corrosion resistant materials (e.g. asbestos cement, fibreglass, PVC). The pipe diameter should be 150-200 mm and should extend 300 mm above the roof; this should be increased to 600 mm if the pipe cannot be located on the sunny side of the superstructure.

1.2 Reed Odourless Earth Closets

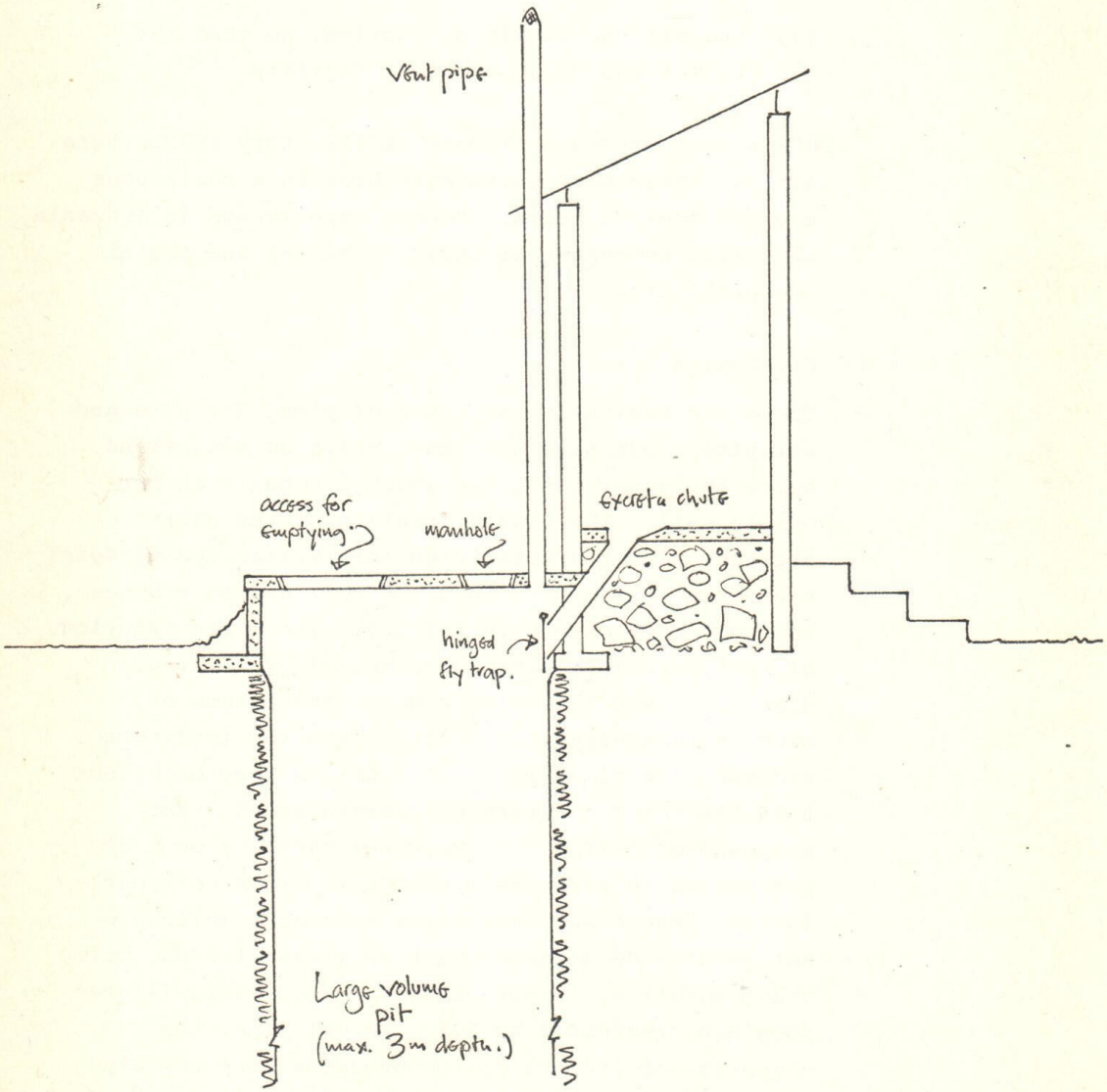
An alternative design for a VIP latrine is the Reed Odourless Earth Closet (ROEC) (see Figure II,2). In this latrine the pit is completely offset and excreta are introduced into the pit via a chute. A vent pipe is provided, as in the VIP latrine, to minimise fly and odour nuisance. A disadvantage of the ROEC, however, is that the chute is easily fouled with excreta and thus provides a site for fly breeding; the chute has therefore to be cleaned regularly with a long handled brush. In spite of this small disadvantage, ROEC's are sometimes preferred to VIP latrines for the following reasons:-

(1) the pit is larger and thus has a longer life than other shallow pits;

Figure II, 2.

REED ODOURLESS EARTH CLOSET

- BASIC PRINCIPLES.



(2) as the pit is completely displaced, the users (particularly children) have no fear of falling into the pit;

(3) it is not possible to see the excreta in the pit; and

(4) the pit can easily be emptied, so that the toilet can be a permanent facility.

ROECs have proved extremely satisfactory in Southern Africa, where some units have been in a continuous use for over 20 years. Recent experiments in Tanzania have also demonstrated their technical and social acceptability.

1.3 Pit Design

There are basically two types of pits: dry pits and wet pits. Dry pits are those which do not extend below the water table and which are built in permeable soil. The liquid fraction of the excreta, together with the water used for latrine and personal cleansing, percolates into the soil and so reduces the volume of exreta in the pit. The solid fraction of the excreta is slowly decomposed by anaerobic digestion, and this also reduces the volume of excreta remaining in the pit. Thus the long-term accumulation of solids in the pit is very much less than the total quantity of excreta added. For purposes of design, the required capacity of a dry pit should be taken as 0.06 m^3 per person per year. In areas where anal cleansing materials which are not readily decomposed (such as grass, leaves, maize cobs, mudballs, cement bags) are used, this figure should be increased by 50%. In wet pits, the digestion of excreta solids proceeds more rapidly than in dry pits. A design capacity of 0.04 m^3 per person per year should be allowed; again, this should

be increased by 50% if resistant anal cleansing materials are used.

Pit latrines should be designed for a minimum life of 5 years and preferably for as long as 10 or even 15 years. The temptation to built small pits should be resisted wherever possible, as it substantially increases the annual cost.

Traditionally, new pits are dug when old ones are almost full. The latter are then filled in and, providing they are left for a year or so, become completely pathogen free. In higher density areas, however, there is rarely space to construct subsequent pits and they have to be emptied. Providing this is done by vacuum truck there is no health risk. VIP latrines as well as REOC's should, where this will be the case, be constructed to allow such desludging.

Pit depths are usually in the range 3-8 m although pits of 12 m or more are found where soils are particularly suitable. With VIP latrines it is sometimes advantageous to use very much enlarged pits provided that the ground conditions are suitable.

The upper part of the pit should be lined so that it can properly support the squatting plate and superstructure. If this is not done, the pit may collapse. In unstable soil conditions it may be necessary to extend this lining down to the bottom of the pit but care must be taken to ensure that the lining does not prevent infiltration.

In areas where the water table is within 1 m of the ground surface, or where excavation is difficult (as, for example, in rocky ground), a built-up pit can be used. The raised plinth should not be more than 1 m above ground level and the watertight

lining should extend at least 0.5 m, and preferably 1 m, below ground level.

Brief discussion

Like all excreta disposal systems, VIP latrines and ROECs require maintenance. However, this maintenance is of a very simple kind and consists principally of keeping the squatting plate and superstructure clean. To prevent mosquito breeding in wet pits, a cupful of kerosene should be added to the pit each week.

In many parts of the world pit latrines have become grossly fouled and often constitute a greater health hazard than promiscuous defacation in the garden or alleys. This is not because of any inherent tendency of pit latrines to become fouled, but because they have often been introduced without sufficient user participation or education into communities which had never previously had any sanitation facility whatsoever. In such communities, other types of latrines would doubtless be equally fouled.

VIP latrines and ROECs are especially suitable in low and medium density areas (up to approximately 300 people per ha or even higher). In such areas houses are normally single-storied and there is sufficient space on each plot for at least two pit sites (one being in use and the other in reserve). However, they can be used at much higher densities (500-600 people per ha) if the pit volume is increased or pits and vaults are easily accessible for emptying and if sullage water disposal is properly managed. Both types of latrine are easy to construct (except in sandy or rocky ground, or when the water table is high), and usually much, if not at all, of the construction can be done by the users. The construction materials are standard and none generally

has to be imported.

Pit latrines contaminate the soil and groundwater and this is obviously dangerous if shallow wells are located nearby (within 10 m or so). If the soil is fissured, the pollution is more extensive and is particularly serious if it affects borehole supplies for large populations.

Pit latrines should obviously not receive household waste-water and therefore, separate arrangements must be made for this. Soakways are satisfactory if constructed well in the first place - preferably with a simple grease trap - and their life can be extended indefinitely with appropriate tree planting to take up the surplus water.

Health Aspects

Provided the squatting place is kept clean, a VIP latrine or ROEC poses a health risk to the user scarcely greater than does a flush toilet. The only area of slightly increased risk is the small hazard of the occurrence of fly and mosquito breeding. However, this is most unlikely to result in serious nuisance if the vent pipe is of the correct size, properly located on the sunny side of the latrine and painted black.

Although both the VIP latrine and the ROEC are designed to minimise mosquito breeding, additional precautions can be taken in wet pits. Trials in West Africa have shown great success by covering the liquid surface with a layer of small polystyrene pellets (as used in soft furnishings). These bar access by mosquitoes to the liquid surface and will rise and fall with the surface level. These trials indicate that even though in the dry season the pellets become attached to the solids level, they

float again when the subsequent rain season fills the pit.

Otherwise, Dursban or a similar larvaecide can be added where Culex fatigans is a serious problem but this is expensive in the long run. As noted earlier, a cupful of kerosene will do instead.

In lower density areas where space is available to dig new pits, the old pit contents can be safely dug out after they have been sealed in the ground at least 12 months. At most, there will be only a few viable Ascaris ova remaining after this time. If, as is recommended earlier, the pit has a minimum life of 5 years then its contents will not be dug out before at least another 5 years have elapsed (the second pit having been in use for the second 5 year period), and after this time the pit contents will not contain any viable excreted pathogens whatsoever.

In higher density areas where pits have to be emptied, the infrequency with which this has to be done with a well designed pit achieves tremendous savings.

Main advantages:-

- extremely low annual costs
- low construction costs and ease of construction (unskilled labour with site supervision)
- ease of maintenance
- minimal odour
- minimal fly or mosquito problem if well designed and constructed
- water only required for cleaning squatting plate (and chute for ROEC)
- very low management requirements by authorities (very occassional emptying)
- minimal risks to health

Main disadvantages:-

- unsuitable (anyway not ideal) for high density areas.
- unsuitable for areas where groundwater is obtained in shallow wells
- unsuitable in fissured soil as pollution can then be quite extensive and may affect other water supplies
- pits cannot be dug to the required depth in rocky ground
- black cotton soil has low soakage potential
- separate arrangements are required for waste-water disposal.

1.4 Pour-Flush Toilets

In its simplest form the pour-flush toilet (PF) is essentially a modification of the pit latrine in which the squatting plate is replaced with a simple bowl with a water seal. Approximately 1-2 litres of water (or sullage) are poured in by hand to flush the excreta into the pit. This type of PF toilet is often used with wet pits as the water seal prevents odour development and mosquito breeding. It is especially suitable where water is used for anal cleansing.

A second type of PF toilet, which is widely used in India, south-east Asia and some parts of Latin America, is used in combination with a completely offset pit. The PF bowl is connected to a short length (8 m maximum) of 100 mm diameter pipe which discharges into an adjacent pit. Approximately 1-2 litres of water are required for each flush. The slope of the connecting pipe should be not less than 1 in 40. The pit is provided with a concrete or ferrocement cover slab and wall lining as necessary. This type

of PF toilet may be installed inside the house, as it is free from both odours and fly and mosquito nuisance; it therefore obviates the need for a separate external superstructure, and it can thus meet social aspirations for an "inside" toilet at low cost. When the pit is full, it can be emptied or, alternatively a new pit can be dug and the toilet connected to it.

