STANDARDS AND CONSTRAINTS IN URBAN RESIDENTIAL ESTATE CIRCULATION SPACE LAYOUTS

An Assessment of the Current Practices in Residential Estates in Nairobi.

By

I,

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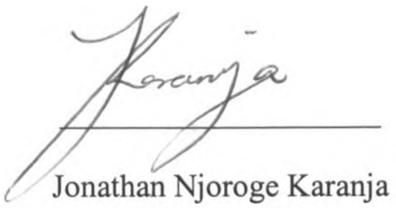
This project is submitted to the Faculty of Architecture, Design and Development, University of Nairobi, in part fulfillment of the requirements for the award of Bachelor of Arts Degree in Building Economics and Management.

August 1999

DECLARATION

I hereby declare that this Project Work is my original work and has not been presented for a degree in any other University.



13/8/99

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This Project has been submitted for examination with my approval as the Candidate's Supervisor and it is to the best of my knowledge, an original account of his field research and investigation.

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DEDICATION

I dedicate this piece of my life, University Education, to dad, **F**redrick; mum, **J**osephine and my dear sister **I**rene.

I would give anything and everything for my family,

my partners in discovering,

the wonder of love,

the fullness of life,

the Glory of God.

Jesus and You make me complete.

I Love You.

Jonathan

APPRECIATION

Because there are so many people who are the reason why I am who I am, I believe with all my heart that it is impossible to call names without offending someone. I never want to be guilty of hurting people who have helped me when I didn't deserve to be helped, and tolerated my imperfections for the sake of this project. I am sincerely humbled by your kindness and unworthy of your friendships and acts of kindness.

To my classmates, lecturers, City Council Official, all the residents who filled my questionnaire every friend, every person who spent time, money, thought to add value to this research project; **TO YOU I SAY THANK YOU**.

SPECIAL THANKS to Mr. H. Gichunge and Mrs. Nzainga for sifting through all that I had done to come up with what I now present. Mike Njagah; roommate, friend and IT advisor rolled into one. Mr. Nzioki for allowing me IT facilities in trust. Irene, Janet and Ann, for allowing me to be, Pauline Njoroge, a steady thought of happiness through it all.

ALL THE GLORY to **JESUS CHRIST** my Lord and Saviour: I am who I am because You have always been and will always be who You are, the King of Kings.

ABSTRACT

This study constitutes a study of the circulation space through the assessment of the statutory requirement, standards and guideline that are put into consideration during the design of the circulation space of residential developments. The study will draw a parallel with the design criteria that are used in other more developed countries. Against this background the study will then evaluate the existing state of the circulation spaces in residential developments in Nairobi with the purpose of ascertaining

- Whether this standards have been adhered to,
- If the standards that have been adhered to, in existing residential developments are sufficient?
- Why the standards have not been adhered to, in existing residential developments?
- The resultant effect of adherence or lack of adherence to the set standards.

The study will incorporate data obtained from field observation, dispensing of questionnaire and measurement to draw conclusions and possible recommendations. The residents' satisfaction and observed statistics will form the yardstick of gauging the suitability of the existing standard.

Methodology & Findings should be part of the abstract

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1.0 INTRODUCTION

The Circulation System of roads, streets, paths, walkways and parking facilities is one of the most expensive of any site development, with the exemption of major buildings, in terms of space and construction costs. While the design team designs these facilities to be functionally essential, they are also potentially costly in terms of environmental and visual quality.

Circulation spaces perform the function of circulating traffic in the form of pedestrians, vehicles and goods. This facilitates and upgrades usefulness of the building forms within the development. The Circulation space layout is one of the most important and permanent features of the physical plan of a residential estate the roads allow for the movement of cars while the walkways allow for the movement of pedestrians. The separation of the spaces prevents detrimental collusion of objects and persons within the system.

If the aesthetic implications of a street and parking lot system are considered for a moment, it is apparent that the Circulation Spaces are one of the most dominant visual parts in any site. The road in fact, controls the way a developmental site is seen or viewed from vehicles by dictating the path, and therefore the sequence of view points. Walks have a similar influence on the pedestrian, but at lower speeds. (Lanphair Harlew [1])

The idea and use of standards in residential estate Circulation Space layout design is familiar to the design team, planners and local Government administrators. Implied in the idea of a standard is the existence of measurable feature of a design, which have qualitative importance. Given the existence of some measure, a standard according to Dean Hawkes [2] is defined as a "fixed value or a range of values for it."

"A constraint is again a variable to which a measurable value can be attached, but here the direct qualitative association of the standard may be omitted" (Dean Hawkes [2]). The outright distinction between the two may be clarified by an example of each. A statement that a five-person house must have a minimum floor area of x m^2 is a

standard. It is possible to think up many ways in which that space can be organised to produce a satisfactory house. A statement that a house must be two-stories in height is a constraint in that it imposes a limit to the range of possible solutions.

At the practical level it is often found that standards have general application and relevance; they offer a basis for many designs, but constraints are frequently more specific in their application and effect, often being imposed on an individual design. It is seen that the unique location and dimensions of a site act as a major set of standards. Similarly, national or local policies about such factors as density and maximum building height, or road width, operate as constraints on all the designs to which they are applied.

In most countries, there are legal controls over the use of land. Its is important to understand how these affect Circulation space, as well as it does the house or building on the land.

Circulation Space, as earlier stated, is one of the most important and permanent features of the physical plan of a residential estate. Because of its important impact on daily life and general development, Circulation Spaces are, and will continue to be an avenue to problems to residents if the design is faulty. Circulation Spaces govern without doubt, the mobility of residents in that estate and the greater urban environment.

Mobility if defined implies the "notion of speed at which a person or objection can move about in an estate or area in which they live." (Christopher Doubleday [9]) Consequently, as the availability of an independent personal means of movement (cars) becomes important, the estate Circulation Spaces' ability to accommodate that means needs serious consideration. A comprehensive view ought to therefore include movement through the physical capability of walking as well as the availability of mechanical modes.

It therefore follows that for the mobility of an estate resident to be desirable, space and time factors have to be considered. However, since in general movement within or without estates does not just occur for its own sake, it is necessary to embrace a wider

view and adapt the concept of an activity. It is the activity that gives propulsion to the individual to desire space and time resources. (Dimitrus Harry [3])

1.1 PROBLEM STATEMENT

When a residential development is considered as a function consisting of many activities, and some activities consist or exist within a given confine of space, it will be viable to avail space for this activities to occur. Circulation of residents' goods and vehicles likewise requires space. It can be reasonably assumed that the individual has a set of needs and desires for space and time usage in the estate's road layouts, due to their efforts to fulfil activity undertaking at various locations within and without the estate. The existing transport infrastructure in some estates does not account in its design for this need. What then seems to result is the encroaching on the space provisions of other activities like footpaths, flower beds and the like. Activities confined to the road space sometimes flow over into footpaths, flowerbeds, and open spaces.

If Circulation Spaces can no longer service their activities then the activity flows onto the space of other activities. When this occurs then fault can be traced to either design or legislation / policy governing the design for the activity.

This is evident in residential estates when cars are parked on the kerbs, or on the pedestrian walks or on the open spaces. The collusion that occurs between pedestrian traffic and vehicular traffic shows the overflow of an activity into the space of another activity. This outward manifestation is due to the adherence or lack of adherence to Standard and Constraints as seen in various statutory instruments. It is seen in the form of traffic congestion, air/ noise pollution, higher accidents (Car to car, Car to bicycle, car to pedestrians), increased inaccessibility of under privileged groups, parking problems, decreased pedestrian precincts, a damage to estate aesthetics, and encroachment on open spaces and children's play areas.

Given the importance of Circulation Spaces on daily life and general development, it follows that if their design is faulty, then they become major avenues of residential

problems. A four-year research conducted by Road Research Laboratories [8], on traffic accidents involving pedestrians in Britain revealed that nearly 75% of all road accident casualties occur in built-up areas like residential areas where the speed limit of 50 or 70 Km/h apply. It further showed that the group of pedestrians most vulnerable to accidents was the young children and the elderly adults.

Pedestrian casualties in one-vehicle accidents investigated over the four-tear period showed that that on speed restricted roads the action of pedestrians prior to fatal or serious accidents were as follows: -

Crossing roads masked by stationary vehicles	19%
Crossing roads masked by moving vehicles	4%
Crossing roads not masked by vehicles	46%
Walking, standing or playing on the roads	9%
Stepping, walking or running off footway or verge	16%
On footways or pedestrian refuge	4%
Unknown	2%
	100%

Cyclists, motorcyclists and their passengers were found to be involved in about 40% of all casualties in built-up areas.

From the statistics just mentioned, it may not seem apparent, but the "objectives of Circulation Space design is to provide for the normal movement of pedestrians and vehicular traffic. It is also for convenience in the performance of external tasks, to safeguard safety and minimise accidents and guard against obsolescence of the Circulation space infrastructure." (James Ford [10]).

An analysis of the existing Circulation Space layouts therefore reveals a considerable variation in road provision (road area per hectare, road area per person etc) from one residential development to the other, even when all the factors are similar. "Areas of tarmac" have been seen to be insufficient in providing for the space-need of residents in most estates. The cause can be attributed to the Standards and Constraints as

stipulated by the existing Building Codes from the Local Authority or City Planners, Road Design Manuals from the Ministry of Transport..

The level of Congestion and collusion in the Circulation Space in a residential estate is a direct derivative of the shortfalls of accessibility, and this has led to the saturation of the vehicular and /or pedestrian Circulation space. Saturation of as transport channel is said to occur as the time to go through it increases towards infinity, that is, the traffic stagnates. (Maricial Echerique [4]) Thus evidently the case in some residential estates, see Plate 1, where snail pace bumper to bumper traffic is witnessed in the morning rush hour and after working hours.

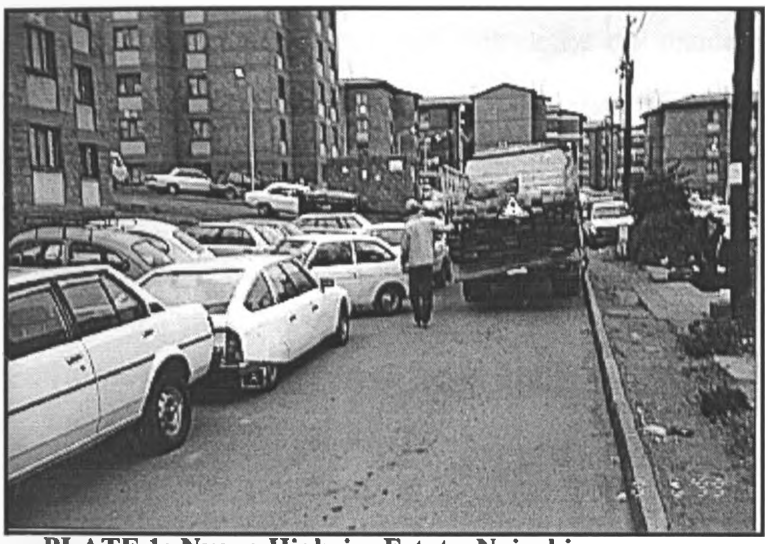

PLATE 1: Nyayo Highrise Estate, Nairobi

The issue arising from these realities is to ask if the Standards and Constraints of the type currently in existence accurately reflect the real priorities in Circulation space design, and ask if they are compatible with the reality of the end user - residents.

1.2 ORGANISATION OF THE RESEARCH

This research is organised in five chapters, with each chapter tailored to a specific section of the research.

Chapter One is an Introduction of the research area, that begins with a definition of standards and constraints as would be applicable in relation to

Circulation spaces. The chapter goes ahead to give a definition of Circulation spaces that will be the working definition for the study. From the working definition of Circulation spaces, the study will look at the current reality in existing residential developments against the backdrop of the existing statutory instruments, policy and legal framework that guided their design and construction. The chapter also outlines the objectives of the study, hypothesis of the study, significance of the study. It also defines terms commonly used in the research study.