Assuming that flushing only takes place when stools are passed and that a maximum of 3 stools are passed per person per day, the maximum water requirement is 6 lcd.

Health Aspects

If properly used and maintained, PF toilets are as safe as any. They also are free of mosquito and fly breeding without additional maintenance measures.

Advantages:-

- water seal maintains the system odour free
- no fly and mosquito breeding
- large self-help component in construction
- low capital costs (though more than those for VIPs or ROECs)
- low annual costs
- low management requirements by authorities
- minimal health risks if used properly

Disadvantages:-

- additional wastewater disposal required
- householder must ensure sufficient supply of flushing water in the toilet at all times
- all the disadvantages of groundwater pollution risks associated with VIP latrines and ROECs and, therefore, not suitable for high densities except in ideal ground conditions

- requires periodic emptying (by vacuum truck) although as with VIPs and ROECs, this could be as infrequently as every few years
- not ideal where large anal cleansing materials are used as blockages will occur in the water seal and/or sufficient water may not be available/used to ensure adequate flushing
- similar disadvantages to VIPs and ROECs regarding the soakage capacity of black cotton soil.

Sewered pour-flush

A third type of pour-flush system replaces the soakage pit with a septic tank with an outflow to a small-bore sewer (see Figure II,3). The sewered PF system is suitable for use in areas where the wastewater flow exceeds soakaway capacity. It can either be developed from an existing PF pit latrine or can be installed as a new facility.

The sewered PF toilet system has 5 parts:-

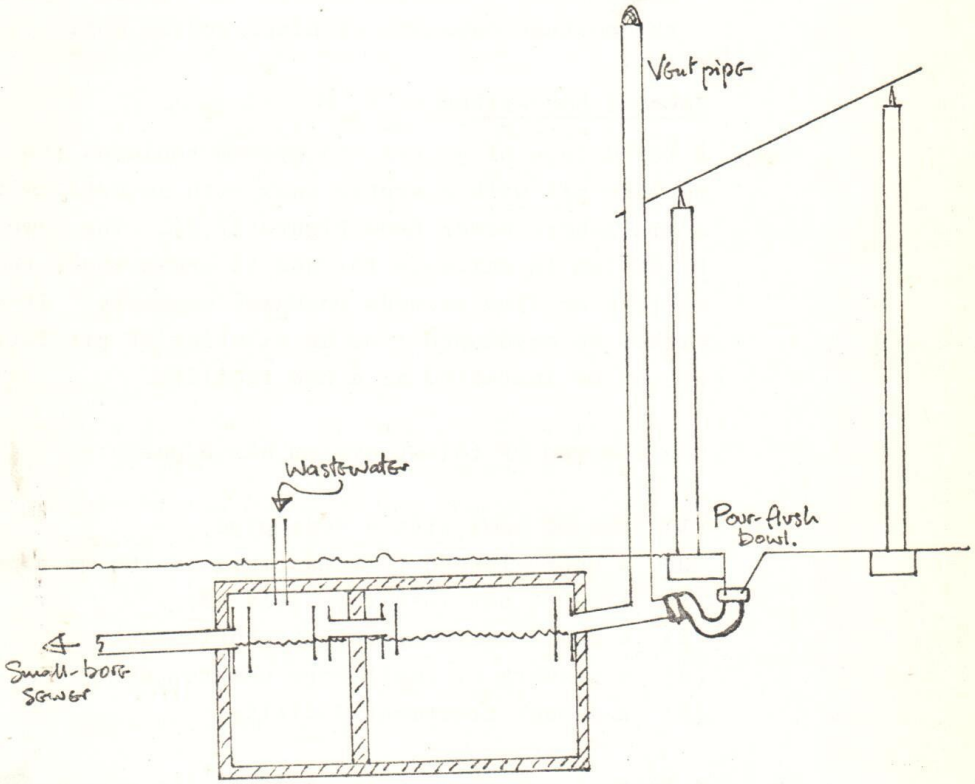
(1) the PF bowl,with a vent pipe;
(2) a short length (8 m maximum) of 100 mm pipe laid at not less than 1 in 40;
(3) a small two-compartment septic tank;
(4) a network of small bore sewers; and
(5) a sewage treatment facility.

A typical arrangement is shown in the accompanying diagram. Excreta and PF water only are discharged into the first compartment of the septic tank, and sullage only into the second. The two compartments are interconnected by a double T-junction, the invert of which is a nominal 3 cm above the invert of the exit pipe of the second compartment which is connected to the street sewer. Thus the contents of the first compartment are able to overflow into the second but sullage cannot enter the first compartment.

FIGURE II, 3

SEWERED POUR-FLUSH

- BASIC PRINCIPLES



This arrangement effectively eliminates the very high degree of hydraulic disturbance caused by high sullage flows which, in single compartment tanks, would resuspend and prematurely flush out some of the settled excreta; it thus permits a considerably higher retention time of excreta in the tank and hence is able to achieve a substantially increased destruction of excreted pathogens.

Guidelines for the size of the two-compartment septic tank may be developed as follows. Assuming a per capita daily production of excreta of 1.5 litres and a maximum pour-flush water usage of 6 litres, the maximum toilet wastewater flow amounts to 7.5 lcd. Allowing a mean hydraulic retention time of 20 days in the first compartment implies a volume requirement of 0.15 m^3 per user. Thus the volume of the first compartment should be calculated on this basis of 0.15 m^3 per user, subject to a minimum volume of 1 m^3. The nominal hydraulic retention time in the second, or sullage, compartment, need be only 12 hours, subject to a minimum volume requirement of 0.5 m^3. For design purposes the sullage flow may be estimated as the water consumption (that is, the relatively small volumes of PF water may be ignored). The minimum recommended size tank (1.5 m^3 working volume) is thus suitable for up to 7 users and a water consumption of 140 lcd.

Since all but the smallest solids are retained in the septic tank, it is not necessary to ensure self-cleansing velocities of 1 m/s in the receiving sewers. As a result small bore sewers of 100-150 mm diameter can be used and these can be laid at flat gradients of 1 in 150-300. Sullage water carries no solids which could clog sewer pipes. Consequently, manholes need only be provided at pipe junctions. Thus the sewered PF system achieves considerable

economies in pipe and excavation cost as compared with a conventional sewerage system. Taking into account these savings, the extra cost of the small septic tank, the savings in water usage and the lower cost of the toilet fixtures, the annual economic cost of a sewered PF system can be expected to be considerably (of the order of 50-70%) less expensive than that of cistern-flush toilets connected to a conventional sewerage system. In addition, treatment costs will be less, due to the enhanced pathogen removal and BOD reduction (approximately 30-50%) in the septic tank.

Advantages:-

- all the advantages of the simpler PF systems discussed above
- can be used in soils with low soakage capacity
- no groundwater pollution risk
- small size of septic tank means that it will be possible to construct in almost any soil/rock conditions
- low maintenance costs (but introduces a sewage treatment cost)
- no additional wastewater disposal provision required
- emptying requirements will be even more infrequent as decomposed solids will enter sewer with liquids

Disadvantages:-

- higher construction costs than any system considered so far
- requires a sewage treatment facility (but this could be a site waste stabilisation pond rather than a municipal sewage works)
- household must provide sufficient flushing water on a regular basis
- not ideal where large anal cleansing materials are used (as for other PF systems above).

1.5 Aqua-Privies

There are three essential variants of the aqua-privy:-

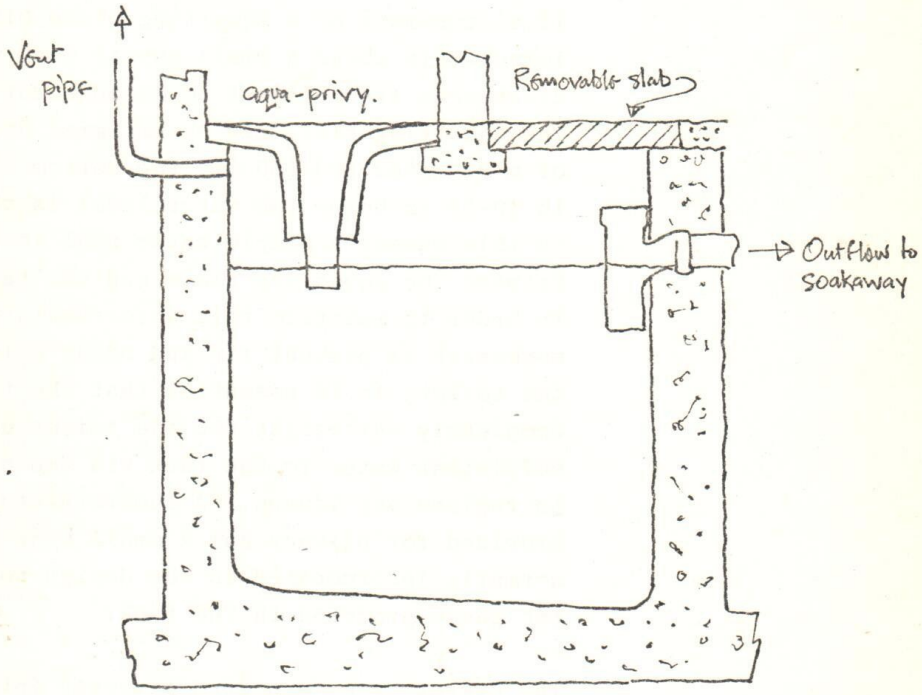
i) the conventional type
ii) the self-topping type
iii) the sewered type

i) The conventional aqua-privy toilet (see Figure II,4) consists of a squatting plate situated immediately above a small septic tank which discharges its effluent to an adjacent soakaway. The squatting plate has an integral drop-pipe, of a diameter 100-150 mm, the bottom of which is 10-15 cm below the water level in the tank. In this manner a simple water seal is formed between the squatting plate and the tank contents. In order to maintain this water seal, which is necessary to prevent fly and odour nuisance in the toilet, it is essential that the tank be completely watertight and the toilet user add sufficient water to the tank via the drop pipe to replace any losses. A superstructure is provided for privacy and a small vent pipe is normally incorporated in the design to exhaust the gases produced in the tank.

The excreta are deposited directly into the tank where they are decomposed anaerobically in the same manner as in a septic tank. There is, as with septic tanks, a gradual accumulation of sludge (approximately 0.03-0.04 m^3 per user per year) which should be removed when the tank is two thirds full of sludge. The tank volume is usually calculated on the basis of 0.12 m^3 per user, with a minimum size of 1 m^3. Disludging is normally required every 2-3 years when the tank is two-thirds full of sludge. The liquid depth in the tank is normally 1-1.5 m in household units; depths of up to 2 m have been used in large communal aqua-privies.

FIGURE II, 4

CONVENTIONAL AQUA-PRIVY.



The volume of excreta added to the aqua-privy tank is approximately 1.5 lcd, and the water used for 'flushing' and maintenance of the water seal is about 4.5 lcd; thus the aqua-privy effluent flow is around 6 lcd. The soakaway should therefore be designed on this basis, although it is common to include a factor of safety so that the design flow would be, say, 8 lcd. The sidewall area of the soak-away should be calculated assuming an infiltration rate of 10 litres/m^2 day.

Maintenance of the water seal has always been a problem with conventional aqua-privies, except in some Islamic communities where the water used for anal cleansing is normally sufficient to maintain the seal. Even there, however, it is necessary for the vault to remain water tight. In many other communities people are either unaware of the importance of maintaining the seal or they dislike to be seen carrying water into the toilet. If the seal is not regularly maintained, there is intense odour release and fly and mosquito nuisance.

ii) The self-topping, sullage or wastewater aqua-privy was developed to overcome the problem of maintenance of the water seal. In this simple modification of the conventional system all the household sullage is added to the tank; the water seal is thus readily maintained and the sullage is conveniently disposed of. Although the sullage can be added to the tank via the drop-pipe, it is more common, and for the user more convenient, for it to be added from either a sink inside or immediately outside the toilet or from one located in an adjacent sanitation block. Naturally, as the volume of water

entering and leaving the aqua-privy tank is increased by the addition of sullage, the soakage pit capacity must be increased to absorb a larger flow. Sullage aqua-privies cannot, therefore, be used in urban areas where the soil is not suitable for soakaways or where the housing density or water usage is too high to permit subsurface percolation for effluent disposal.

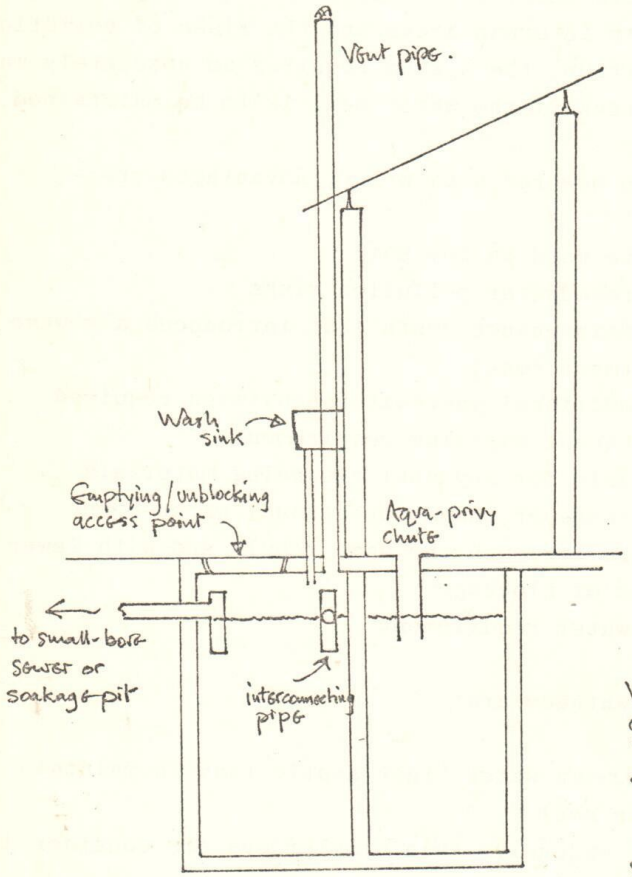
iii) The sewered aqua-privy replaces the soakage pit with a septic tank the outflow of which is connected to a small bore sewer system. Since all but the smallest solids are retained in the aqua-privy tank the sewers can be of small diameter and laid at the nominal falls necessary to ensure a velocity of around 0.3 m/s rather than the self-cleansing velocity of 1 m/s required in conventional sewers transporting raw sewage. Commonly 10-15 cm pipes are used at a fall of 1 in 150-300. Substantial economies in sewer and excavation costs are thus achieved, and sewered aqua-privy systems are therefore considerably (50-60%) less expensive than conventional sewerage systems.

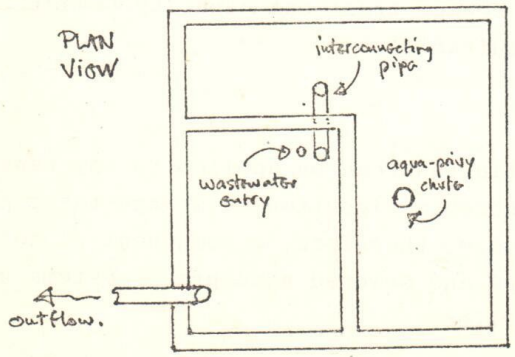
This system is much improved by the modification of adding a separate wastewater receiving compartment (see Figure II,5). This is provided to avoid hydraulic disturbance of the settled excreta in the main part of the tank. The invert of the pipe connecting the two compartments is a nominal 30-50 mm below the invert of the effluent pipe from the sullage compartment (which leads to the soakage pit or sewer), so that the sullage flow can be used to maintain the water seal in the main compartment, but is unable to resuspend the settled excreta.

Figure II, 5

AQUA-PRIVY.

- IMPROVED, TWO-TANK, SELF-TOPPING





Wastewater flows into 2ND compartment avoiding hyraulic disturbance in septic tank.

Interconnecting pipe ensures septic tank remains topped up to level above base of excreta chute.

Advantages and Disadvantages

The main disadvantages of the self-topping aqua-privy are those of all systems requiring soakage capacity in urban areas and the risks of pollution. In addition, the system requires an absolutely water-tight tank if the water seal is to be maintained.

For the sewered aqua-privy, advantages are:-

- can be used in any soil
- no groundwater pollution risks
- low maintenance costs (but introduces a sewage treatment cost)
- no additional wastewater provision required
- infrequent emptying requirements
- suitable for any anal cleansing materials
- much cheaper than conventional water-borne sewage for much the same result and with fewer risks of blockage
- low water requirement

Disadvantages are:-

- requires a water tight septic tank to maintain water seal
- more expensive than simpler systems considered earlier
- requires a sewage treatment capacity (stabilisation ponds are suitable).

1.6 Septic Tanks

The term septic tank can be applied to any tank in which the anaerobic digestion of sewage takes place. Septic tanks are, therefore, a component of both the sewered PF and sewered aqua-privy systems as described earlier.

Essentially, septic tanks are small, rectangular

chambers, usually sited just below ground level which receive both excreta and flushwater from flush toilets and all other household wastewater. The mean hydraulic retention time in the tank is usually 1-3 days. During this time the solids settle to the bottom of the tank where they are digested anaerobically. A thick crust of scum is formed at the surface and this helps to maintain anaerobic conditions. Although digestion of the settled solids is reasonably effective, some sludge accumulates (approximately 0.03-0.04 m^3 per user per year) and the tank must be desludged at regular intervals, usually once every 1-5 years. The effluent from septic tanks is, from a health point of view, as dangerous as raw sewage and so is ordinarily discharged to soakaways or leaching fields; it should not be discharged to surface waters without further treatment. Although septic tanks are most commonly used to treat the sewage from individual hoseholds, they can be used as a communal facility for populations up to about 300.

A two-compartment septic tank is now generally preferred to one with only a single compartment as the suspended solids concentration in its effluent is considerably lower. The first compartment is usually twice the size of the second. The liquid depth is 1-2 m and the overall length to breadth ratio 2-3 to 1. Experience has shown that in order to provide sufficiently quiescent conditions for effective sedimentation of the sewage solids, the liquid retention time should be at least 24 hours. Two-thirds of the tank volume is normally reserved for the storage of accumulated sludge and scum, so that the size of the septic tank should be based on 3 days retention at start-up; this ensures that there is at least 1 day retention just prior to each desluding operation. Sludge accumulates at the rate of

0.03-0.04 m^3 per person per year and thus knowing the number of users, the interval between successive desluding operations (which are required when the tank is one third full of sludge) is readily calculated.

Septic tank effluent is normally disposed of by sub-surface irrigation in drainfield trenches (soakaways). The drainfield soil must of course be sufficiently permeable. For large flows (from populations above 100) waste stabilization ponds may be more suitable.

With drainfield disposal, the tank effluent is discharged directly to a number of drainage trenches connected in series. Each trench consists of open-joint agricultural drainage tiles of 100 mm diameter laid on a 1 m depth of rock fill (20-50 mm grading). The effluent infiltrates into the soil surrounding the trench which eventually becomes clogged with sewage solids (provision must be therefore made to set aside land for use as a future replacement drainfield). Soil percolation tests should be used to determine qualitatively whether or not the soil is sufficiently permeable. However, the infiltration should not be estimated from percolation test results because they merely indicate the infiltration rate of clean water into virgin soil. The infiltration rate that should be used in drainfield design is the rate at which septic tank effluent can infiltrate the soil surface that has become partially clogged with sewage solids (which form an interface between the soil and the drainage trench). Simple formulae exist to calculate andrelate the various factors involved.

Brief discussion

Septic tanks of the conventional design described above are suitable only for houses which have both an in-house water supply and sufficient land for

effluent disposal. These two constraints effectively limit the responsible use of septic tanks to low density urban areas. In such areas they are a very acceptable form of sanitation. However, it is all too common to see septic tanks provided in medium density areas where the effluent, being unable to infiltrate into the soil, is discharged either onto the ground surface, where it ponds, or into street gutters or storm drains; in these cases it causes odour nuisance and encourages mosquito breeding, and is a potential health hazard.

However, it is possible to alter the design of the septic tank to make it more suitable for use in medium density areas (up to approximately 200 people per ha). The design modifications are as follows. The septic tank should be provided with 3 compartments; toilet wastes only are discharged into the first compartment and sullage directly into the second. This arrangement avoids excessive dilution of the toilet wastes with sullage and reduces the hydraulic disturbance in the first compartment, hence minimizing the resuspension of settled excreta and solids carry-over into the second compartment. The third compartment acts as a final settlement chamber before the effluent is discharged into the drainfield. The first compartment should be sized so as to provide 2 days retention time, and the second and third compartment to provide 1 day retention time. Since the effluent from the third compartment contains very few fecal solids (which are predominantly responsible for the clogging of drainage trenches receiving conventionally designed septic tank effluents), the infiltration rate of the effluent is much higher, approximately 30-60 litres/m^2 day. The trench length is correspondingly smaller and thus septic tanks with soakaways become technically feasible, and the need for sewerage obviated, at higher housing

densities than is possible with conventionally designed septic tanks. If low volume cistern-flush (or pour-flush) toilets and other water saving fixtures are installed, it is possible to use septic tanks and soakaways at even greater housing densities, perhaps as high as 300 people per ha.

As has been seen with the sewered PF and sewered aqua-privy systems, septic tanks can be used in conjunction with a small-bore sewer network. The tremendous advantages of this are that solids are kept out of the sewers and these can thus be of very small dimensions, laid at virtually flat gradients and require few manholes. This system is ideal for connection to an on-site self-maintaining treatment system in the form of waste stabilisation ponds the effluent from which can be discharged to groundwater without health risk.

1.7 Conventional Water-Borne Sewerage

The conventional cistern-flush toilet is basically a water-seal squatting plate or pedestal unit in which excreta are deposited and then flushed away by 10-20 litres of clean, potable water which have been stored in an adjacent cistern; the cistern is connected to the household water supply and is provided with a float valve so that it automatically refills to the correct volume in readiness for the next flush. The excreta and flushwater are discharged, together with all the other household wastewater into an underground network of sewers for transport to a sewage treatment works or marine discharge station. Alternatively, in low-density areas, they may be discharged into a septic tank.

There are two types of conventional sewerage systems; separate and combined. In the separate or sanitary sewerage system, only household wastwater is

transported; stormwater is not permitted to enter the sewers but is drained away into a separate system of underground pipes or into open stormwater drains for eventual discharge into local streams or rivers. In the combined sewerage system, the same network of sewers is used for both sewage and stormwater. Usually, and especially in tropical countries where rainfall occurs seasonally and often with extremely high intensity, it is cheaper to install small sewers for sanitary sewage and separate drains for stormwater, rather than to provide a large combined sewer whose capacity is only fully utilized during periods of intense rainfall and which is liable to have insufficiently high flow velocities to transport excreta in the dry season.

Sanitary sewers are usually made from concrete, asbestos cement, vitrified clay or PVC. They are commonly designed for gravity transport of a maximum or 'peak' flow of 2.5-4 times the mean daily flow and to achieve a 'self-cleansing' velocity of 0.6-1.0 m/s when carrying a flow equal to the mean daily flow. This self-cleansing velocity is required to resuspend and transport any solid material which may have settled out during periods of lower flow (and hence lower velocity). In those developing countries where the use of bulky anal cleansing materials such as corncobs is common and where sand is used for scouring pots, etc., the self-cleansing velocity should be taken as 1 m/s as experience has shown that otherwise blockage of the sewer is common. To achieve a self-cleansing velocity of 1 m/s requires fairly steep pipe gradients; for example a 200 mm pipe (which is the minimum recommended size) must be laid at 1 in 90; in contrast a 100 mm diameter pipe serving a sewered PF toilet need only be laid

at 1 in 200 provided the joints are sufficiently tight to exclude groundwater and sand. Excavation and pipe costs for a conventional sanitary sewerage system are thus very high, and can approach twice those for a sewered PF system.

Brief discussion

Conventional water-borne sewerage has certain obvious advantages including high user convenience and (where the system is working perfectly) low municipal maintenance and low health risks.

However, the system has several serious disadvantages:-

- It can only be installed in areas where the houses have at least a single tap in-house level of water supply service. Many urban and most rural communities in developing countreis are without this facility and many will be unable to afford it in the foreseeable future.