Chapter Two, to a great measure, comprehensively looks at the existing literature in relation to highlighted problem and issues. The review of published and unpublished literature of related text forms the theoretical framework that constitutes the basis and yardstick of the research. Literature on standards adopted in other counties mainly Britain and United States of America is also critically examined. This standards and their implementation will help shed light to how much change we would need to adopt locally to achieve the standards accepted and adopted in developed countries. The search for relates literature will also see the researcher utilise the Information Technology facility of the Internet. On the *Internet*, he shall review published books and research work that is posted on websites all over the *Internet.*

Chapter Three outlines the different legislation and statutory instruments that affects Circulation Spaces within the Municipality of Nairobi and Kenya in general. It examines the Building Code, Road Design Manuals, and City Roads Engineers clauses and policy on Circulation Space. It also traces the history associated with roads and footpaths that has led to the deriving of the current legislation and policy.

Chapter Four has been compiled after the fieldwork of the study, has been conducted. It outlines the method used in the data collection and analysis. It shows statistical representation of manifested Circulation Space problems in the case study residential developments and the resultant social impact assessment. It contains feedback by way of responses and opinions obtained using questionnaires and observation sheets prepared for this study. Conclusions from chapter three are outlined in this chapter. Problems and setbacks encountered in the course of the fieldwork are also highlighted.

Chapter Five comprises of the Conclusions and Recommendations from the fieldwork, in addition to the professional recommendations made. Areas of possible further research identified will be outlined.

1.3 STATEMENT OF HYPOTHESIS

The current Standards and Constraints as stipulated in the current Legislation or Building Codes, Planning Law and Road Design Manuals do not in totality cater for the Circulation Space needs in residential estates.

1.4 RESEARCH OBJECTIVES

1. Establish whether or not current By-laws, Legislation or policy framework on Circulation spaces in residential estates, adequately addresses the need and function requirement of the residents.

2. Identify and outline the social impact of adherence or lack of adherence to laid down Standard and Constraints.

3. Identify the space demands in relation to Circulation Spaces that exist in residential neighbourhoods.

1.6 SIGNIFICANCE OF STUDY

The purpose of this study on Standards and Constraints in residential estate Circulation spaces is oriented mainly to serving the decision making needs of policy makers and design tram members. This will be by highlighting the impact of the Standards and Constraints on the end-users. This will facilitate decision-making process at the policy or legislation formulation stage. This will aid in making

necessary change and amendments that bear positively on the Circulation space of the residential estate.

It will aim at improving the formulation, design and administration or road/Circulation space policies in order to ameliorate the disbenefits and increase the benefits to residents in estates.

It also aims at examining the ways in which Circulation space layouts in estates could be satisfactorily amended at the design stage. The research output is therefore also targeted at the design professionals with the hope of integrating intended residents' needs and desires for mobility space, at the design stage. It is at this level of detailed design that this study hopes also to contribute, where performance can be exhaustively examined by the design team.

1.7 SCOPE AND LIMITATION

The study has been undertaken with reference to residential estates in Nairobi area. This is due to the limitation of resources as pertaining to time, human resource and finances. Also Nairobi being the most developed City in Kenya, the province possesses acute problems in regards to Circulation spaces, that are yet to be experience in a greater part of Kenya. Hence the selecting of residential estate in the province of Nairobi.

The study will address itself to the corridors of land between residential boundaries set aside to enhance human and automotive mobility. Variables affecting transportation like traffic generation, traffic categorisation, construction quality shall not be all addressed, and mention will be made only where those variables have a major impact on the discussion of argument being generated by the researcher.

1.8 RESEARCH METHODOLOGY

The research methodology used to compile this paper will comprise the collection of primary and secondary data, from which an analysis will be made.

Primary Data will be obtained from the following sources

- **Questionnaires** will be administered to sample residents, residing in the selected case-study residential estates in Nairobi that the researcher will have sampled to visit. This will be in a bid to get their views in relation.to the existing Circulation Space realty in their residential developments.

- **Role-playing or Observation**. The researcher will visit residential estates as a visitor, and reside in some as would a guest, so as to get the feel of the Circulation space in the particular development. From observation and experiences, the researcher will be able to make appropriate conclusions.

- **Measurement**. The researcher will visit different residential developments and measure the width of roads and footpaths, calculate the parking space allowance per residential unit, record the condition of the Circulation space features like street lighting, and street furniture.

Secondary Data will be obtained from what has already been researched and written by others on the subject of the study. This will be obtained from research papers, professional journals and articles.

The researcher will also seek permission from the City Planning and Architecture Department of the City Council of Nairobi, to peruse over the development plans or site plans of existing residential developments. This is in order that he may calculate the percentage of Circulation space (road, footpath, parking space) in relation to the total area of the site per each residential development that will be used as a case study in this research.

SAMPLING

Since it is not possible to examine each and every of the residential estates, residents, or design professionals in each of the target population, a sample will be used in order to obtain a representation of the population.

Out of the possible number 214 residential developments in Nairobi, a sample to represent the population will be obtained. The same will be obtained from the design professional of whom a definite number could not be obtained for the purpose of this study.

The research aims at maintaining a confidence level of at least 75% in the obtaining of data. Assuming that the research wishes to have at least 75% Confidence Level in the data obtained, it mean that in any question answered, it will be within 75% of the correct answer. Taking a higher value than this would only serve to increase the accuracy of the findings, but would evidently require more time and money resources.

For analysis the data collected, simple descriptive statistical methods are used. This includes percentages, averages and mean and median.

The methodology to be employed in the gathering of data from the case study involves also an assessment of the Circulation space facilities. By use of measurement of linear dimension of Circulation spaces that are used for movement of persons and goods, including terminal facilities, parking spaces, road provisions and pedestrian footpaths. Analysis and interpretation of data concerning the existing conditions in the case study, against the back drop of Building Laws and the planners drawing (if in existence). This entails thus the factual collection of data in relation to existing land-use.

1.6 DEFINITION OF TERMS

Act (Ordinance) – A Government (National), authoritative decree, law or regulation to control the physical development of the built environment. This can only be amended by a Legislative authority and is statutory in effect.

Building Codes – Set of practical, technical and administrative rules and requirements for the construction of buildings. Unlike building regulations, codes are not mandatory but could be made so by appropriate reference in the regulation, whereas building codes are technical requirements and details, which support the regulations.

Statutory Instruments or Building Regulation (or rules) – A set of detailed regulations to control the construction of buildings. They expand on the purely legislative document of acts and ordinances, but on their own they are statutory and must be complied with. The term "building by-law" is technically synonymous with building regulations but it refers to rules adopted at the local level as opposed to the national level.

By-Law – Similar to an Act, but enacted by a subsidiary authority, such as a Municipal council. It is also statutory in nature.

Constraint - It is a variable to which a measurable value can be attached, but here the direct qualitative association of the standard may be omitted (Dean Hawkes [2]).

Design Team – This refers to construction professionals who are engaged in the construction of a project. The term refers to the Architect, Quantity Surveyor, Structural Engineer, Civil Engineer, Mechanical Engineer and Electrical Engineer.

Specifications – Synonymous with standards in that they refer to certain stipulated requirements under which design elements will be deemed satisfactory. They are not mandatory unless it is specified in building contract and are usually published separately from codes and regulations.

Standards – The idea and use of standards in residential estate Circulation Space layout design is familiar to the design team, planners and local Government administrators. Implied in the idea of a standard is the existence of measurable feature of a design, which have qualitative importance. Dean Hawkes [2] defines a standard as a "fixed value or a range of values for it."

Street – A road that has become partly or wholly defined by buildings established along one on both frontages. A form of layout constituting a carriage-way for vehicles that flanks pavements for pedestrians and with frontage developments with direct access to premises for pedestrians and occasionally for vehicles.

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CHAPTER TWO

LITERATURE REVIEW

LITERATURE REVIEW

The basic component of any residential housing site is the dwelling unit. A dwelling unit is linked to a family, single adult, young people, couple etc. Beer Anne [1] suggests that the design team knows before hand the intended inhabitant. Is needs to determine whether limitations of the inhabitants are to be dictated by the income of the inhabitants or by a housing distribution policy within the control of the local government or other agencies. Such factors will determine the social, economic and age/sex structure of the inhabitants and have a strong impact on how an area should be shown.

Beer Anne [1] continues to say that in addition to the number of units to be provided on a given area of land, the site planner, therefore tries to find out the special characteristics of the future population of the site. The design team also establishes the preferred type of unit, the preferred form of the development, as well as the client's intention concerning community facilities and access to circulation networks.

The safety of those using the road must be a prime consideration in a circulation space design at all the stages and for all types of circulation spaces. Because the scope of this research is limited to access roads, the safety factors applicable to the minor roads only will be considered. Safety considerations highlighted by Green Ernest [20] are :

(a) The practicability of the segregation of vehicles and pedestrians
(b) Number of junctions and intersections should be related to the function of the road.
(c) Radius of the kerb at the junction should permit traffic to negotiate safely and should not be less than 6m.
(d) Adequate site line at road junctions. The usual minimum standards are 1 metre above the ground level for 60 metres along the kerb of the carriageway of major roads.
(e) The number of individual vehicle accesses allowed should take into account the number and type of vehicles using the road.
(f) Ample visitors parking should be provided.

(g) Building line should be defined in respect of all roads with frontages, which are likely to be developed. Between 6 – 8metres is acceptable.
(h) Footwalks should be of adequate width and unobstructed by street furniture.
(i) Street lighting should be adequate and uniform and lamp stands should be no closer than 0.45 metres from the carriageways.
(j) Steep longitudinal gradient should be avoided, particularly at road junctions. This should not be greater than 1:5 within 1 metre of the junction.

2.2.1 VEHICULAR CIRCULATION

Landphair Klatt's [2] sentiments on vehicular circulation hold that, vehicular circulation acts as a major force of the visible landscape of any site development. Regardless of the kind or order of the vehicle hierarchy, residents and visitors tend to relate their experiences of residential space in terms of the vehicular circulation.

Kevin Lynche's [3] work in *The Image Of The City* demonstrates that people do not relate the location of an activity by giving a house or block number; it is usually by a street location. The design team must therefore realise that the layout of the street pattern within a project is not just a matter of function criteria and cost. Design image is also important; good design should also help people understand where they are and how to use the system to get where they want to go safely.

When organising vehicular circulation on a proposed site, the design team should consider alternative design that will arrive at a viable and aesthetically harmonious solution. Consideration should be given to the type of people expected to use the site, how many will they be and will they be arriving by car, public means or motorcycle.

Secondary vehicular circulation system for bicycles, motorcycles and specialised vehicles are usually less dominant form-giving elements at the residential estate scale, but they are no less important. Aside from the safety benefits of traffic separation, the scale of the linear space is different. This scale difference contributes to the uneasiness experienced by pedestrians or bicyclists on roads.

2.2.1.1 Types or Road Systems In Residential Areas

Traffic planners and engineers determine street classification by traffic volume estimates and traffic types. The most widely use measure of traffic volume is ADT, Average Daily Traffic. This is the 24 hr traffic volume average of the road section for one year.

One a street is officially classifies, the location is governed by two basic criteria:

a. Access
b. Topography.

i. Collector Streets - This are inter neighbourhood streets. They pick up traffic from local streets and transfer this to arterial streets. Traffic control is usually provided by stop signs on the side street and on street parking may be permitted.

ii. Local Streets - These are short streets that discourage through traffic. They provide direct access to residential properties and permit on street parking.

iii. Cul-de-sac - This is a short dead-end street with a turn-around area provided at or near the end.

2.2.1.2 Street Location

Town planners and road engineers ideally determine the location of the roads leading to a site, and therefore greatly influencing the site organisation in relation to building location and circulation space layout. There is however, a great measure of freedom left to the design team to locate and layout the streets within a residential developments.