- The system is very extravagant with water. It is not uncommon for 60-120 lcd of otherwise unused potable water to be used for flushing the toilet. This is both expensive - amounting to 20-40% of the total annual economic cost of the whole system - and wasteful: large quantities of an often scarce resource are used to transport small quantities of excreta to a treatment works where considerable effort is expended at great cost in an attempt to separate them.

- In areas where the total water use is less than about 75 lcd, the system is prone to malfunction as there is insufficient flow to transport excreta and other solids along the sewers. Blockages are common, especially in areas where bulky anal

cleansing materials are used and where other objects (such as items of domestic refuse) are flushed into the sewers. Even in areas where water use is normally above 75 lcd, the system is difficult to maintain during periods of drought.

- The system requires careful and expensive planning and design, tasks often done by expatriate consultants with a consequent cost in foreign exchange. Additionally, since sewers generally have to be laid in fairly straight lines in order to avoid even greater expense and minimise maintenance efforts, it is very difficult and usually impossible to sewer many traditional 'unplanned' housing areas without demolishing a substantial number of houses.

- In hot climates concrete and asbestos cement sewers are highly susceptible to corrosion by sulfuric acid produced by bacteria in the sewer. This corrosion can occur comparatively quickly - within 5-10 years in some environments such as the Middle East.

  Vitrified clay and PVC pipes are not susceptible to this form of corrosion. For sewers above the maximum size of PVC pipe (usually 400 mm) and in areas where PVC pipe is unavailable, concrete or asbestos cement pipes with coal-tar epoxy or pure epoxy coatings are required. The coatings not only require careful application but they are very expensive, approximately double the shelf cost of asbestos cement pipe.

- It is seldom possible to design a sewerage system which operates entirely by gravity flow. Pumping stations have high capital maintenance, and energy costs. Corrosion of steel force mains is another costly problem which requires expensive preventive

measures.

- One of the most important disadvantages of conventional sewerage is its costs. The system is extremely expensive compared with all others and is unlikely to be affordable by enormous numbers of people. Whilst a government or municipality may wish to provide conventional sewerage for all its citizens, this can be done only by massive subsidies to the middle and low income majority. This respresents a huge opportunity cost to the national and municipal economy; moreover, if improved health is perceived as the principal benefit of conventional sewerage, it is likely that the desired health improvements can be as effectively achieved by alternative lower-cost sanitation technologies.

  There is little prospect of reducing the costs of conventional sewerage. Even in industrialized countries the system is already designed to minimum standards. Innovative designs of sewer layouts and appurtenances (such as manholes) may reduce construction costs by perhaps as much as 20%, a substantial saving in monetary terms but not one which would put the system within economic reach of the majority of people.

  Frequently, the largest components of conventional sewerage (e.g. interceptor sewers and marine outfalls) have to be designed not for the present population but for the population at the end of their design life (usually 20-50 years). This means that, although all the investment costs are incurred at the start during construction, few of the benefits of the system are accrued immediately on completion; future benefits when discounted back to present day values are relatively small. Moreover, the predicted value of the earliest benefits is generally diminished as householders are often reluctant or unable to invest in

the plumbing facilities and pay the usually expensive fee to be connected to the system. Not only is this poor investment economics but it also means that during the initial years when few houses are connected self-cleansing velocities are unlikely to be reached as there is insufficient flow in the sewer; sewer maintenance costs are thus increased.

- Finally, conventional sewerage does not deal with or treat sewage directly (as does the pit latrine for example). It simply transfers that problem elsewhere. Conventional sewage treatment works are frequently an expensive and constant problem and not only in developing countries. They suffer from disadvantages that include:-

  i) Poor pathogen removal performance. Effluents from conventional treatment works (based on primary sedimentation trickling filters and secondary sedimentation) contain significant concentrations of viruses, bacteria, protozoa and helminth ova and are thus unsafe for direct agricultural use or for discharge to fresh water bodies - although this is often done.

     Conventional treatment has been evolved more for achieving adequate chemical quality (BOD reduction) than for pathogen removal.

     This performance can be improved by the use of waste stabilisation ponds and by other tertiary treatment methods.

  ii) Very high capital and running costs and, usually, the need for a high imported component.

  iii) The need for a high level of maintenance skill.

1.8 Waste-Stabilization Ponds

Waste-stabilization ponds can be considered as an alternative to conventional sewage treatment. They can be employed to service a single housing development or whole sections of towns and are suitable wherever land can be made available.

Waste stabilization ponds are large shallow ponds in which organic wastes are decomposed by micro-organisms in a combination of natural processes involving both bacteria and algae. Stabilization pond systems can treat raw sewage, the effluent from sewered pour-flush toilets or diluted night-soil.

Waste stabilization ponds are the most economical method of sewage treatment wherever land is available at relatively low cost. Their principal advantages in developing countries are that they achieve very low survival rates of excreted pathogens at a much lower cost than any other form of treatment and with minimum maintenance requirements. In fact a pond system can achieve with a high degree of confidence, the total elimination of all excreted pathogens. This is not normally done because the additional benefits resulting from achieving zero survival, rather than very low survival, are less than the associated incremental costs. Waste stabilization ponds are the recommended form of treatment in tropical developing countries where sufficient land is available except when marine discharge is cheaper.

There are 3 types of ponds in common use:-

(1) anaerobic pretreatment ponds, which function much like open septic tanks. They have retention times of 1-5 days and depths of 2-4 m. Design loadings are in the range 100-400 g BOD5/m^2 day; commonly 250 g/m^2

day is used for temperatures above 20°C.

(2) faculative ponds, in which the oxygen necessary for bio-oxidation of the organic material is supplied principally by photosynthetic algae which grow naturally and with great profusion in them. They have retention times of 5-30 days (sometimes more) and depths of 1-1.5 m. Design loadings are commonly 100-400 kg BOD/ha/day, depending on the pond temperature.

(3) maturation ponds, which receive facultative pond effluent and are responsible for the quality of the final effluent. They have retention times of 5-10 days and depths of 1.5 m. They are normally designed on the basis of faecal coliform removal, rather than for BOD removal; very approximately each pond with a 5 day retention time can reduce the faecal coliform concentration by an order of magnitude.

Anaerobic and facultative ponds are designed for BOD removal, whereas the function of maturation ponds is the destruction or removal of exreted pathogens. Thus these three types of ponds should normally be used in conjunction to form a series of ponds. Although it is all too common to see only a single facultative pond treating domestic wastes, this is a totally unsatisfactory design; it is essential to have maturation ponds in order to ensure low pathogen survivals. Thus good designs incorporate a facultative pond and two or more maturation ponds; for strong wastes (BOD's $>$ 400 mg/l) the use of anaerobic ponds as pretreatment units ahead of facultative ponds is often advantageous as they minimize the land requirements of the whole pond system.

Well-designed pond systems, incorporating a minimum of 3 ponds in series and having a minimum overall

retention time of 20 days, produce an effluent which will either be completely pathogen free or will contain only small numbers of enteric bacteria and viruses. Pathogenic helminths and protozoa will be completely eliminated. Any bacterial or viral pollution can be reduced or eliminated by adding more ponds to the system. The effluent is suitable for direct reuse or discharge into receiving waters.

Snail and mosquito breeding in properly maintained waste stabilization ponds does not occur. It is associated only with poor maintenance which allows vegetation to emerge from the pond bottom or to grow down the embankment into the pond, thereby providing shaded breeding sites. This can be prevented by providing pond depths of at least 1 m and concrete slabs or stone rip-rap at top water level. The latter strategy also prevents erosion of the embankment by wave action.

Proper and regular maintenance of ponds is simple but nonetheless essential. It consists merely of cutting the grass on the embankments and removing floating scum mats from the pond surfaces.

1.9 Toilet Superstructure

Insufficient attention is frequently given to this aspect of sanitation from a health point of view. Assuming a suitable sanitation technology choice has been made that disposes of and treats human excreta without pathogen risk in the process, the remaining disease transmission risk at the household level is focussed on human contact with the toilet immediately before, during and immediately after defaecation or urination i.e. in or around the toilet superstructure.

The following principles should be followed:-

- the building shell

Assuming that this is contructionally sound, the most important aspects concern light, air and privacy.

Light - as much as possible - should be admitted from the highest points in the walls. This is probably best achieved by leaving large gaps between the tops of the walls and the roof. Daylight is essential for sanitary use, to encourage cleaning maintenance and to not deter children.

Ventilation is essential to dispell odours so that these are not a disincentive to use the toilet. A free flow of air is required, also, to maintain the down-draft principles of the VIP latrine and the ROEC. The required ventilation is best achieved via the daylight appertures described above.

Providing privacy and weather proofing are not infringed, there is no reason why these appertures should not be as large as possible. No savings are made by reducing their size and, therefore, we would recommend that the minimum level presently specified in the Building Code - Grade I (Section 190,(3)(iii)) of 20 sq ins is far too small.

To maintain privacy, prevent rodent access etc., opening should not be left near the floor (e.g. under the door). The bottom of the door should be flush fitting.

- floor finishes

The objective here is to provide a surface that can be easily cleaned with a minimum of water. Bare earth floors should not be allowed under any circumstances as apart from being impossible to clean or

replace adequately, they provide ideal environments for certain helminth ova. Similarly, wood is a higher undesirable material for latrine floors.

If concrete is employed, it should be given the smoothest possible finish or, if possible, coated with an alkali-resistant gloss paint.

Floors should be made to slope slightly towards the squatting plate so that removal of water used to wash the floor etc. can be easily disposed of. Under no circumstances should it be made more convenient to sweep this fouled water outside onto the ground and to prevent this, a small step at the base of the door can be incorporated.

- squatting plate materials

From a health point of view, the ideal is to have the squatting plate formed as part of the complete toilet floor unit so as to remove the probability of joins accumulating dirt and pathogens. Where this is not possible, squatting plates should be depressed slightly below the floor level and joined securely.

Several materials are satisfactory including reinforced concrete, ferrocement, sulfar cement, ceramics, glass reinforced plastic (grp), PVC etc. The surface should be as smooth as possible to facilitate easy washing.

Note that reasonably clean household waste water is perfectly adequate for toilet cleaning. Wastewater containing soap or detergent does not prevent the operation of septic tanks. However, the excessive use of disinfectants will.Obviously pit latrines do not benefit from the disposal of wastewater but small volumes of toilet cleansing water will do little harm.

- squatting plate design

The opening should be about 400 mm long to prevent soiling of the squatting plate and at most 200 mm wide to prevent children falling into the pit. A "keyhole" shape is suitable.

Foot-rests should be provided as an integral part of the squatting plate and properly located so that excreta fall into the pit and not on to the squatting plate itself.

The free distance from the back wall of the superstructure to the opening in the squatting plate should be in the range 100-200 mm; if it is less there is insufficient space, and if it is more then there is the danger that the rear part of the squatting plate will be soiled. Generally, the preferred distance is 150 mm.

The squatting plate should have no sharp edges to make its cleaning difficult and unpleasant.

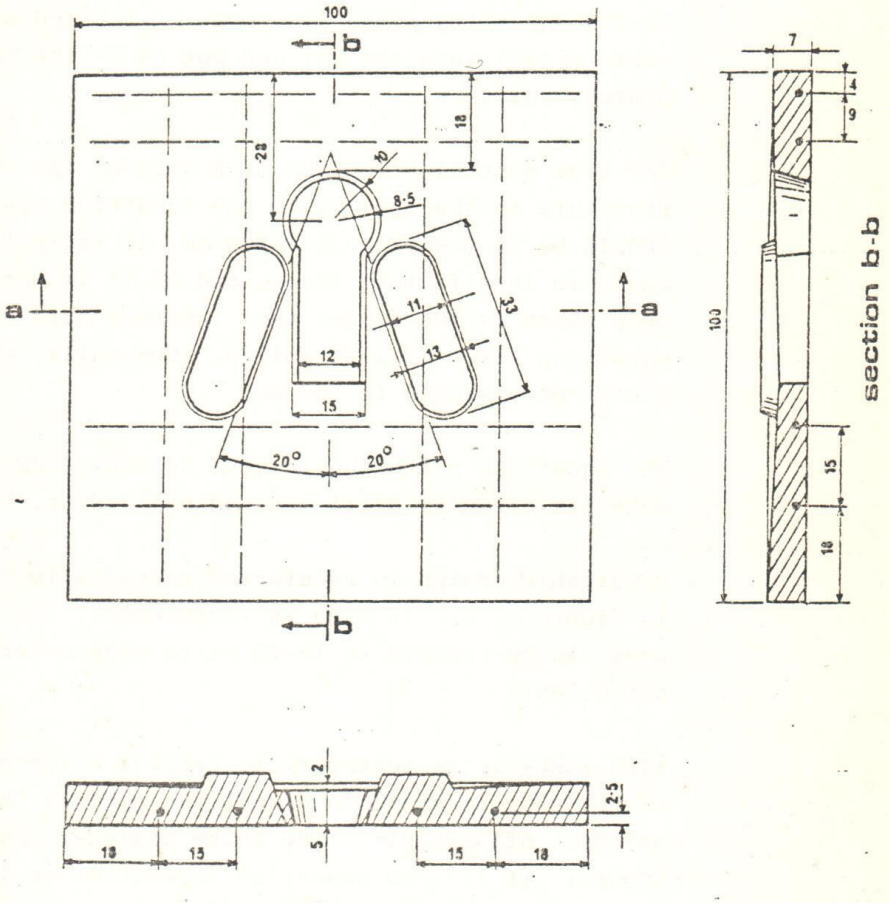
A suitable design in reinforced concrete is shown in Figure II.6. If made in ferrocement, the thickness can be reduced to 18-25 mm to save materials and weight.