The classification of the road depends on the traffic volume on each of the chosen circulation spaces. For vehicles, as mentioned, the measure used for traffic volume is the ADT. This is the 24-hour traffic volume average for the road over a 1-year period. (Landphair Klatt [2])

Once a street is officially classified, the location on the site depends on access and topography of the street. Landphair Klatt [2] points out that beyond the mechanical consideration, street corridors also carry with them visual and environmental concerns. In most cases, he adds, if the criteria of access and topography are handled properly, all the problems created by a street can be handles economically. In addition to providing for access for the general residents, access must be convenient for delivery of services and emergency vehicles. This is why as a standard, road regulations or by-laws will or should specify maximum length and permissible lengths for cul-de-sac.

2.2.2 Design Standards for Streets

To be functional, streets must meet some basic design criteria. As with grading standards, level of workmanship and material used, most local government authorities will have a set of guidelines for the development of circulation spaces within their jurisdiction.

A street on an architect's plan is essentially a geometric line composed of arcs and tangents with a predetermined cross section. Before the actual configuration of a road, footpath or parking lot can be fixed its important to place into consideration some things. Its important to remember that the road is a circulation path for machines and human traffic that have limitations. The design team will therefore be designing for human performance, plus the performance of vehicles as well.

Design Criteria to be adhered to are in regards to: -

2.2.2.1 Design speed

Design speed is the maximum safe speed at which an average vehicle and driver can be expected to negotiate the curves and grade of the street. At low speeds, the curve on a street may be shaper and the gradient steeper. As the operating speed increase, the curves must be longer and the slope decreases. Design speeds are determined by the road classifications.

Minimum Recommended Design speeds by Highway Classifications

Road Type	Design Speed (km/h)
Freeway	115>
Expressway	97>
Arterial	72 – 97
Collector, Major	72 – 97
Collector, Minor	65 – 80
Local	48 – 72
Cul-de-sac	48<

Adapted from information in AASHTO, A policy on the Geometric Design Highway and Street, 1984 [AASHTO (American Association of State Highway Transportation Officials), *A policy on the Geometric Design Highway and Street*, Washington, D.C. 1984] [4]

The design speed is then used to the minimum standard for horizontal and vertical alignment of the street.

2.2.2.2 Maximum Gradient

This is the steepest gradient that the vehicle using the street can be expected to negotiate in a normal operating mode. The application of this standard requires some design judgement, because a great deal depends on accurately estimating the type of vehicle and the weather limitations.

Table 2.1 Maximum Gradient for Vehicles, Dry Pavements

Vehicle Type	Maximum Gradient in High Gear	Maximum Gradient in Low Gear [a]
Heavy Trucks	3% - 33.33:1	5% - 20:1
Medium Trucks	3% - 33.33:1	7% - 14:1
Light Trucks	4% - 25:1	17% - 6:1
Automobiles	7% - 14.1	25% - 4:1

[a] Gradient of as much as 32% on local streets in mountainous areas. These cannot be considered all-weather roads.

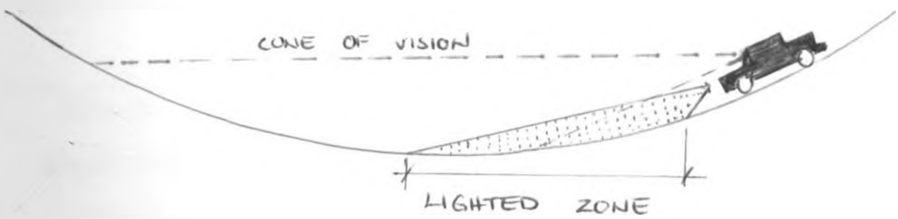
Table 2.2 : Road Design Criteria as a Function of Design Speed

Design Speed	Degree of Curve		Minimum Radius	Minimum Sight Distance No Passing	Minimum Sight Distance Passing	Minimum Vertical Curve L Each 1% Difference	Maximum Gradient
Kph	Degrees	R=m	m	m	M	m	G
32	57	30.48	30	45	152	3	0.15
48	22	78.40	76	61	183	6	0.12
64	12	145.54	137	84	335	11	0.08
80	7	250.0	230	107	488	21	0.06
97	5	350.0	335	145	701	46	0.05
115	3	583.20	488	183	975	61	0.03

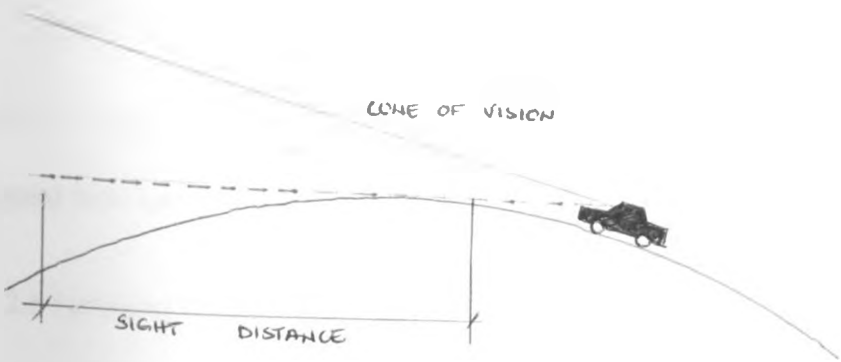
Adapted from Landphair, Harlew [2]

2.2.2.3 Sight Distances

Sight distance according to George Baker [8] is measures from a point *4 Inches* above the pavement to a point 4.5 Feet above the pavement. The critical point occurs at a transition to either an upgrade or a downgrade. At first glance, a downgrade would not seem critical since the cone of the vision includes the uphill portion of the road. However at night the headlights of a vehicle or motor cycle would not reach the uphill portion of the road.



DOWNHILL GRADIENT

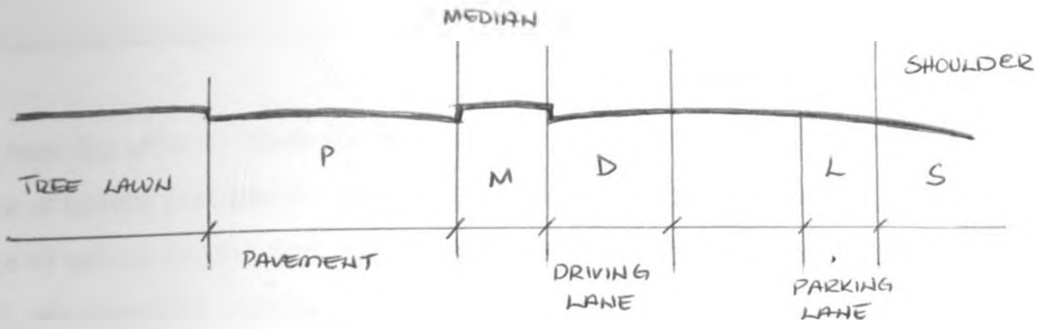


UPHILL GRADIENT

2.2.2.4 Street Width

This varies with the type of traffic, street classification and local government restrictions. Streets in a residential estate are usually two-way streets. Undivided pavements with parking are also or should also be considered in the street width of a residential development to accommodate parking demands from visitors.

Table 2.3 Cross-Sectional Dimensions of Streets By Classification



Classification	P M	D m	L M	S m	M m	Right of Way M
Freeway	7.3	3.7	0	3.0	6.1+	61+
Expressway	7.3	3.7	0	3.0	3.0+	61+
Arterial	7.3	3.7	0	3.0	3.0+	36.6+
Collector, Major	7.3	3.7	0	3.0	3.0+	36.9+
Collector, Minor	7.3	3.7	2.4	2.4	0	18.3+
Local	7.3	3.7	2.4	0	0	15.2

Adapted from Landphair Harlew [2]

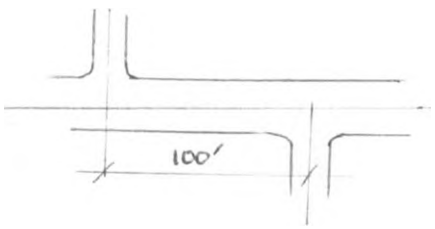
2.2.2.5 Pavement Design

The type and number of vehicles using a street will determine the pavement design. Large volumes of heavy commercial trucks will require much heavier pavements than for residential estates where automobiles the order of the day. The treatment of the base and the type of pavement to be used in any situation should be based on good geo-technical data on the site The data will result in recommendations about the preparation and compaction of the sub-base, the material and the thickness to be used for the road base and the type and thickness of the pavement to be used. The Local Authority or Road Section of the Ministry of Works should specify actual criteria to be met. Each municipality should have a standard specification for the construction of

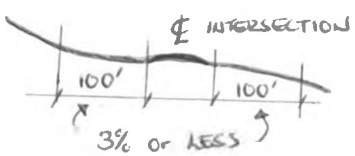
roads and bridges to act as a reference for the region under its influence. When designing the pavements' standard specifications, regional differences in climate, soil type and geological structure are taken into account.

2.2.2.6 Intersections

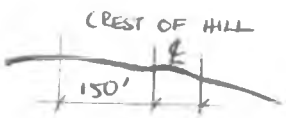
Factors that must be taken into consideration in the design of an intersection are the ease of turning movements, and safety. The ease of turning movement depends on the type of vehicle and the radii of the corner. The manoeuvring characteristics of vehicles and recommended turning radii for intersection in residential areas are designed primarily for passenger cares, thus excluding heavy commercial vehicles. The safety of an intersection or junction is primarily in the function of visibility.



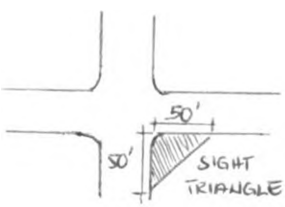
ALLOW 100 FEET MINIMUM BETWEEN THE CENTRE LINE OF ALL THE INTERSECTIONS.



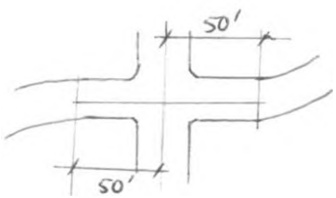
KEEP GRADES FLAT WITHIN 100 FEET OF ROAD INTERSECTIONS



AVOID INTERSECTIONS WITHIN 150 FEET OF THE CREST OF A HILL



PROVIDE A ZONE 50' × 50' CLEAR OF OBSTRUCTIONS AT ALL CORNERS



KEEP A TANGENT OF AT LEAST 50' AT ALL INTERSECTIONS

Rules of intersection.

X should have been typed?

2.2.2.7 Parking Utilities

Parking is an important land use in any residential development. It can be visually and functionally disruptive if it is not properly placed in relation to the topography and to other activities or uses. To organise parking, the design team must be aware of the dimension of the vehicle for which they are designed to provide adequate spaces. Included are overall length, width, front and rear overhand and minimum turning radii for both inside and outside front and rear bumper.

According to Harvey Rubenstain (1987)[5], site planners must device schemes for the largest vehicle using a site (whether cars, bus or truck). Factors affecting parking that should be investigated are: -

- Size of the Parking area in square feet and the dimensions.
- Angle of parking - 90, 60 or 45 degrees.
- Direction of the traffic flow to the site.
- Type of parking - self or attended.
- Width of parking spaces -8.5, 9, 9.5 or 10 Ft, with parking spaces for the handicapped at 12 Ft.
- Widths of the access drive.

Organisation of circulation within the parking area, both vehicular and pedestrian should consider:-

i) Positions of possible points of entrance and exit to minimise cross movement and turns.
ii) Aesthetic factors -depressing parked cars below eye level, planting, lighting, and paving material.
iii) Drainage of parking.
iv) Maximum walking distance from parking to building.
v) Separation of customer/resident parking and service areas e.g. garbage collection points.

In shopping centres, parking index -amount of parking for each 1,000ft^2 of gross leasable area, including all basements, mezzanine, and floor area 3,000 to 40,00ft^2.

In some case, the width of usable land determines the type of parking. In residential developments characterised by flats, a greater number of cars can be packed at 90 degrees using the same available width than at less acute angle like 60 or 45 degrees. The advantage of a 60 or 45 degree or less parking slot is that it establishes a one-way traffic system and makes it easy to pull into a space. According to Geoffrey Baker and Bruno Funaro [6], it is more convenient and less hazardous, however to back out of a 90 degree because of the larger width aisle that is sometimes provided. Commonly used parking dimensions are: -

Table 2.4 Commonly Used Parking Dimensions (ft)

Angle - degrees	Width	Curb Length	Length of Space	Aisle Width	Total
90	9 Stall	9	19	24	62
60	9 Stall	10.4	21	18	60
45	9 Stall	12.7	19.8	13	52.6

[George Baker and Bruno Funaro, *Parking*, Chapman-Reinhold Inc, New York, 1958][8]

Parking facilities for motorcycles and bicycles also ought to be considered, especially when designing the parking lots for residential flats or other communal facilities like residential community halls within residential estates. They should be located in reference to the building and the existing street and utilities available.

2.3.1 PEDESTRIAN WAYS / FOOTWAYS

Pedestrian circulation system is a major force in shaping the layout of a residential housing project. The scale of a pedestrian space is much smaller than that of a vehicular circulation system, and because movement through them is much smaller, details become increasingly important. John Fruin [16] adds that much more attention is required in the definition of the movement corridors, views, transition spaces and

access points. Steepnes of slope, transition grades with ramps and steps, intersection and the material used in construction.

It should be noted that though used interchangeably, Pedestrian Ways and Footways differ slightly in definition. ***Footway*** refers to the walkways that are adjacent to the existing road system. ***Pedestrian Ways*** on the other hand, refers to the "secondary system of streets reserved for pedestrians only. This segregates itself from vehicular traffic by weaving through the residential development as an independent mobility system." (Road Research Laboratories [17])

Another important part of the pedestrian circulation system is the removal of access barriers for the disabled. A detailed discussion of barrier-free design requirements is however beyond the scope of this research project.

2.3.2 Determining Pedestrial Flow

The adapted formula in the United States of America for calculating pedestrian flow volume (P), in pedestrians per foot width of walkway per minute (PFM) is the following:

$$P = S/M$$

Where P = pedestrian volume

S = average pedestrian speed per minute

M = average number of square meters per pedestrian

E.g. If the average pedestrian speed per minute is 270 ft and there is an average pedestrian area of 30 ft^2, the pedestrian volume equals 9 PFM:

270 ft/minute / 30 ft^2 /pedestrian = 9 PFM

Surveys conducted show that the average free flow walking speed for pedestrian is 265 ft/minute. Mean speed for dense pedestrian flows are about 25 ft^2 /person. The minimum normal walking speed of 145 ft / minute is attained with an occupancy of 7 ft^2/person.

Table 2.5 Level of Service on walks

Ft^2/Person	Average Flow (PFM)	Speed and Bypassing
35	7 or less	Free selection of speed Can bypass freely No severe peaks
25 – 35	7- 10	Normal walking speed Can bypass other No severe peaks
15 - 25	10 – 15	Walking speed is restricted slightly Inability to bypass freely
10 – 15	15 – 20	Majority have normal walking speed restricted Difficulty in bypassing
5 - 10	20 – 25	All pedestrian have speed restrictions Much difficulty in bypassing
5 or less	Up to 25	Extremely restricted Frequent unavoidable contact with people No by passing

[Adapted from John J. Fruin, *Pedestrian Planning and design.* New York, Metropolitan Association of Urban Designers and Environmental Planners, Inc., 1971.][16]

Longitudinal Slope: *Landscape Architecture Construction* [2] states that the most comfortable slope for walks lies between 1% and 5%. Above 5%, most pedestrians will begin to feel the slope if it is carried over any distance. For short distances, a slope of 10% can be used so long as there is no need for handicapped access.

Handicapped Slope: Landphair Klatt [2], points out that "Handicapped ramps that have a rise of 6 Inch or less can have a slope of 10%. For vertical changes of greater than 6 Inch the maximum slope is 8.33%, (12:1). If the vertical change is greater than 3ft then the ramp must be broken with landings, generally one landing for each vertical change of 3ft. Ramps must be 4 ft wide and have railings on both sides" Harvey

Rubenstain [5], has stated that an absolutely minimum length of 5ft, though 6.5 ft has become a desirable minimum length based on a persons' stride.

Side slopes: An important criterion for pedestrian ways is the side slope or pitch, on walking surface should be between 1% and 3% (US Standards). Side slopes greater than 3% tend to be uncomfortable and noticeable. (Landphair Klatt [2]). Crossfalls with range of 1 in 40 to 1 in 30 (British Standards) should meet this criterion, masking it easier to drain and comfortable to walk upon. (Road Research Laboratory)[17]

Recommended Walkway Width

Type Of Road	Recommended minimum footway width
District distributor	8ft in residential districts
Local Distributor	6ft in residential districts
	Principle means of access
Access areas	6ft in residential areas
	12 –15 ft adjoining shopping frontage
	Secondary means of access
	2ft verge instead of footway in roads in residential areas.

[Adapted from Road Research Laboratories. *Research on Road Safety* , London, HMSO, 1983] [17]

Steps: Outdoor steps are given different consideration than for internal staircases. A general rise of 4 in to 5 in is preferred. "The portion of rise to run should be that the rise plus the run equal 21 in. Thus, a step with 5 in risers should have a tread of 16 in. This particular portion is one of the most comfortable." Landphair Klatt [2].

For safety reasons, steps should have a minimum of two risers, since a single riser may not be seen and might cause people to fall. Likewise, landings should break a

long run of steps. "A good rule of thumb is that any time the number of risers exceeds 12, a landing should be provided if possible". (Rubenstein [5].)

Materials: As a brief mention on materials used on pedestrian surfaces outdoors, care should be taken in materials selection. No slick or polished finishes like ceramic tiles, steel trowel finished concrete, terrazzo and polished stone should ever be used. Care should be taken to select a material and finishes that will provide positive footing in all weather conditions. Texture of material, aggregate size and shape should also be considered.

2.4 BICYCLE WAYS

Bicycles are a popular means of transportation and recreation even in residential estates. Unfortunately, the bicycle is not a vehicle that mixes well with motorised vehicles or even with pedestrians. The motorised transport is a hazard to the cyclist, and the cyclist in turn poses a hazard to the pedestrian. The obvious solution would be to provide a separate path for the three different types of traffic. The only hindrance to that is the exorbitant price accruing to the development due to the cost associates with the construction and the space utilisation.

Standard that need to be considered in relation to bicycle ways and systems are providing special signage, marking paths along streets and other markings. The current trend according to Landphair Klatt [2] seems to be that bicycles are being taken off the streets. The thinking now seems be that less serious injuries occur from bicycle–pedestrian incidents than from bicycle-motor vehicle incidents. The other criteria for this are that the design criteria for bicycle seem to be more compatible with that of pedestrian walkways. Design standard consideration for bicycles are outlines below.

2.4.2 Longitudinal Slope:

Long runs with gradients that exceed 5% should be avoided if possible. Any gradient greater than 3% would be noticeable to the average cyclist. This does not however mean the elimination of the slope, as it is useful for practice.

2.4.3 Side Slopes

The pitch of a bicycle path according to Landphair [2] should be 2%. This is adequate to get the water of the surface without noticeable effects on the bicycle performance. If possible, a crown section similar to a road should be used.

2.4.4 Width of Lanes

Above 3 feet of width should be ideally left for each lane of bicycle traffic. A width of 2.1 metres is preferred for a path with two-way traffic.

2.4.4.1 Material

The material for a bicycle path should be some type of cemented material, asphalt or synthetic material to provide a stable riding environment within the site development.

2.5.1 ROAD SIGNS

Road signs not only help in directing and controlling both vehicular and pedestrian traffic, but they also enhance safety in the residential development. Traffic signs when used in residential developments should first conform to the appropriate stipulated statutory instruments and Local Government development recommendations. They should then the show sensitivity to the diversity of user to be found in residential areas. This is by way of children, adults and elderly. In that case they should be clearly visible, with appropriate letter sizes and graphical illustration in relation to speed and type of traffic. All warnings, mandatory, prohibitory and advanced direction signs should be illuminated by direct lighting or reflectorised.

2.6.1 PUBLIC TRANSPORT SERVICES

Efficient public transport should form an integral part of the overall plan for major residential developments with a predetermined population size. It should be layout in

a manner that facilitates its easy use by resident as well as an attractive as possible to the use of the private car. Consultation should take place in the design stage of the preparation of the circulation layout of such a development. It should cover the provisions made for the bus services to serve the proposed development in way of road width, sitting of the bus stops, terminals and interchange with other forms of transport.

2.6.2 Bus Routes

Bus routes should be planned to give rapid and convenient access to the many parts of a residential development, as is practical and insofar as it does not infringe on the privacy and safety of the residents.

2.6.3 Bus Stops

These should not be cited where their use might cause unreasonable interference with the flow of vehicular traffic within the residential development. On average the bus stop should be comfortable ten-minute walk from the furthest residential unit. Recommendations from the Scottish Development Department [18] go on to suggest that bus stops on opposite sides of single two-way roads should be staggered so that the bus stops tail to tail and move away from each other. Staggered stops should be 200 – 300 ft apart. To maintain reasonable operating speed and minimise interference with other traffic, bus stops should be preferably be spaces at intervals of not less than 1200ft, along local distributor roads and district distributor roads in residential districts.

2.7.1 LIGHTING DESIGN

Good lighting in a circulation system can extend the use of outdoor environments, contribute to the safety of an area, and add charm and drama to the nightline of a residential development. Lighting according to Parker [19] has three functions.

a. Utility and Security – This is the practical consideration that enters every landscape project and it is associated with the area or effect of lighting,

where the objective is to increase the efficiency of the driver or pedestrian at night.

b. Area Lighting – This refers to the lighting that permits the use of an area with near daylight conditions. This is the case for atheletic or sports field, or high use public spaces.

c. Effect Lighting – This is the most demanding of the three lighting functions, because it must satisfy the objectives of security and utility lighting with the added objective of creating and interesting visual environment.

2.7.2 Determination of Lighting Distribution

The primary measure of light intensity is the *footcandel* (fc). One footcandel is equal to one lumen of light energy distributed over one square foot. (Cambridge Dictionary) Based on this unit of light intensity, one can use several methods to determine how much light will be cast on any surface. Two common method used methods according Parker [19] , that are used by landscape architects are Point-by-Point Method and Average Illumination Method.. Point-by-Point is the more accurate of the two and is used in the light-design for sports fields and street lighting. Average Illumination Method is useful for walk lights and lights for parking facilities.

Table 2.6 Recommended Lighting Levels for Circulation Spaces

	Recommended illumination in footcandels	
	Max	Min
Utility Lighting		
Minimum Visibility	-	0.5
Driving	1.0	0.5
Pedestrian Ways	1.0	0.5
Open spaces (Generally)	2.0	1.0
Area Lighting		
Parking Lot	2.0	1.0

[Adapted from Parker, Harry, John W. MacGuire, *Simplified Site Engineering for Architects and Builders*, New York, John Wiley & Sons Inc, 1954]

2.8.1 ROLE OF THE DESIGN TEAM

The design teams task of planning, designing, operating and maintaining Circulation Spaces in residential estates can be complex. The planning process must be characterised by a systematic and rational approach, with assumptions made explicit, objectives clearly outlined and alternative causes of action identified. Most importantly, the needs, wishes and opinions of the residents of an urban area of estate must be taken into serious consideration.

Design professional should seek the views of the residents of previous developments, and prospective residents to the proposed residential development. Turner [12] commented by saying that "When dwellers control the major decisions and are free to make their own contribution in the design, construction or management of their housing, both this process and the environment produced stimulate individual ad social well-being. When people have no control over nor responsibility for the key decisions in the housing process, on the other hand, dwelling environments may instead become a barrier to personal fulfilment and a burden on the economy."

In Turner [12] opinion, the end users should hold the final decision when it comes to deliberation of the design of the environment in which they live. This would then ensure that the Circulation space layout would be to the personal fulfilment of the residents.

This thought pattern falls into what Wates [13] describes as Community Architecture. Community Architecture is attempting to understand the needs of a small group of residents. It involves working with them and under their instruction and guidance, in order to articulate their case and present it to the various organisations that hold either the purse strings or the approval/rejection powers welded by the Local Government.