With ROECs it is necessary to provide a steeply (60^{o}C) sloping chute to direct the excreta into the adjacent off-set pit. The chute diameter should be 200 mm. It is also essential to provide an inclined depression in front of the chute to permit urine to drain away satisfactorily. It is possible, but rather difficult, to cast the chute in ferrocement as an integral part of the squatting plate; in practice it is easier to use metal or PVC pipe cut to shape.

A basic design for a squatting plate suitable for a pour-flush system with completely off-set pit is shown in Figure II.7.

Figure II. 6

CONCRETE SQUATTING PLATE

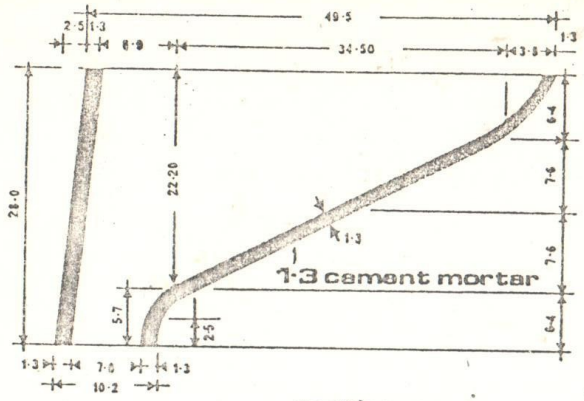


measurements in mm

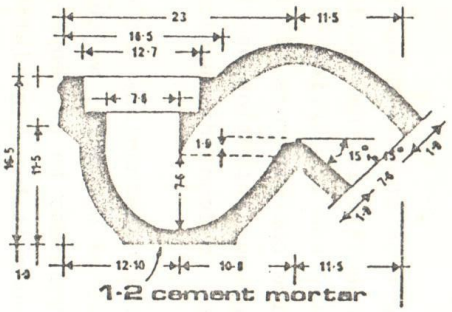
Source: (From Wagner and Lanoix)

Figure II.7

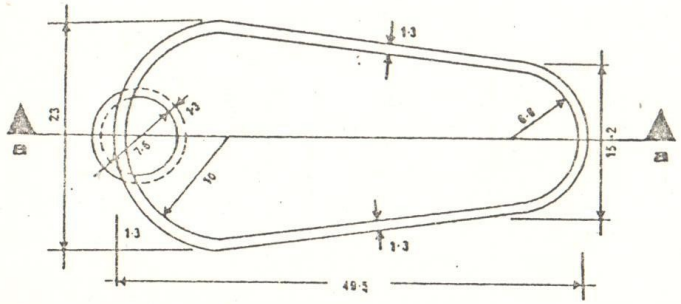
SQUATTING PLATE AND WATER SEAL UNIT DETAILS FOR INDIAN P–F TOILET
WITH COMPLETELY DISPLACED PIT



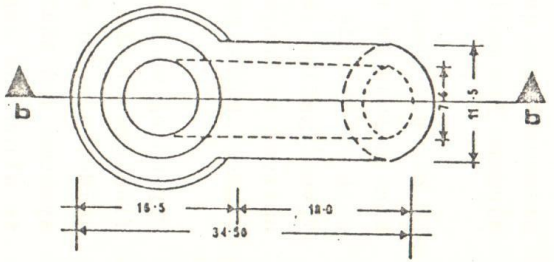
section a-a



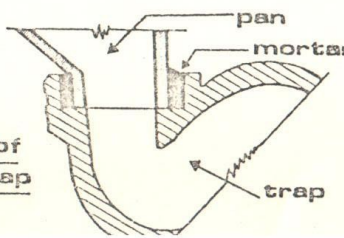
section b-b



plan of w.c. pan



plan of w.c. trap



junction of
pan & trap

dimensions in cm

Figure II.7

1.10 Summary

It can be seen then that each of the main distinct variations for sanitation technology has its advantages, disadvantages and operating constraints which will dictate its suitability for any particular situation.

It has not been our intention at this stage to draw conclusions or to make specific recommendation. Our work on this is continuing and in particular we are investigating the relative cost factors of these alternatives in Kenya. Rather our intention has been to present basic information to focus discussion.

Depending on the outcome of discussions and on the findings of the remainder of our work, we shall propose guidelines for what we consider to be Kenya-appropriate systems and shall propose suitable legislative change to allow the legal use of such systems.

2. WASTE-WATER DISPOSAL AND SURFACE DRAINAGE

The adoption of on-site excreta disposal technologies such as improved latrines, ROECs etc. (but excluding septic tanks) requires that separate facilities be provided for sullage disposal. Sullage is defined here as all domestic wastewater other than toilet wastes; it is thus the wastewater from showers and sinks and includes laundry and kitchen wastes as well as water used for personal washing. It contains some excreted pathogens; per capita contributions of enteric indicator bacteria in excreta are 10^4 to 10^5 higher than those in sullage. Sullage also contains a variety of organic compounds, most of which are readily biodegradable (with the notable exception of 'hard' detergents if these are present in locally manufactured washing powders). Approximately 40-60% of the total household production of waste organics (excluding garbage) is associated with sullage - that is, some 20-30 g BOD5 per capita per day (gcd). This figure, however, depends on water consumption; a family with suitable facilities and abundant water for personal and clothes washing will obviously generate more sullage BOD than one which obtains only small quantities of water for drinking and cooking purposes from a public standpipe.

The volume of sullage generated is also clearly related to water consumption. In many industrialised countries sullage accounts for 50-70% of total domestic water use, the balance being used to flush cistern-flush toilets. A similar situation undoubtedly exists in the more affluent communities in developing countries (although there are no data available), and it can be safely assumed that in communities which have a water consumption of 200-300 lcd and cistern-flush toilets the volume of sullage generated is approximately 60% of the water consumption (excluding garden watering). With other (less affluent) urban communities in developing countries, the prediction of sullage volumes is more difficult. However, tentative estimates are as follows:

(1) In households with a hand-carried water supply (obtained from public standposts or vendors) and pit latrines or compost toilets, sullage generation may be conservatively estimated as the water consumption; that is, normally around 20-30 lcd.

(2) In households with a on-site single-tap water supply and pour-flush toilets or vaults, the sullage volume can also be taken as the water consumption (excluding that used for garden watering and the 3-6 lcd flushwater); that is, normally about 50-100 lcd.

Local figures should be used in any site - specific calculations.

In contrast, it is very time consuming to obtain good estimates of the daily per capita BOD contribution in sullage. Where no data on this are available it is probably reasonable to estimate 5-10 gcd and 15-25 gcd for communities which have hand-carried and on-site water supplies respectively. Thus the BOD of sullage is probably in the approximate range of 100-350 mg/l. The use of plumbing fixtures designed to reduce water consumption will of course increase these concentrations.

In developing countries sullage is therefore a wastewater with approximately the same organic pollution potential as raw sewage in North America. Indeed there are many canals and streams in urban areas of developing countries which are grossly polluted (BOD up to 250 mg/l) by sullage. Indiscriminate sullage disposal not only damages the environment but also has sometimes serious public health consequences.

There are basically four kinds of sullage disposal systems:

(1) casual disposal by tipping in the street, houseyard or garden;

(2) on-site disposal in ground seepage pits;

(3) disposal in open drains (commonly stormwater drains);

(4) disposal in covered drains or sewers.

Each system has different health risks and these are reviewed below preceding the discussion of design considerations.

Health Aspects

Tipping sullage on the ground in backyards or gardens may create breeding sites for Culex pipiens (see Appendix 1) which is a cosmopolitan nuisance mosquito and also the vector of bancroftian filariasis. It may also create muddy and insanitary conditions which could help to promote the development of helminth ova which require a fairly moist environment. A clean dry yard is less likely to be used for defaecation by children, and any ova deposited are unlikely to develop. A wet muddy yard will conceal any faeces deposited and will promote development of worm eggs and larvae. There is evidence that families whose yards are clean and dry (due to hygienic practices and/or soil types) have lower intensities of Ascaris infection than do other families. Sullage containing pathogens from babies' bathwater or adults' ablution water may infect children playing in the yard. In permeable soils or where evaporation is high, and where sullage production and housing density are low, tipping of sullage on to the ground is unlikely to be a significant health hazard. However, where the soil is less permeable and evaporation low, and where either water use or housing density is high, an alternative method of sullage disposal becomes essential.

Sullage disposal in properly designed and constructed ground seepage pits causes only a low risk of groundwater contamination because the risk of microbiological and

may be advisable to consider alternative channel sections such as triangular ones; these should be lined at the apex in order to provide higher sullage velocities and minimize erosion and blockage.

Whatever channel section is adopted, it is necessary to maintain the drains routinely. This includes removal of blockages and perhaps flushing with river water. The maintenance can be done by municipal workers, by contracting the work to the private sector, or by motivating and organizing community effort on a neighbourhood basis. The material removed from the drains should be disposed of in a sanitary landfill.

To reduce the risk of blockage from kitchen water, there should also be a small pit with screen on the sullage discharge line on the home owner's property. This applies regardless of the means of sullage disposal and includes in particular soakage pit disposal to avoid clogging the pit.

Sullage treatment

As noted above sullage has a reasonably high BOD, and large volumes of sullage should normally be treated prior to discharge into local streams or rivers, unless their flow is such that the sullage would cause little additional pollution. If storm-water drains are used for sullage collection these should discharge into a single facultative waste stabilization pond which is normally the most convenient method of treatment wherever land is available. Maturation ponds are not necessary as the concentration of excreted pathogens in sullage is small. The pond should be protected from high stormwater flows in the wet season by incorporating a simple stormwater overflow weir into the pond inlet structure.

nitrate pollution of groundwater from sullage is very much lower than it is with sewage, since sullage contains far fewer pathogens and much less nitrogen.

Sullage disposal in open drains, such as stormwater drains, provides the most readily identifiable potential health risk - namely that of promoting the breeding of Culex pipiens and other mosquitoes where these are a risk. Assume that sullage is being introduced into the stormwater drainage system. In areas of year-round rainfall, these drains will contain water continuously. If they are kept free of garbage and are well designed they will flow freely and provide few sites for mosquito breeding. The presence or absence of sullage will make no difference. However, in areas of seasonal rainfall, or where the drains are liable to become blocked with garbage, the addition of sullage will create year-round water and thus year-round Culex breeding where previously only seasonal breeding may have occurred. Here it is not the quality of the sullage which is important, since ponded stormwater would also be sufficiently polluted to allow Culex pipiens breeding, but it is rather the continuous production of sullage which may have the effect of converting wet season breeding into year-round breeding in areas where the stormwater drains are liable to pond. The change from wet season breeding to year-round breeding may have a considerable impact on filariasis transmission, and in some cases it may lead to increases in both the prevalence and intensity of the infection.

Sullage disposal in closed drains or sewers is expensive, but has no special health problem unless it is eventually discharged without treatment into a sluggish or ephemeral stream where it may promote Culex breeding. The disposal of sullage, along with excreta, into sanitary sewers also presents no additional health risks, but this is in itself no justification for the provision of conventional sanitary sewers.