This concept would spell doom to the construction process in terms of time taken at each stage, due to involvement of other parties. However, when examined the concept hold water in that it tells the design team to design circulation space layouts with their ears to the ground.

It is the task of the design team to anticipate the need of residential development and co-ordinate the means of satisfying them. They must be able to understand the ever-changing relations of social forces and of the physical environment in which these forces operate. They team when designing places and streets, must clearly see relate the simple spatial relations of the paves surfaces and the residents space requirements not only for movement but also for well being.

"Today we must regain, by conscious effort, the essential unity of function and form. It isn't really a question of inventing only 'beautiful estates', it is a question of discovering the form that will most clearly give expression to the function and social harmony of our residential estates." Blumenfeld [14] .

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CHAPTER THREE

ROLE OF LEGISLATION IN THE PLANNING OF CIRCULATION SPACES

ROLE OF LEGISLATION IN THE PLANNING OF CIRCULATION SPACES.

3.1 INTRODUCTION

The responsibility of circulation spaces in residential areas for the interest of health, safety, welfare and convenience of the public, falls under the jurisdiction of the Municipality of Nairobi, Nairobi City Council. The Nairobi City Council achieves this together with other agencies like the Public Health Division, City Engineers Department, Ministry of Housing and Public Works and the Ministry of Transport.

The standards adopted by the local authority is used by this statutory authorities, is by the way of By-laws and policy. This requires the submission of plans and other information concerning building material and methods of construction. This is in order to regulate the construction of quality buildings and planning regulations for the orderly development, and are a pre-requisite to safe and healthy built environments. The history of the development of this by-law and planning policy dating back to the colonial times is traced later in this chapter.

3.2 APPROVAL OF SITE PLANS / DEVELOPMENT PLANS

The site developer presents to the Nairobi City Council the proposed development plans in form of site plan, topographic plan, sketch diagram of construction and accompanying working drawings. It is specified that building or site plans *must* be signed by a person registered with the local body of architects.

Its is at this stage that it is easiest to check on whether the plans submitted abide to existing legislation and policy. It is also the least expensive stage to make any amendments to the plans.

Proper utilisation of land as a natural resource for the benefit of the residents is realised through guidance by way of laid down legislation and planning in relation to planning for human settlements. This exercise is called physical planning. When the plans are found to be in accordance to the building code and regulations, a building permit is issued as a sign that all the requirements are deemed to have been fulfilled.

The process of having site plans approved requires that the prospective developer submit their drawings to the **Development Control Section** of the **City Planning and Architecture Department** for approval. 'Approval' in our case is in accordance to By-Law (2) in the Building Code of 1968 where it means approved by the Council. 'Approved Plans' means plans retained by the Council, whether or not approved.

3.2.1 Requirements for approval of Development Plans

The prospective developer should submit a written application in a form that has to be attached to plans and other relevant documents as required by the form. Reference is made to Appendix V, which is the City Council of Nairobi Submitted Plans Comment Sheet.

Payment of statutory fees for a building permit or approval of plans. The provision for this is in By-Law (6) of the Building Codes.

3.2.2 The Circulation Process of Proposed Development

On receipt of an application together with other particulars as required, the plans are circulated to various departments of the Nairobi City Council to check adherence to relevant pieces of legislation. The departments and section are as follows.

The Forward Planning Section: - This section of the City Planning Department is concerned with receiving applications from the prospective developers and communicating the outcome of their application process to them.

Medical Officer of Health: - Here the head of the Public Health Departments and he has to approve the health aspect of the proposed development, such as circulation, ventilation etc.

Chief Fire Officer: - The head of the Fire Section, falling under the City Engineer's Department, approves of the fire control and prevention aspects of the proposed development. In relation to circulation spaces, they look at the prospects of a fire engine gaining access to the building facility were a fire emergency to occur. Ideally such services should be catered for and accommodated in the circulation layouts of the development site.

Housing Development Department (H. D. D.): - This department, based in Dandora, concerns itself with developments on site and service schemes which are normally developed using type plans provided for by this department. The H. D. D. tasks itself with ensuring adherence to these type of plans and controlling new developments. Any extension to these type-planned houses has to be approved by the City Planning Department at City Hall. The H. D. D is also charged with the City Council Leases, land tenure system and the service system on the site. This ensures that there are no outstanding sums unpaid for the lease in the plot under consideration.

Structural Section: - Falling under the City Engineer's Department. It approves structural drawings with the aim of ensuring structural stability in the proposed development.

Valuation Department: - This department falls under the office of the Town Clerk. Its task is to value the land to be used for the proposed site, to calculate the necessary tariffs and rates due.

Sewer Section: - This is a section within the Water and Sewerage Department. Plans are circulated to this section for development in areas not served by and sewers. It

approves the contribution of the proposed development to the existing sewer service in the area.

Water Section: - This section is also under the Water and Sewerage Department and is supposed to approve water supply plans for a development not served by any council mains.

Kenya Railways: - This is in relation to areas that are serves by railway lines. Circulation is therefore made to the Kenya Railways Corporation where a proposed development has to be served by a railway line, is adjacent to a railway line. It also comes in where the land for the proposed site is held under the Kenya Railways leasehold.

Roads Section: - This section that bears most on circulation layouts in development plans. It comes under the City Engineer's Department and approves of the road networks for the proposed development.

By-Law Enforcement Unit: - This unit of the City Planning Department ensures compliance to the requirements of Building By-Laws. As stipulated in By-Law 254 of the Building Code, it passes out penalties where there is non-compliance, in the form of fines, court actions, demolition or order to comply with By-Law requirements.

3.2.3 Approval

At the end of the circulation, the Forward Planning Section, in accordance with By-Law 7[1] of the Building Code, makes a notification to the applicant. The clause provides that within thirty days of receiving a duly completed application form together with such particulars as are required by these By-Laws, the council shall notify the applicant in writing, whether approved or not. It may extend the period for another days (By-Law 7[2]).

Comments made on the plans will have to be modified of acted upon before plans can be approved in accordance to By-Law 9 of the Building Code. By-Law 9[2] adds that erecting buildings from invalidated plans constitutes an offence. By-Law 9[3] states

that approval of plans does not authorise any unauthorised building work or change of existing use of the premises.

3.4 Historical Background of Legislation bearing Impact on Circulation Spaces

The need to manage circulation spaces can be traces along the legislative paths of human settlement. Though not out-rightly written for the sole purpose of roads, the legislation bears in its directive consideration to roads. There are pieces of legislation, mainly ordinances borrowed from England, which influence the utilisation of land. Highlighted are a few of the statutes that are considered to have influence on physical development in the country over time.

3.4.1 The Crown Land Ordinance, 1902

This statute re-enacted in 1915, is what eventually became the Government Land Act, CAP 280 of 1970. The Ordinance empowered the Commissioner of Land to prepare Urban Plans, thereby making him the Chief Land Administrator and Planner. The GLA, 1970 allows the Commissioner of Lands to decide on subdivision of government land for alienation, including conditions of use.

3.4.2 The Municipalities Ordinance, 1928

The law gave the local authorities mandate to plan for public utilities such as roads, open spaces and parks. In post independence Kenya it converted to the Local Government Act, Cap. 265 of 1968, retaining the functions of development control and planning under Sections 1599 and 166, respectively.

3.4.3 The Public Health (Division of Lands) Ordinance, 1928

This statute provides for regulation of subdivision planning and development of land outside municipalities and townships, with the power of approval vested in the Commissioner of Lands. After independence the Public Health Act, 1972 provided for making By-Laws for approval of building plans.

3.4.4 The Township Ordinance, 1931

This governed planning and development within townships, with District Commissioners as planning authorities.

3.4.5 The Town Planning Ordinance, 1931

These statutes provide for comprehensive and integrated urban planning, covering townships and municipalities. I was later re-enacted as the Town Planning Act, Cap. 134, of 1931. Under the Act, preparation of town planning schemes was by "Executive Authority". The approving power was vested in the Governor in Council, an equivalent of Minister [S.5 (2)].

The Act stipulated in detail what should be covered by the town planning schemes - urban physical development plan. The Act empowered the Commissioner of Lands to play the role of Preparatory Authority and / or Executive Authority where the latter were deemed to have failed [S.22].

The Commissioner of Lands was empowered by Section 23 to carry out planning in area outside townships and municipalities. Thus, he sought for the services of the Town Planning Advisor (currently Director of Physical Planning).

Section 24 was the most widely applies provision of the Act. It gave the powers of approval of subdivision schemes to the Commissioner of Lands. The approval was to be granted with conditions, giving due regard to approved plans.

3.4.6 The Native Land Trust Ordinance, 1938

This changed to Trust Land Act, Cap.288 of 1962. It gives the Commissioner of Lands administrator and planning authority as an agent of local authorities, albeit with the approval of the Minister.

3.4.7 The Land Planning Act, Cap.303, 1968

The statutes put together the Development and the use of Land (Planning) and Land Control Regulations of 1961 that were hitherto under separate Legal Notices [L.N. 516/1961 and 142/1961. Relatively]. The most significant aspects of the Act were the establishment of the Central Authority, which controlled development outside towns.

The authorities established by the Act rarely functioned [i.e Interim Planning Authority] thereby giving the local authorities the presumed role of planning authorities. In effect the Director of Physical Planning prepared plans, though not gazetted as the Interim Planning Authority.

Another flaw with the Act was difficulty in enforcement. It never stipulated penalties for non-adherence to approved plans. Roles of preparing and implementing plans were not clearly defined.

It should be noted that under Regulation 8 the power of approval of plans was vested in the Minister. He was also empowered to make Rules for the better carrying out provisions of the Act. The most recent application of such powers was masking rules related to fees payable for physical planning services - L.N.303, Physical Planning (Planning Fees) Rules. 1994 of 18th April, 1994

3.4.8 OBSERVATIONS

It may be observed that planning legislation existed in scattered, sometimes conflicting, statutes. Provisions of most of the law were largely ignored of found to be inapplicable. Circulation spaces layout is hardly specifically mentioned in any of the legislation. It became necessary to formulate more effective planning legislation to cope with the fast growing human settlement, and cater for the increasingly overburdened infrastructure in terms of roads.

3.5 CURRENT PLANNING LAW

Efforts by the Government to revise the by-laws to put in place the Physical Planning law begun in earnest in mid-1980s when a study sponsored by the World Bank. The Office of Lands and Settlements, the Attorney General and, several of the other agencies got together to start drafting the legislation.

The Physical Planning Bill was drafted in 1985 and completed in 1987. After circulation and thorough consultation, the first draft was printed in 1991. In July 1992 the Cabinet approved the draft Physical Planning Bill, which consisted of all aspects of physical planning with Part VII devoted to Physical Planning Bill and Physical Planners Registration Bill, 1994.

Consultation with the Attorney General, other ministries, departments and agencies culminated in the publication of the two Bill in 1996. In the same year they debated in the National Assembly, passed and accorded Presidential assent to become Acts of parliament. The Physical Planners Registration Acts was assented to on 9th July 1996, while the Physical Planning Act got the assent on 24th October, 1996.

3.5.1 Effect on Human Settlements Management and Development Control

The coming to force of the Act is expected to have a positive impact on human settlements management and development control in the country.

Only registered physical planners and/or those under direct supervision of the Director of Physical Planning will be allowed to prepare physical development plans at all levels (national, regional and local), including subdivision schemes. In the past, plans, especially subdivision schemes, could be prepare by anybody, irrespective of whether or no the person is trained / qualified in the field of physical planning.

The exclusion of non-professionals in the preparation of plans will ensure proper plans for human settlement.

3.5.2 The Physical Planning Acts (No. 6 of 1996)

3.5.2.1 Objectives

The Act was meant to accomplish, inter-alia, the following:

- Provide for preparation and implemented of regional and local physical development plans;
- Ensure co-ordinated and orderly physical development and proper use of land;
- Establishment of the office of the Director of Physical Planning and other officers who are legally mandated to carry out physical planning functions throughout the country.
- Establishment of Physical Planning Liaison committees to arbitrates in disputes between stakeholders in planning on the one hand and the Director or Local authorities on the other;
- Give powers to local authorities to control development and ensure environment protection; and
- Restrict physical planning (especially land subdivision) to professional planners [S.41]

3.5.2.2 Contents of the Act

It is divided into six parts and fifty-four sections. In addition, it has five schedules that give detail of the nature, type and contents of the contents of the various physical development plans. The sample of form to be used is also in the schedules.

To put in the into effect, and in compliance with Section 49, Regulations have been formulated with regard to the following matters:

- Procedure for preparation, submission and approval of development;
- Procedure for applying for development permission;
- Physical Planning Development Order - what development require(or do not) permission;
- Physical Planning Subdivision;

- Planning Control (Building and Development);
- Planning and Endorsement Fees;
- Physical Planning (Enforcement Notices);
- Appeals to Planning Liaison Committees.

3.6 City of Nairobi Legislation on Site Development, with Reference to Circulation Spaces (Issued August 1978)

This document that contains guidance for persons submitting development schemes, constitutes the yards stick or criterion against which development plans are approved in relation to circulation space layout. The document currently in use was issued in **August 1978!** (Appendix 11)

3.6.1 Scope of document

"The notes cover all schemes, from plot entrance serving a private property or a simple subdivision of an existing plot to a comprehensive scheme opening up a new area.
This are general guidelines, and the Council reserves the right to impose additional conditions as necessary."

3.6.2 Layout of the Road Reserve

The required width of the road reserve shall be defined from time to time by the Council.

Provision of Road Reserves

The Width of the reserves to be provided in development schemes shall be not less than the following: -

	Category	Road Reserve (metres)
1	Major Commercial Routes	60
2	Important through-routes likely to require major treatment in the future	30-36
3	Spine Roads and Roads in commercial or industrial areas.	25
4	Bus Routes.	18
5	Local Distributor roads. (Numbered vehicle plot access.)	18
6	Major access roads exceeding 150 metres in length.	15
7	**Access Roads (Normal residential street) not exceeding 150 metres in length.**	**12**
8	**Minor access roads (short cul-de-sac), not exceeding 60 metres.**	**9**

3.6.3 Foot Reserves

Pedestrian Routes in new developments should be provided in relation to external and internal requirements.

Reserves should **not be less than 3 metres wide**; but if combined with a drainage wayleave, the width must be sufficient to give not less than **2 metres** clear width of footpath.

3.6.4 Open Spaces

An adequate area of permanent open spaces shall be provided and developed to the satisfaction of the Council. Developers should consult the City Planning Officer and the Parks Superintendent on the matter. **Pedestrian routes should be related to the open spaces.**

3.6.5 Street Lighting

All developments to and average density of more than one dwelling per hectare shall be provided with approved street lighting, and with precinct lighting in courts and pedestrian ways.

3.6.6 Street Furniture

The position of street furniture, poles and other obstructions must be shown and should be considered in relation to other design features and services. The necessary minimum width of a footway may not be obstructed by a signpost, street light column, marker etc.

3.6.7 Engineering Details

Before work commences, the following details have are submitted to the City Engineer for his approval.

i. Layout Plan.
ii. Longitudinal Section showing centre line gradient of roads and cross sections at 30 metre intervals.
iii. Longitudinal Section showing gradient of sewers and drains.
iv. Culvert sizes.
v. Typical Road sections.
vi. Outfall surface water drain.
vii. All other engineering details.

3.7.0 Circulation Space Standards

3.7.1 Carriageway Widths

	Road type	Width (meters)
a.	Spine roads and/or Bus Routes	7
b.	Access roads (normal residential streets)	5.5
c.	Culs-de-sac (not exceeding 60 m)	5

3.7.2 Footways

The standard provision is two metres wide on each side of the carriageway, subject to the following conditions: -

i. Cul-de-sac serving less than 10 plots, a single Footway is considered to be sufficient.
ii. Occasional obstruction should nowhere reduce the Footway below 1.2 metres.

The infrastructural standards report that Pedestrians shall be physically separated from moving vehicles by a barrier such as an upstand kerb, open drain or wide verge.

3.7.3 Car Parking

Parking facilities for cars are to be provided to the extent of **1.5 bays (Car spaces)** for each dwelling unit in the site. Where on street parking is not practical, then off-street car parking should be provided. If it can be shown that on-plot (private) parking has been provided, then this may be allowed against the number of public spaces.

Maximum distance allowed between a dwelling and its associated parking area is 50 metres.

Parking for commercial vehicles and for shopper in a shopping arcade within the development, shall be in addition to the above.

3.7.4 Design Standards for Access Roads

Roads in residential areas are to conform to one or other of the following specifications.

Specification 1 (Appendix II)

Area where the zoning stipulates a minimum plot size of less than 0.4 hectare.

-Wearing course – 25-mm machine laid asphalt.
-Base Course – 25-40 mm machine
-Laid bituminous macadam.
-Concrete kerb and channel
-Footway 100-mm. murram with slurry seal on single chip seal.
-On Black Cotton Soil, a waterproof shoulder shall extend 1.5m. from edge of carriage way.

Specification 2 (Appendix II)

Areas where the zoning stipulates a minimum plot size of less than 1 hectare.

Kerb on Inside Curve not exceeding 20 metres radius.
Footways 100-mm. Murram with double seal.
Waterproof shoulder on Black Cotton Soil.

Specification 3 Appendix II)

Areas with zoning stipulate a minimum plot size of 1 hectare or over.

The road will remain an unadopted street.

3.7.5 Flats and Maisonettes

Where flats and maisonettes are permitted, thereby allowing more than one dwelling per plot, the average plot area for the purposes of the above classifications, is stipulated to be the average area available for each dwelling unit.

3.7.6 Comments and Observations

From the above, it is quite clear that substantial work has been done in terms of reviewing By-laws and Planning Standards, mot much has been made in terms of their applications. In addition to this, the involvement of the Nairobi City Council in the construction process is limited, based on observation and the manpower that is allocated to do the inspection. Appendix VI and Appendix VIII show inspection sheets that are intended for use by the City Planning and Architecture Department when making site inspections. The sheets for most of the developments are hardly filled in showing that little inspection is carries out during construction to check if the construction is consistent with the approved plans.

A study of Appendix VI and VIII also reveal that the inspection sheets give no consideration for circulation space details. No provision is given for the details of notice in regards to parking, roads or side walks. It would come as a worthy recommendation that even at the inspection stage, their should be provision for inspection of circulation space details.

References:

1. Agevi, E & Ngari, J; Proceedings of the Seminar on Building By-Laws and Planning Regulations, Milimani Hotel, Nairobi Kenya; 27-28, 1990

2. Local Government (Adoptive By-Laws) (Building) Order 1968

3. Kiruthi N. P.; *Obstacles to the Implementation of Building Legislation In Low-Income Residential Schemes In Kenya: A Case Study of Umoja Estate, Nairobi,* July 1996.

4. Ing'ea K. W. ; *Impact of Residential Building and Estate Design on the Economy of Land Utilisation: A Case Study of Kenya Railways Quarters, Nairobi* June 1996

CHAPTER FOUR

DATA PRESENTATION AND ANLYSIS

DATA PRESENTING AND ANALYSIS

4.1 INTRODUCTION

In this chapter, emphasis is laid on the results of the researcher's field observations within the case study area; which was demarcated for the convenience of this research. An examination of the role played by the current state of the statutory instruments in the layout of circulation spaces in residential developments. The data gathered from the field is analysed, paving way for conclusions to be made in the later chapter of this research project.

4.2 SURVEY METHOD

The main method of obtaining data on the impact of existing statutory instruments on circulation spaces was by way of questionnaires administered residents of a random sample of residential developments.

The researcher also obtained data by way of observation using an observation sheet, coupled with playing the role of residents in some residential developments in order that he may experience circulation spaces first hand. Observation involved also the taking of measurements of the road and footwalks width.

The last tool of data collection was the keen studying of development plans of the estates visited in order to confirm consistency between the planned and the existing.

4.2.1 The Questionnaire

The scope and wording of the questions (see Appendix I) appropriate for the residents was decided as result of pilot study conducted earlier at the beginning the research. In particular it became apparent that data and opinions should be obtained from those in the age bracket of 25 – 30 years and above. This was seen as the age group that was more likely to give a second thought to the state of the circulation space. The questionnaire asked for detailed data on the means of transport and effect of circulation space on resident. Residents' were also asked to state their opinions in

regards to safety. The structure of the questionnaire tried to categorise common responses so as to make it easier to analyse the data. The questionnaire included specific questions that require 'YES' and 'NO' replies and few open ended questions.

4.2.2 Observation, Measurement and Role playing

The researcher took time to observe use of Circulation Space in most residential developments using a structured observation sheet (See Appendix III). He was also able to assume the role of resident as he traversed the circulation spaces of most estates. Measurement was of the width, lengths of roads and footwalks, parking-lot capacity, state of the street lighting and street furniture and other circulation space features.

4.2.3 Studying of Development/Site Plans

With permission from the City Engineer's office (See Appendix IV), the researcher was able to obtain and study the development plans of two thirds of the development plans of the estates that were selected for this study. This enabled him to look at the approved plans and compare them with the existing reality for each of the estates. This helped note the consistency of the approved development plans against what was constructed. The plans studied showed a great inconsistency in the information contained in them.

4.3 PRESENTATION OF DATA

The data obtained in the survey is presented in three sections, as outlined below;

4.3.1 STUDY OF DEVELOPMENT PLANS

An analysis of the proportion of circulation space (Road, Footwalk and Parking) to the total site area reveals from the data that on average **17.43%** of the site is committed to Circulation space. The lowest recorded was in Dandora Housing Phase II, where the proportion was estimated at **9%** of the total site! Sevo II Estate, which consists of Bungalows, have an estimated **27%** of site usage committed to circulation space. The variance arose where some residential developments had streets that were wider that

the minimum stipulated. They also made provision for Visitors parking, Service access like refuse and fire engine services.

It was not possible to obtain the specific width of the footwalks, because they were shown as part of the road provisions, plus the road reserve. This therefore made the comparison against the existing widths difficult.

4.3.2 QUESTIONNAIRE SURVEY

AGE AND GENDER OF RESPONDENTS

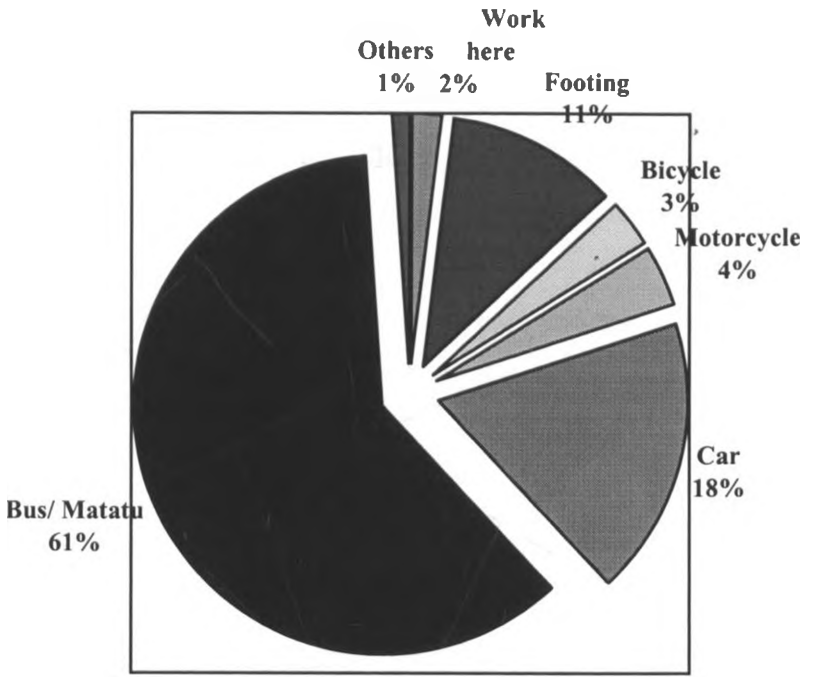
The range of ages of respondents fell under the category of 31 – 35 yrs. The ration of men to women respondents was 11 is to 14. This was probably due to the fact that the researcher did most of his survey at in the afternoons when more women ere available as housewives of housekeepers.