Engineering Design

Seepage pits

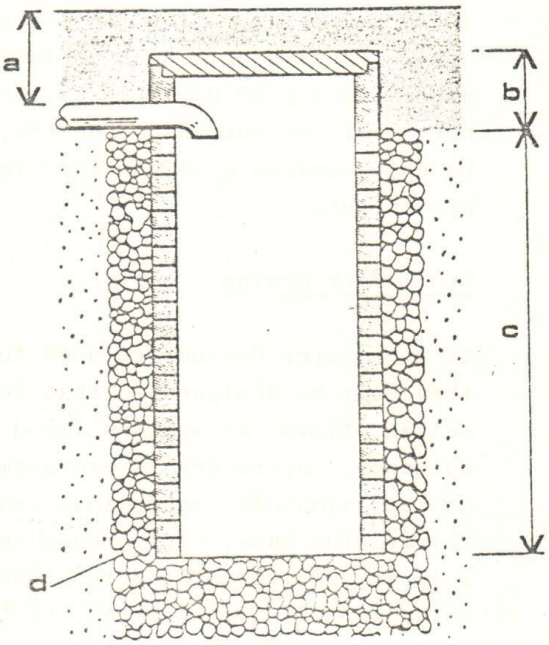
A suitable design for a seepage pit for use in permeable soils is shown in Figure II.8. The pit may be circular, square, rectangular, or even irregular in plan, to suit the space available. The side walls may be lined with open brickwork, or unlined and filled with rock (50-100 mm grading) or brickbats. The rate of infiltration of sullage is approximately three times higher than that of conventional septic tank effluent; that is, approximately 30-90 litre/m^2 of sidewall area per day. For the purpose of design, 30 litre/m^2 should be used, unless a higher rate is known to be more appropriate.

Stormwater drains

If stormwater drains are used for sullage disposal they must be designed so that they can handle low sullage flows, as well as flood peaks, without nuisance. Storm drains are normally designed with an approximately trapezoidal cross-section with a fairly wide base. This means that the depth and velocity of flow of the relatively small amounts of sullage (relative, that is, to the drain's storm-water capacity) will be low, and the risk of blockage and ponding high. If the storm drains are already in existence and lined, it is advisable (but somewhat costly) to modify the channel section as shown in Figure II.9 so that the sullage can flow with a higher velocity in the central section only. If the drains are not already lined, it would be advisable to line at least the base incorporating a reduced central section as shown. If surface drainage is to be provided at the same time as the improvements in excreta and sullage disposal, it

FIGURE II, 8

SULLAGE SEEPAGE PIT

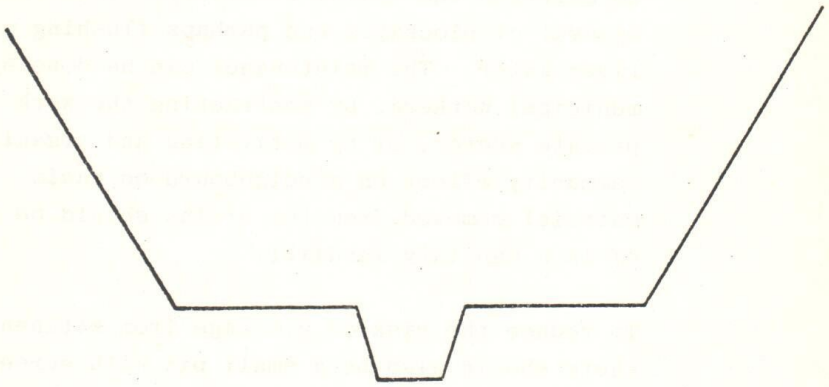


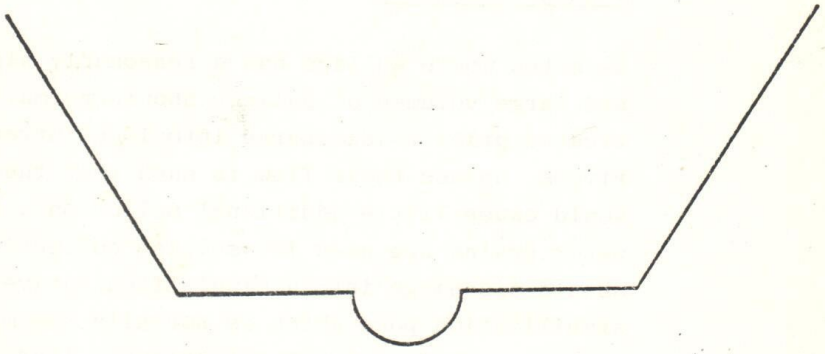
Key:
A. Variable Cover of Soil
B. Tight Joints
C. Open Joints
D. Rock Fill (150 mm Minimum)

Source: (From Wagner and Lanoix)

Figure II, 9

MODIFICATIONS TO STORM WATER DRAINAGE CHANNEL GEOMETRY TO PERMIT INCREASED SULLAGE FLOW VELOCITIES





evidence is available on this point. However, the question immediately points to the importance of the inter-dependencies of water and sanitation choice. The individual who is disposing of 30-40 litres of water a day in his cistern-flushing, water-borne sewer system 'needs' that much more than his neighbour with an aqua-privy.

Cairncross and Feachem (1978) suggest that water consumption can be expected to be in the region of 20 litres per capita per day (lcd) where it is carried from a standpipe as opposed to 80 lcd when available from a single tap in the home.

In analysing data from surveys of low cost housing areas in Kenya (Waweru et al, 1976), de Krujff arrives at an average consumption of 13.7 lcd where water is obtained from kiosks.

In a study of Mathare Valley, Linn (1976) shows an average consumption of 10-11 lcd.

In a recent study of water use in low-cost housing areas in Kenya, de Krujff maintains that health benefits from water use begin to level out somewhere between 30-80 lcd depending on the type of sanitation system in use and its water consumption needs.

Certainly, Bannaga (1977) found in a six month monitoring of households in western Sudan that there were few health benefits obtained above the level of 60 lcd.

In fact the figure of 60 lcd is often taken as a rough guideline of water needs but it should be emphasized again that this depends on the type of sanitation system.

Standpipe supply

Taking this as a rough guideline, however, it is easy to see one of the main disadvantages with standpipe or kiosk

may be advisable to consider alternative channel sections such as triangular ones; these should be lined at the apex in order to provide higher sullage velocities and minimize erosion and blockage.

Whatever channel section is adopted, it is necessary to maintain the drains routinely. This includes removal of blockages and perhaps flushing with river water. The maintenance can be done by municipal workers, by contracting the work to the private sector, or by motivating and organizing community effort on a neighbourhood basis. The material removed from the drains should be disposed of in a sanitary landfill.

To reduce the risk of blockage from kitchen water, there should also be a small pit with screen on the sullage discharge line on the home owner's property. This applies regardless of the means of sullage disposal and includes in particular soakage pit disposal to avoid clogging the pit.

Sullage treatment

As noted above sullage has a reasonably high BOD, and large volumes of sullage should normally be treated prior to discharge into local streams or rivers, unless their flow is such that the sullage would cause little additional pollution. If storm-water drains are used for sullage collection these should discharge into a single facultative waste stabilization pond which is normally the most convenient method of treatment wherever land is available. Maturation ponds are not necessary as the concentration of excreted pathogens in sullage is small. The pond should be protected from high stormwater flows in the wet season by incorporating a simple stormwater overflow weir into the pond inlet structure.

3. WATER SUPPLIES

From the observations made in Appendix I, it is clear that water is the key to breaking the transmission cycle of a large group of diseases. Most of the major faecal-oral transmission routes can, in theory, be interrupted directly by hand washing after toilet contact and before food contact. A reduction in these excreta-related diseases will have other positive spin-offs, for example in a likely reduction in severity of some upper respiratory diseases through the improved nutrition that a reduction in diarrhoeas and helminth diseases will achieve.

Although many or most of the excreta-related diseases can be transmitted via the water supply, when this occurs it tends to be associated with an explosive outbreak resulting from a defective supply or contamination at some point on the distribution network for example where intermittent supply introduces contaminated groundwater into a pipe. Far more frequent is the day to day endemic occurance of excreta-related disease that is not water-borne but where transmission occurs by a more direct faeces-hands-mouth or faeces-hands-food-mouth route. It is for this reason that the availability of sufficient water for personal hygiene is the key issue.

Protection of the water supply is, of course, important but is an often over-rated source of infection. In any case this is not the concern of housing authorities apart from ensuring that on-site contamination does not occur. Of far more importance, is the influence over and control of what happens to that water once it leaves the tap and ensuring that it is available in sufficient quantities to facilitate personal hygiene.

The issue of water and health therefore should start from a consideration of how much water is required to keep a human being healthy. Unfortunately, very little conclusive

supply. A family of five, say, requires then 300 lcd. Ignoring even the cost factor involved (kiosk water is roughly twice as expensive as household water), it is evident that the carrying of 300 lcd from the standpipe to the house is a tremendous burden - indeed consumption will be reduced for this reason alone.

There are other, equally serious problems with standpipe supply. The water taken to the house is in buckets, plastic cans or other containers and is then either put into a storage container or remains in the carrying container. Either way, the use of that water for hand washing is extremely inconvenient. It also introduces risks of contaminating the stored water itself during the process of pouring, refastening lids etc.

Stored water offers many opportunities for contamination from hands and utensils used to take water from the storage container. Many excreta-related diseases can be very effectively spread in this way.

Although of course water from a standpipe is better than no water at all, it is vastly inferior from health considerations than that from a household supply. In view of the large range of common diseases associated with lack of water for washing, we would maintain that water to the house is a top priority and that many other items should be sacrificed in order to achieve this basic need.

Household supply

The key problem with water provision in low-income areas is that of achieving a balance between raising water consumption to health-effective levels whilst keeping capital and recurrent costs down.

It is not the intention of this paper to deal specifically with the economic or engineering aspects of water provision. However, it should be noted that some very sensible

suggestions of how this balance can be achieved have recently been put forward by de Kruijff (1979). It is maintained that using household "Fordilla" self-closing taps, appropriate engineering, flat rate water charges collected in the general rate, rent or loan repayment procedures etc., it is economically feasible to supply all low-income families with household water.

These findings are of the greatest importance to health and should be tested and implemented.

4. VENTILATION AND CLIMATIC COMFORT

From the discussion in Appendix I, we conclude that the issue of ventilation is a much over-rated one as far as health is concerned. It is impossible to show that improved ventilation achieves a reduction in disease transmission.

Much airborne infection - particularly the childhood diseases - is inevitable. Even if houses were constructed to the standards of operating theatres cross-infection would still occur through close personal contact and outside the home. Indeed we have argued that it is undesirable to attempt to reduce transmission risks for such inevitable disease since this will only result in infection later in life with more serious consequences. Several more serious airborne diseases can be made non-inevitable through artificial immunity and efforts are better directed towards vaccination programmes. Earlier and more effective treatment after infection would achieve reduction in seriousness for some diseases. Better nutrition would also reduce disease seriousness for some airborne infections.

We therefore maintain that standards of ventilation are impossible to devise and that spurious standards should not be used to prevent house construction. Controlled legal housing offers the very opportunities for immunisation, treatment and better nutrition through improved

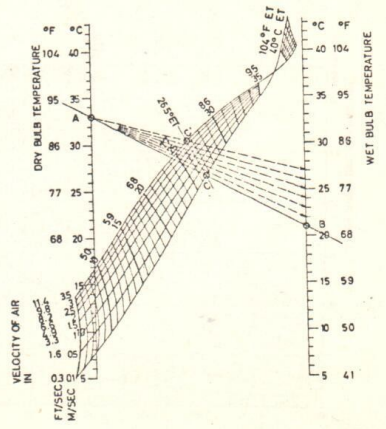
socio-economic circumstances that we should be seeking.

However, ventilation is concerned with human comfort levels. The ability to open doors and windows and to close them again to regulate the house environment is an obvious necessary quality. Similarly, daylight is a necessary factor for indoor activity - the more so where, as in low-cost housing, electric light is unaffordable - and is probably an incentive for maintaining house cleanliness.

It has been suggested (Demeter and Lippsmeier et al, German Research Foundation, 1973) that in the vicinity of the equator, the 'comfort zone' ranges from about 22.5-29.5°C temperature and from 20-60% relative humidity.