MODE OF TRANSPORT TO WORK

The mode of transport for two thirds (61%) of the respondents used bus or matatu as a mode of transport. For most of the respondents, the public transport is outside the residential development, while some residential developments had public transport using its circulation space. The implication of having public transport flowing within the estate calls for its accommodation into the design of circulation space. Public transport can be seen to bring along with it loss of privacy, increased noise, reckless driving, increased vehicular volume and bus stops, all of which need to be accessed in terms of their impact and magnitude on the resident, before including them in the design. For a resident the pedestrian footwalk need to be designed such that the resident is no more than a ten-minute walk from the bus-stop. Legislation is called to lay down standards for the integration of public transport within the circulation space of residential developments of predetermined population size.

Cars, though used by 18% of the respondents utilised majority of the circulation space. The situation obtained through observation by the researcher showed that

CHART 4.1: MODE OF TRANSPORT TO WORK



designs at times lacked in accommodating vehicular movement as seen in traffic congestion in estates like Nyayo Highrise and Koma Rock during the peak hours. The car at its state of rest was also not well provided for.

Respondents who walked to work were 11%, though this does not represent the percentage who use footpaths. In reality, close to 100% of the residents use the footwalks at one point or the other and this ought to be borne in mind even at the design stage.

Motorcycles and Bicycles are not a favourite means of transport to work in Nairobi owing to the well fact that riders and cyclist are among the least respected residents on roads. Most people fear for their safety when it comes to using a bicycle or motorcycle to work. One of the roots of this fear is the fact that the existing infrastructure in estates and outside of them does not in its design give consideration to the cyclist and the rider. The 4% of motorcyclist used company motorcycles while the few of them who owned were to be found in high-income residential developments characterised by bungalows, wider streets and plenty of open space.

Some of the residents worked from home, but not eliminating the fact that when they travel to the city centre the either use car, matatu, foot or buses. Approximately one percent was picked from home by company buses or cars.

OWNERSHIP OF MODE OF TRANSPORT

Car ownership per household averages at 2.2 cars while adult bicycles and motorcycles averages a nil. Children's bicycles per household were about 1.3 bicycles.

From observation it was seen that in some estates the cars and the bicycles share the same space. One resultant of this sharing is accidents that either injure or prove fatal to the children.

The existing statutory requirements require that on as a minimum standard, 1.5 cars should be accommodated in the parking space of each residential unit. Few residential developments have exceeded this minimum requirement, especially those with maisionette and flat house types. The result of this is that the resident with two or more cars will have to:

- Park the second car or other cars outside on the footwalk or street (68%).
- Convert the frontage of the house into a parking space by covering the grass patch with cement or concrete covering.(27%)
- Others will park their cars at a neighbour's house. (2.5%)
- Park the car at the fuel station or shopping centre.(2.5%)

In a resident population of 100 households with each owning 2 cars, then 68 cars will on every given night be parked on the street. 27 households will have additional parking within the compound, while 5 cars will be either parked at a neighbour's or at a petrol station or the shopping centre.

This scenario creates a problem with security, estate aesthetics, and affects pedestrian flow (see PLATE 2) if cars are parked on the streets, and increases road accidents. Legislation should seek to cater or accommodate the 68 cars using either the example from the 25 households that converted their frontyard into a parking lot, or by adding street parking. Children's' cycling need to be catered in the open spaces.

PLATE 2: Kerb parking that obstructs pedestrian movement

SAFETY

The questionnaire sought to establish the residents' opinion in regards to safety within the estate, with reference to the circulation space. It then tried to establish the causes of danger. 52% of the respondents termed their estates' circulation space as unsafe, while 30% said it was very unsafe. 12% and 6% of the respondents thought that their estates were safe and moderately safe respectively. The high response on the negative extreme (very unsafe) is probably a reaction by the respondent based on their experiencing the "unsafe " nature of the streets within the residential development, personally or through a close friend.

The reason residents doe not feel safe can be attributed to social-economic problems, though the role of the circulation space as a catalyst or contributing factor is seen on the 84% response. Cars to car accidents are a cause of apprehension, and this ranges from outright smash-ups ups to minor collisions or scrape-off. The injury rate from car to car accidents is minimal because in most case the speeds of cars within residential areas hardly exceed 50 – 60%.

Person to car accidents occurs where a car collides with a pedestrian. This is the greatest source of danger to the residents owing to the fact that they are pedestrians very often. This category of accidents contains the highest rate of injury and mortality. Since all residents, children inclusive, are given to walk along the footwalks at one point or another, the risk of colliding with speeding cars is made higher by:

- The state of the footwalk. Most footwalks are seen to be littered with parked cars, garbage, construction debris, overgrown plants, commercial activities and excavations. This increases the risks of pedestrians getting knocked down as they attempt to share the road with speeding cars
- Drivers navigate the roads at high speeds without putting into consideration the many human activities that occur along the roads.
- State of the open spaces, that pushes playing children on to the roads.
- Kerb-parking. This contributes to the high rate of accidents in the following ways.

  a. A car parked on the kerb is usually partly on the street and partly on the road. This narrows the street-width available to other drivers, creating tight fits that lead to incidences of collisions.
  b. Kerb parking in most case blocks the footwalks, causing pedestrians to walk around parked cars onto the already narrow roads, which they have to share with the cars.
  c. Kerb parking hinders the sight distance or visual fields of a pedestrian who is about to cross the road, especially children. Some pedestrians step onto the roads without knowledge of impending danger of oncoming cars. The scenario is made worse when large vehicles like lorries, buses and mini vans are parked on the kerb as shown on PLATE 3. This inconveniences the pedestrians who result to them sharing with speeding vehicles.

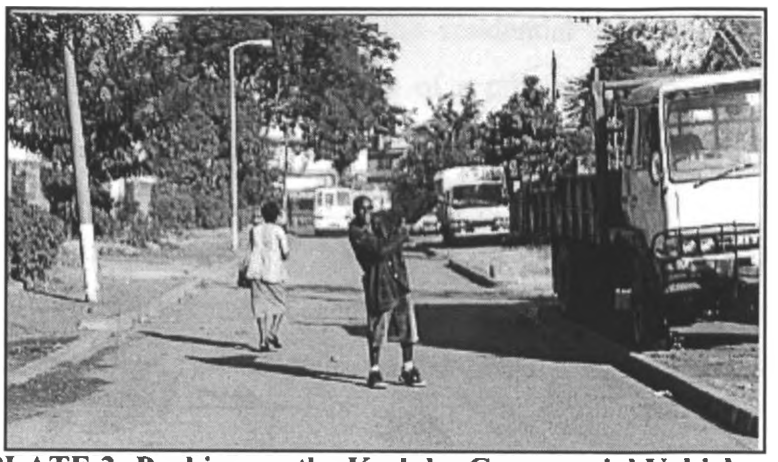


PLATE 3: Parking on the Kerb by Commercial Vehicles

Danger caused by mugging, though a social evil arising from social economic problems is made to flourish in part by the state of the circulation space through;

a. Insufficient lighting on the footwalk.
b. Footwalks that are overgrown with plants or that act as storage for the shells of abandoned vehicles or heaps of garbage and debris.

Provision of adequate lighting and proper maintenance of footwalks, garbage points will help minimise the incidences of mugging and car-jacking and other social evils that find home on the circulation spaces.

EFFECT OF USE OF CIRCULATION SPACE

Vibration and noise troubles 36% of the respondents. This does not mean in any way that vibration and noise from the vehicles using the roads is in any way minimal. From the researcher's observation, noise and vibration were acute it case where the respondent said that they did not bother them. This shows that a greater number or residents who have been residing in the particular estates over 2 years over time gotten used or come to accept the noise levels and vibration coming from the roads.

The design teams attention is drawn towards the design of residential road in terms of distance from fencing, road reserve, incorporating sonic barriers to shield noise from major roads. The vibration from roads has allot to do with the construction design of the roads and soil type, which is outside the scope of this study. Distance from the

road reduces the vibration felt within the residential unit, and this should be incorporated within the overall site layout of a proposed residential development. Impact of vibration on residential units is seen in the growth of cracks on the walks of residential units that are near busy or major roads. Examples are estates like Koma Rock where heavy commercial vehicles laden with sand cause vibrations that cause cracks on the walls of the house adjacent to the road. Legally enforceable standards should be established and recommended to the design team in regards to noise and vibration.

Dust, Exhaust Fumes, Smells and Glare bothered 17% of the respondents. Dirt and smells are partly an attribute of level of maintenance of the circulation space. Dirt and smells arise from the garbage that is at times disposed on the footwalks, roads or parking spaces. Exhaust fumes when released from vehicles into the air are blown by prevailing winds onto the windward roofs of the residential unit adjacent to the road. Aesthetically, the result over time is that the roof darkens in colour due to the carbon deposits. When it rains any storm water collected is dark-coloured owing to carbon deposits plus other chemical deposits. This has health implications on the residents. Residential developments against which prevailing winds blow over major roads like Waiyaki Way, Jogoo Road, Thika Road have evidence of this exhaust deposits and impact of vibrations.

Glare was not much of a bother due to the serious emphasis on fencing in most residential developments. The fences in most cases shield the light from cars on the road. Exceptional cases are where the roads are raised above the fences due to slopes or fly-overs. High-rise residential developments are not shielded by fences and therefore experience a glare from headlights. Design of glazing for such residential units should include anti-glare covering on the windows.

DESIGN OF THE CIRCULATION SPACE

Table 4.1: Design of the Circulation Space

ROAD WIDTH	
Wide	2 %
Narrow	45 %
Adequate	53 %
WIDTH OF SIDEWALK	
Wide	-
Narrow	76 %
Adequate	24 %
STEEPNESS	
Road	Adequate - 100 %
Sidewalk	Adequate - 100 %
PARKING PROVISION	
Too few	56 %
Adequate	41 %
Plentiful	3 %
STREET PARKING LOTS	
Too few	83 %
Adequate	17 %
Plentiful	-

Source: Field Survey

Respondents took road width in most cases to mean the literal and the visual. Few respondents considered the functional aspect of the roads. The response on the sidewalk was remarkably different, because most residents experience the sidewalk almost on a daily basis, and based on their experiences were able to record their opinion. Again this is because most use of the site takes place on or close to the sidewalk. Too often pedestrian movement is given considerably less thought than vehicle movement and the fact that respondents found sidewalks narrow was no surprise.

Steepness in most residential areas was not an issue because most residential developments are built on fairly level sites. Some among the few that were built on sloping grounds were adequately landscaped. Design standards on steepness do not exist locally, and this ought to be defined bearing in mind factors and parameters mentioned in Chapter Two, and not left to the interpretation of the design team.

Parking provision was thought of as adequate by 41% of respondents, while 83% of the same respondents' thought that the street parking was limited. With the average car ownership at 2.2 cars, 56% of the respondents would like more parking space. The 83% of respondents who wanted more streetparking could be interpreted as requesting for fewer cars parked on the kerbs, to free the footwalks or also as a need for visitors parking.

CHILDREN'S SAFETY

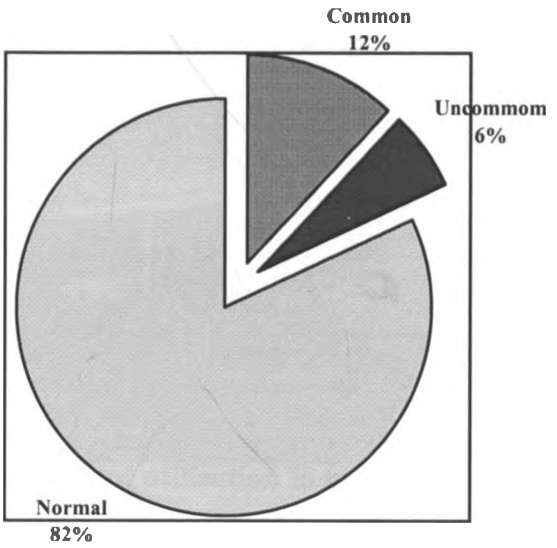
Children are by far the greatest users of shared outdoor space in residential developments, and most estates studied indicated that problems with children's play area are one of the most frequent subjects of complaint. Adults need to be able to predict with some accuracy what will happen when children are playing outside the house.