Many attemtpts have been made to devise a single measure which would sum up the main factors of 'climatic comfort'. Houghton and Yaglon (1923) proposed the concept of 'Effective Temperature' (ET) to combine the effects of actual temperature, humidity and air movement.

The determination of 'Effective Temperature' can be made using a simple nomogram as shown below.



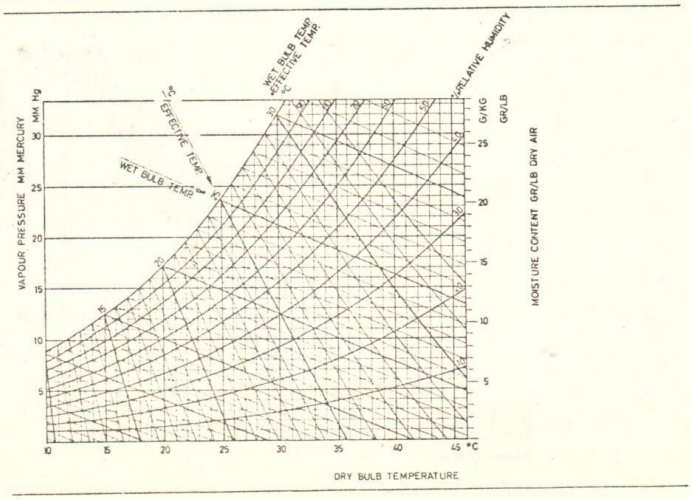
Effective Temperature Nomogram

Knowing values for dry bulb and wet bulb temperature, a line is drawn between the two values. The example shown above connects 33°C dry with 21°C wet. Where this line intersects the curves for air velocity (e.g. 0.1 m/sec) the 'Effective Temperature' (ET) can be read off (i.e. 26.5° ET in the example).

The same series of tests indicated a 'comfort zone' in tropical conditions in the region of 19-26° ET (a little higher for arid areas). Most people begin to perspire noticeably at about 26° ET and at 26.5-30° ET human resistance and efficiency begin to fall markedly. A very difficult environment is found between about 33.5-35.5° ET and an impossible one beyond 35-36° ET.

Similar methods to the above have been developed by the Medical Research Council, London.

In a similar way, a series of nomograms can be constructed for different air movement levels. That shown below is for air movement of 0.1 m/sec. This nomogram also introduces measures of relative humidiy, air moisture content etc.



Knowing the required environmental data then and fixing an upper desirable 'Effective Temperature' (26^{o} ET, say), a nomogram like the first of those above can be used to calculate a required minimum air movement rate.

In practice, however, this is only a partial solution. The designer wishes to know how he should design a dwelling to achieve that air movement and there is no short-cut to this except experiment - models, wind tunnels etc. To be realistic, this would have to be done for every proposed design, inter-house spacing, orientation to prevailing winds etc.

Unless experimental facilities are available, therefore, the designer is obliged to fall back on experience and what is known about the broad principles of house ventilation (see for example, Koeningsberger et al, United Nations 1971; Koeningsberger and Lynn, 1965; Givoni 1965; Goromosor 1965; Van Straaten 1967; Olgyay 1963; Adeeb 1966 etc.

Adequate ventilation is, of course, particularly appropriate in the humid coastal and Lake Victoria areas. Good basic design principles aim to achieve:-

- a low level entry point for air flow to achieve good air movement at body level; combined with

- high exist points to achieve maximum negative pressure effects (where low level flows over the site are constricted by buildings, walls, fences, trees etc.).

- the avoidance of 'dead space' between roof and ceiling or in the high areas of the roof if ceilings are not built.

On this latter requirement, ventilation openings between roof overhangs and the tops of walls are essential in

hot, humid regions. It should be borne in mind, however, that these provide ideal entry points for mosquitoes if no ceilings are provided. To satisfy this problem all that is essentially required is a ceiling in some stretched material or netting rather than a solid construction.

5. 'BAREFOOT' MAINTENANCE TECHNOLOGIES

From the epidemiological discussions of Appendix I and from the earlier sections of this present Appendix, it is clear that organisational, educational and maintenance factors are at least as important as the physical provision of infrastructure.

To be successful, low-cost housing relies heavily on levels of organisation above those of the individual household. It is clear, however, that public authorities are already over stretched with maintenance workloads and suffer from staff shortages etc. Since there is little short-term prospect of dramatic improvement in this situation, it is clear that new, creative solutions must be sought.

One area in which such solutions might be sought is in more community involvement through the development of 'barefoot' technicians.

The term 'barefoot' comes from China where a system of 'barefoot doctors' was developed to compensate for the shortage of conventional doctors. These 'barefoot' medical auxiliaries were selected from suitable candidates from each village, given a basic practical (non-theoretical) training and returned to their villages under routine supervision of the health authorities. There, they continue with their normal jobs, practicing their medical skills as needed. Small additional payments are made to these workers to compensate for time lost from their normal occupational activities.

The concept has been adopted in many other parts of the world in the health field but an added incentive was provided by the success of the Chinese system. It was shown that with a minimum training, these workers could provide a successful system of basic primary medical care.

Additional benefits soon became apparent. First it was discovered that, far from being second rate doctors, these workers provided something that doctors did not - namely knowledge of their village populations. They became trusted and valued citizens without any of the 'social distance' that normally exists between village populations and highly educated doctors from a different social class. Secondly, themedical auxiliary movement has given rise to new diagnostic and clinical management techniques which now have benefits for the more traditional professionals in health care.

This is not the place to go into detail about the medical auxiliary but the analogy with the low-cost housing problem is clear. Why cannot a small number of site allottees be given a simple course of intruction and paid small amounts to provide certain community functions in addition to their main jobs?

Such a 'barefoot sanitary engineer' could provide useful work in areas such as:-

- the maintenance of excreta disposal systems on the site on which he lives. All systems require a degree of maintenance of some kind from advice and arrangements for the emptying of pit latrines to the unblocking of conventional water borne sanitation systems;

- the maintenance of surface water drains;

- maintenance of waste stabilisation ponds;

- maintenance of solid waste disposal; etc.

An important benefit of the 'barefoot' concept is that residents see a responsible person. They know who to complain to. For incidents beyond the abilities of the 'barefoot' worker, at least he is in contact with authorities to effect suitable arrangements or repairs.

Considerable opposition to such an idea can be anticipated from various professional bodies just as the medical profession was vigorously opposed to the 'barefoot' doctor. But if these authorities are unable to provide the necessary services in conventional ways, they must be convinced that realistic alternatives are available.

Some experiments in this concept would be timely and fully consistant with the national philosophy of 'harambee'.

APPENDIX II

COMMENTS ON THE LEGISLATION

D R A F T

APPENDIX III

Comments on the Local Government (Adoptive By-Laws) (Building) Order 1968 (Grade I By-Laws). The Local Government (Adoptive By-Laws) (Grade II Building) Order 1968 (Grade II By-Laws) and their compatibility with the Public Health Act 1972, the Local Government and the Drainage and Latrine Rules and each other.

Applicability.

Both Grade I and Grade II By-laws are adoptive by any municipal or county council. This By-law 2 leaves out a number of other local authority who appear in effect to be using the Building Code (i.e. Grade I and II By-laws). It seems that Grade I rules are being used by many authorities whether they have been adopted or not. However, it seems clear that under the Local Government Act Revised 1978 Section 4, all local authorities are either Municipalities or County Councils. The City of Nairobi is included as a municipality under 4 (a). It also appears that all lesser authorities derive their existence from the County Councils.

The Public Health (Drainage & Latrine) rules have been applied to certain local authorities but not all (see note on Subsidiary Legislation page 1).

The Public Health Act and the Local Government Act apply to all areas of Kenya.

As far as applicability is conerned, generally the Grade II By-laws would apply to scheduled areas within municipal or county councils who have adopted them. However, this would apply to specific matters actually included in the Grade II rules and where these are silent, then senior rules would apply and finally an Act.

Housing and Public Health Legislation.

General

The main statutory instrument is the Public Health Act.

Important subsidiary legislation is contained in:-

The Building Rules 1962 (Have they been repeated?)

The Public Health (Drainage & Latrine) Rules, 1948

The Public Health (Kisumu Density of Dwellings) Rules 1948

The Public Health (Medical Officers of Health and Health Inspectors) Rules, 1963.

In addition there is the Building Code containing:-

(1) The Local Government (Adoptive By-laws) (Building) Order 1968.

(2) The Local Government (Adoptive By-laws) (Grade II Building) Order 1968.

The Building Code is subsidiary legislation of the Public Health Act but made under regulation 210 of the Local Government Regulations 1963 by the Minister for Local Government in accordance with Section 126A(5). The Building Code does not have the force of law until the Adoptive By-Laws are adopted by any municipal or county council. This is not obligatory but permissive only.

Under Section 126A of the Public Health Act local councils may and shall if required by the Minister for Local Government (with the agreement of the Minister of Health) make by-laws

as regards buildings, works and fittings, the planning procedure, the inspection of works and alterations. No by-law can be inconsistent with any written law in force in the same area made under any other provision of the Public Health Act. It must be presumed that the Building Code has the agreement of the Minister of Health. We need to know which councils have adopted the Building Code and whether any amendments or additions have been made by individual councils.

It remains to ensure that there has been no subsidiary legislation relevant to housing since 1972.

The Public Health Act (Revised 1972) CAP. 242.

The relevant sections are as follows:-

Preliminary

Section 2. Interpretation.

This section contains a series of definitions relating to housing which are repeated to some extent in subsidiary legislation. The interpretations are the crucial ones and take precedence over any in subsidiary legislation if the latter are incomplet or obscure.

Thus interpretations require speical noting. "drainage authority" means the Ministry of Works or any other authority the Minister of Health may appoint for any particular area. Note: The Minister has presumably appointed the Engineering depts. in Nairobi, Mombasa, Kisumu and perhaps others.

"health authority" in relation to the area of a municipality means the municipal council of the municipality concerned, and, in relation to any other area, means the Minister of Health.

PART II Administration

Section 10 (2)

Included in the legal functions of the Medical Department; "to advise and direct local authorities in regard to matters affecting the public health."

Section 13

Sets out the duties of health authorities in general terms.

Section 14

Allows for the failure by a municipal council to exercise its powers and duties for these to be undertaken by default by the Minister of Health.

Section 15

Refers to agreement of the Minister of Health being necessary when any by-laws relating to Public Health are to be approved by the Minister for Local Government.

Section 16

Makes it clear that the Public Health Act has overiding authority with regard to any law made under other Acts relevant to health.

PART III Notification of Infectious Diseases

Nothing specifically relevant.

PART IV Prevention and Suppression of Infectious Diseases

Section 21

Gives right of entry to M.O.H.

Section 22

Cleansing and disinfecting of premises by the health authority.

Section 23

Allows for the destruction of infected buildings on the medical officer of health's authority. Compensation.

Sections 30, 31

Infected house may not be let. True information must be given to prospective tenant.

PART IX Sanitation and Housing

This is of course the most relevant part, it is the final authority where doubt exists in any subsidiary legislation and the only authority where subsidiary legislation does not exist.

It extends from Section 115 to 126C.

Section 115

No person shall cause a nuisance or allow one to exist on

land or premises owned or occupied by him. Or other condition liable to be injurious or dangerous to health. Nuisances are specified in Section 118.

Section 116

Every local authority is oblied to maintain its area in clean and sanitary state and to prevent nuisances occuring. The L.A. is empowered to prosecute offenders.

Note: No mention is made of the funds necessary to perform these functions. Any penalties are paid in to the treasury presumably.

Section 117

This section relates particularly to the duty of the L.A. for preventing or remedying any conditions arising from the following:

Erection of unhealthy dwellings

Occupation of unhealthy dwellings or premises.

*Erection of dwellings on unhealthy sites

Erection of dwellings on sites of insufficient extent

Overcrowding

Erection, condition or manner of use of factory or trade premises.

Section 118

This lists 19 causes of nuisances. The ones relevant to housing are:-

(b) A dwelling so constructed or in such condition

which in the MOH's opinion is dangerous etc. to health or liable to spread infectious disease.

(c) Refers to situations in the external environment. Likely to be offensive or dangerous etc. to health. Includes. Streets etc., streams, gutters etc. latrines etc. Dust bin, refuse pits etc.

*(d) Water. Used domestic or any drinking purpose. Opinion of the MOH polluted or injurious or dangerous to health.
Note: Really applies to drinking water only.

(e) Above would cover standing water liable to breed vectors carrying disease and nuisance insects.

(e) Discharge of noxious or other waste into public street or any public waterway.
Note: Prohibits household? being put into open drains. (vide Lamu).

*(h) Accumulations of refuse constitues a nuisance.

*(i) Any accumulation of building materials if MOH thinks is likely to harbour rats etc.

*(j) Premises likely to harbour rats.

(k) Overcrowding - being injurious etc to health.

Dilapidated.

Defective in lighting or ventilation.

Not provided with sanitation.

Situated so sanitation cannot be provided to the satisfaction of the MOH.

Note: A very important subsection. It all depends upon interpretation especially overcrowded premises. Lighting, ventilation and sanitation standards are specified in subsidiary legislation.

(m) Any occupied dwelling without proper, sufficient and wholesome water is not available within a reasonable distance.

*(p) Any area of land kept or permitted to remain offensive, liable to cause disease, injurious etc.

(s) Any act, omission or thing which is or may be dangerous to life or injurious to health.
Note: (s) is quoted in full. No one's opinion is required therefore depends upon the Courts. A let out clause.

Section 119

Sets out the methods to remedy or remove the nuisance. Duty of the MOH.

Owner responsible for structural defects or where the occupier

cannot be found.

MOH can remedy where the author of the nuisance cannot be found or where the nuisance does not arise from the actions of occupier or owner.

Section 120, 121, 122

Procedure if nuisances not remedied.
Penalties. Court procedure and powers.

Section 123

Rights of entry for examining of nuisances.

Section 124

Demolition as the result of a nuisance and so dilapidated or so defectively constructed or so situated repairs not likely to remove nuisance or render dwelling fit for habitation. (The Court decides not the MOH or his staff who give evidence). One month at least notice to demolish. No compensation. The section details procedure.

Section 125

Medical Department has the duty to survey overcrowding bad or insufficient in the various districts of Kenya.

Inquire into best methods of dealing with overcrowding or bad housing. Publish recommendations.
Note: This would now appear to be more in the province of the Ministry of Housing.

*Section 126

This empowers the Minister of Health, with the advice of the Central Board of Health to make rules and confer powers with regard to implementation on local authorities, magistrates, owners and others. These include:-

(a) Land, dwellings, buildings etc. free from nuisance or danger to P.H.

(b) Construction buildings, lighting and sanitation, overcrowding.

(c) Cleansing, whitewashing or other treatment.

(d) Drainage and disposal of waste.

*(e) Sub-division and lay-out of land for building sites.
Street levels etc.
Limitation of numbrs of dwellings
Proportion of site to be built on
Zoning

(f) Inspection by L.A. for public health purposes.

Note: Subject to any rules that may have been made after 1972, the Minister of Health has only made rules as referred to above. It should be noted that the Kisumu Density of Building rules appear to be very old but were still in force in 1972. These fules were clearly made by the Minister presumably under

Section 126 above subsection (e).

This particular section (e) is, important in relation to 'infrastructure' and also siting but it does not appear that general rules or others applying to specific Municipalities have been made.

It would also appear that the Building Rules are no longer in force since they are not attached to the revised Public Health Act of 1972. This is borne out by the fact that the Public Health (Drainage & Latrine) Rules which originated in 1948 and amended in 1959 and 1960 are attached.

Section 126A

This section has already been referred to in the paragraphs under General. It is this section which empowered the Minister of Local Government to introduce the Building Codes.

We should need to know not only how many councils have adopted the Building Code but also whether councils have in fact (as they are empowered to do) made amy By-laws of their own. It would appear that until either the Building Code is adopted or By-laws are made that there are no legal provisions applying to Building (as the old Building Rules did) except those provisions contained in the Public Health Act itself.

Section 126B

Allows L.A. to release its own By-laws with the approval of the Minister for Local Government and the Minister of Health.

There are conditions.

Section 126C

This deals with the procedure to be adopted for presentation of plans to the L.A.

It should be noted that there is provision in Subsection (3) for the determination by the Court (not any Minister) if an applicant considers the L.A. has not applied the By-laws correctly. There are conditions.

The prescribed period for the passing or rejection of plans is one month. The plans must be presented (when meetings are monthly) 3 days before and the period can be extended to 5 weeks.

The L.A. within the first month may extend the period by one further month.

The maximum period therefore becomes 66 days.

Section 126D

This is a long section dealing with work either commenced or undertaken illegally or where plans have been passed, building is not in accordance with the plans. It deals with the procedure and the Courts function.

PART X Protection of Foodstuffs

Section 127

Unspecific protection from rats. Subject on three occassions to the opinion of the Medical Officer of Health.

Appeal to the Court allowed who may acquit an accused if it is satisfied. That reasonable steps have been taken!

Section 128

Prevents the case of a kitchen or room used for food storage for residence or sleeping.

Gives powers to Medical Officer of Health.

PART XI Public Water Supplies, Meat, Milk and other articles of Food

*Section 129

L.A. to ensure that any water which the public has a right to use is not polluted dangerously to health.

L.A. has the duty to purify any polluted source.

Note: Polluted is not defined in the Act.

*Section 130

Empowers the Minister of Health may make rules applicable to defined areas for:-

Prohibiting bating in, clothes wahsing etc,

animal

which might cause water to be used for drinking etc. to be polluted.

Prohibiting or regulating the erection of:-

Dwellings

Sanitary convenience

Stables etc.

Dipping tanks

Factories

any of which might cause pollution.

Due regard to be paid to agriculture and other industries.

Note: Although the Drainage & Latrine rules do make some reference to pollution and effluents they were not made under Section 130 but under Section 126. No rules have been made up to 1972 under this Section.

PART XII The Prevention and Destruction of Mosquitoes

*Section 136

Spells out not only that mosquito breeding is a statutory nuisance (to be added to those in Section 118) but refers to other parasites of man or domestic animals. In practice this is a comprehensive section.

*Section 138

Premises or land shall not harbour mosquitoes. Overgrown bushes, long grass. Opinion of the MOH sufficient.

*Section 139

Wells etc. to be covered to provent entry of mosquitoes. To be properly protected or screened to the satisfaction of the MOH.

*Section 141

MOH may require gutters etc. to be perforated every 2 feet to prevent accumulations of water.

Immature stages of mosquitoes may be destroyed by application of oil or larvicide or otherwise.

Section 143

Presence of mosquito larvae an offence.

PART XIV

*Section 152

Should be read in full. Minister of Health may make rules for conduct and inspection of lodging houses.

Note: He has not done so up to 1972.

No person to keep lodging house unless the house is registered and the keeper is licensed by the L.A.

N.B.

Lodging House is defined in Section 2. It is clear that any house which sublets comes under this definition. According to

the lasw as it stands all such letting is subject to Section 152. Is this Section implemented in practice.

*Section 157(2)

Empowers the Minister of Health to make rules for:-

Preventing standing water

Drainage and control of standing water

Inspection repair and cleansing channels etc.

This in connection with the irrigation of land.

PART XV Miscellaneous Provisions

Sections 159-169

None of these sections are directly relevant to housing. They deal with procedural matters, powers, duties and prosecutions.

The final section 169 gives the Minister of Health powers to make rules generally. The Public (Medical officers of Health and Health Inspectors) Rules 1963 were made under this section.

Notes on Subsidiary Legislation to the Public Health Act relevant to housing

The Public Health (Drainage & Latrine) Rules.

This note will deal with the general provisions and application of the Rules. There compatability with other legislation will be discussed separately.

Rule 2

The Minister (of Health) may by notice apply the Rules to any area of a local authority.

All the Rules have been applied to:-

Kisumu, Eldoret, Nakuru, Kitale — Municipalities

Nyeri, Nanyuki, Malindi, Voi, Thomsons Falls, Kabarnet, Karatina — Townships

Parts of Kiambu

Naivasha Urban District Council

Gilgil Township

Ol Kalon Township

Embu Township

County Council of Nairobi

The rules have also been applied to the following with the exception Rules 77-82 which relates to Licensing of Plumbers and Drainlayers.

Townships

Kakamega
Kisii
Kericho
Bungoma
Ngong
Kiambu
Limuru
All within Nakuru County & Lanet Planning Area

Kisii Township is not subject to Rules 18 and 24 dealing with inspection chambers in manufacturing premises and connections to public sewer by residents outside township area.

Note:

The Rules do not apply to Nairobi City Council or Mombasa Municipality. There is a reference to the City of Nairobi (Building) (Amendment) By-Laws 1965 in the published revised legislation. However, it is clear that By-laws made under 126A are not published as appendices to the law.

With regard to the Low-Cost Housing By-Law Study, it is important to discover what laws actually do apply. Of the 11 (eleven) towns selected,only 4 apparently apply the Drainage & Latrine Rules. Whilst it can be expected that Nairobi and

Mombasa have adopted or introduced suitable by-laws it seems unlikely that the others have done so.

General Note

Drainage and Sanitation or Latrine provisions are contained in at least the following:-

The Public Health Act. Part IX
The Public Health (Drainage & Latrine) Rules
The Local Government Act. Sections 168-176
*The Local Government Regulations 1963
The Local Government (Adoptive By-Laws) (Building) Order 1968
The Local Government (Adoptive By-Laws) (Grade II Building) Order 1968

It is probable that to these should be added:-

The City of Nairobi (Building) (Amendment) By-Laws 1965
By-Laws applicable to Mombasa

It would seem likely that Low-Cost Housing could be established by any Local Authority. At present and at this stage of the study, it is uncertain what legislation would apply to any particular area. The Grade II Adoptive By-Laws can at present be adopted by any municipal or country council. However, it appears that there are other Local Authorities. The Local Government Act defines a local authority as "a municipal council, county council, town council, urban or area council". It also in the definition refers to a local council which is defined as one established under section 48 of the Act. Part III of the Act

sets out the law relating to Municipal Councils (5.12 ff) County and Town Councils (5.28 & ff) Urban and Area Councils (5.41 & ff) and Local Councils (5.48 & ff).

It would appear that in each case the law requires such Councils to be established. This may or not have been achieved, it may be that Kenya is administrately divided into Municipal and County Councils only but this seems unlikely.

On the other hand, the Local Government (Adoptive By-Laws) (Building) Order 1968, similarly can be applied only by any municipal or country council. Both the Adoptive By-Laws exclude from application areas to which one set of By-laws have been applied. In each case the By-laws need to be specific about application. In the Local Government (Adoptive By-Laws) (Building) Order 1968, By-Law 3 (3) contains the provision and in the Grade II By-Laws, By-Law 3 deals with application.

The situation is at present confused since it is possible that several statutory instruments could apply to the same area. In practice this is probably not important but at least any new By-laws or other instrument should be clear on what laws, rules, regulations or By-laws do actually apply.

There is nothing contained in the Grade II By-laws which relates to the requirements for general drainage, sanitation, roads, solid waste disposal of a housing area (infrastructure). The By-laws are concerned with individual plots and buildings or dwellings built upon them by plot owners. It seems clear that

where these By-laws are silent on any particular matter or have not been adopted, the higher rules or laws will apply. In considering what laws apply to the 'infrastructure' it is probable that from the engineering point of view all relevant legislation must be taken into account.

The Public Health (Kisumu Density of Dwellings) Rules 1948

These Rules are made under Section 126 of the Public Health Act. They apply only to the Municipality of Kisumu. No similar rules had been made up to 1972.

They are possibly derived from some older provision since Rule 5 refers to the 1st April, 1929 though this could well be a misprint for 1949.

The rules include the following provisions:-

The proportion of plots to be built on
Limits development to 35 houses to an acre
Access to plots
Minimum frontage of 14 feet

The Public Health (Medical Officers of Health and Health Inspectors) Rules 1963

Made under Section 169 of the Public Health Act with reference to Section 9 (1A). In effect only Municipal Councils may with approval appoint a medical officer of health. Presumably, other MOH are direct appointees and employees of the Central Government. The position of Health Inspectors is not clear.

Rules 10 & 11

These contain the functions of the MOH and the HI respectively. It is clear that where they are appointed they have responsibility for all public health matters including health aspects of housing.

REFERENCES

(Not yet typed)