Table 4.2 Children's Play Area

Area	Percentage (%)	Implications
Playground	25	+ Adequate open space - Poor state of open space - Poorly maintained open space
Streets	44	- inadequate open space - Health risk posed to children - Danger of accidents - Hindrance/ inconvenience to vehicular navigation - Insecurity over theft and mugging
Indoors (within Compound)	28	- Children's guardians do not think that its safe to play outside - Streets too busy - Inadequate open spaces within the estate - No one to watch over them - Insecurity over theft and mugging
No children in the household	3	
Are the streets safe for the Children?	**87% - NO**	**13 % - YES**

KERB PARKING

CHART 4.2: OCCURENCE OF KERB PARKING



Kerb parking as indicated is a normal occurrence to 82% of the respondents. For kerb-parking to have become a normal occurrence shows that the activity has occurred and been repeated over time, until residents accepted it as an alternate use of space within the estate. Residents who commented that it was common (12%) or uncommon (6%) were mostly from residential developments where the parking provisions were more that the minimum 1.5 parking spaces. This is mostly in high-income maisionettes or bungalow developments or flats with adequate parking in addition to provision for visitors parking. Plainsview Flats and Loresho Estate are examples of such residential developments where it was uncommon to find kerb-parking.

Kerb-parking for what it is represents the overflow of vehicular traffic onto the space reserved for pedestrians. This is due to the narrowness of roads, which limits street parking, and the inadequacy of parking provisions per residential unit.

Revision of the existing statutory requirements for parking needs to be revised from 1.5 parking spaces to a minimum of 2 parking spaces per residential unit. Alternative is to provide street-parking that will absorb additional per household, or visitors cars. A solution that is seen to work is the incorporation of parking and open space along slopping land as shown in PLATE 4.

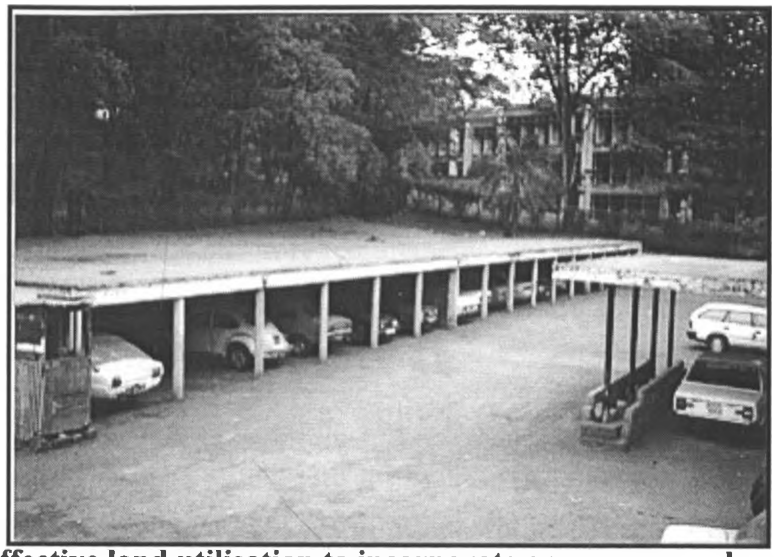
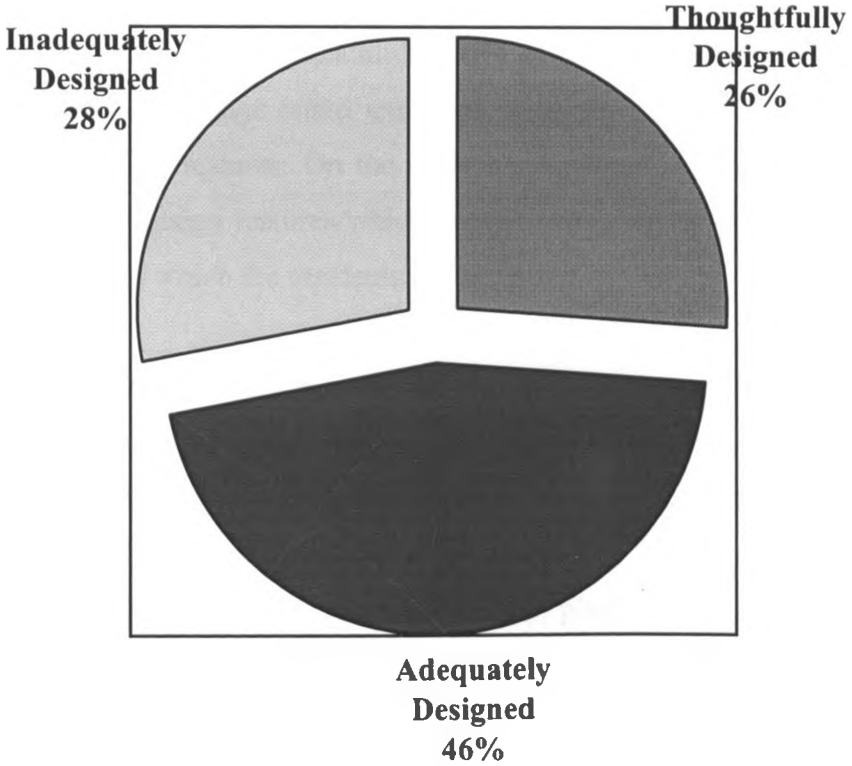


PLATE 4: Effective land utilisation to incorporate open space and parking space.

RESONDENTS OPINION OF DESIGN OF CIRCULATION SPACE

CHART 4.3: Residents' Opinion on the design of the Circulation Space



In the opinion of the residents, the design of the circulation space within their estate is as displayed in the pie chart. A key element in the design of multifamily housing development (for whatever income group) is its capacity to handle efficiently movement from A to B whether by car, bicycle or on foot and the indicator is that only 46% of the respondent think that's the case in their estates. Is this then a failure by the design team or by the statutory requirements and By-laws?

ROLE OF THE RESIDENTS

The residents response to the question on taking responsibility for the state of the circulation space revealed that 44% were willing while 56% did not think it was their responsibility, or were unsure on what responsibility entails. Good management is essential for the success of a multifamily housing development. Many of the problems identified to occur along or cause of the circulation space are often more attributed to the management of the estate than to design, composition of residents or location of developments. The different rates of crime, vandalism, accidents, aesthetic distortion, inadequacy of space and structural deterioration can all in some way be harnessed or curbed by better management policies.

> A "good" estate, that is, one where people feel happy and settled, is not just one in which a few particular important features are well handled, but one in which balance between, a multiplicity of factors comes out on the credit side. Thus on an average estate, excellent management may be counter-balanced by poor design features. On the other hand a "bad" estate may contain several excellent design features which are overwhelmed by poor management or by the way in which the residents use the place.
>
> Shankland, Cox Partnership, in association with the Institute of Community Studies. "Housing management and design; Inner area study, Lambeth." IAS/LA/18. London: Department of Environment. Mimeo. 1977.

Although there is little conclusive proof locally, plenty of circumstantial evidence in developing countries suggest that the more individuals (in a housing, residential setting) are permitted some control over the design, maintenance and personalization

of their estate, the more satisfied that will be and fewer will be the complaints coming from the residents.

Given however the cost of housing in Nairobi, many residents feel that the rent or mortgage they pay exonerates them and compels the owner or agents to conduct maintenance work within the estate. Added to this, residents expect the City Council to justify the rates they pay by collecting garbage and cleaning the streets.

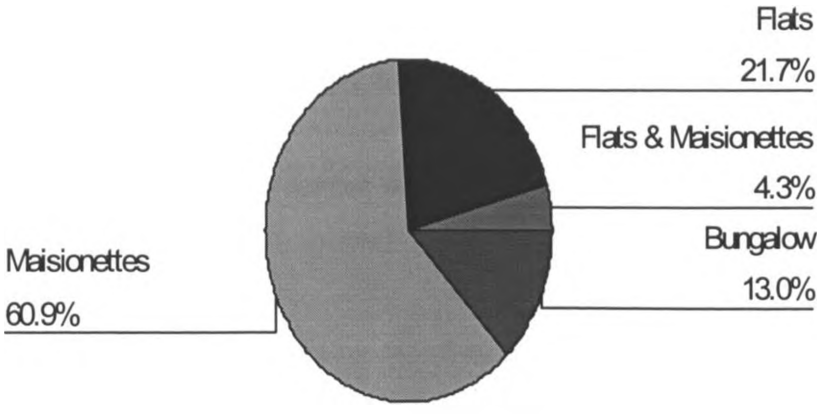
The design team should try and incorporate potential users of the proposed residential development, at the design stage. With the freedom to make reasonable changes and improvements, housing residents (whether tenants or owners) are likely to invest energy, money and time in maintaining the set standards and aesthetically it will lead to cleaner, neater circulation spaces. Such improvements and involvement will enrich the residents' commitment to their estate.

Further research should be done on various methods of increasing participation of residents through formation and involvement of more of housing or estate management committees.

4.3.3 OBSERVATION AND ROLE PLAYING

CIRCULATION SPACES IN RESIDENTIAL ESTATES

An Overview of the type of house types of the Residential Developments



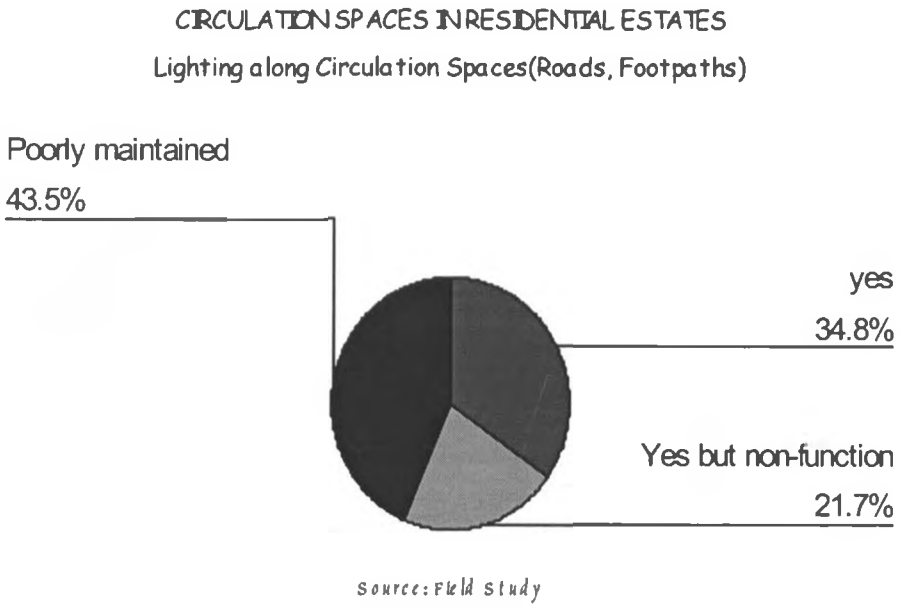
Source: Field Study

The pie chart (CHART 4.4) above show the percentage of house types representation of the houses of the residential developments that the researcher was able to visit.

MEASUREMENTS

The average width of footpaths that were measured was calculated at 1.74meters, while that of the main street averages at 5.18meters.

LIGHTING PROVISIONS



From Chart 4.5, all the residential developments that were visited had the capacity for street lighting in way of street lamps. This standard has been abided to in all the residential development visited.

YES (34.8%) represents those residential developments where street lighting works continuously. The maintenance of the streetlights is done on a regular basis.

POORLY MAINTAINED (43.5%) is a representation of those estates where the street lighting works unreliably. On some day it is working, on others it is not, or one section of the estate works while the other does not work Majority of the street

lighting in most residential estates is in this state of disrepair and can not be relied upon.

YES, BUT NON-FUNCTIONAL (21.7%) shows the percentage of residential estates where lighting does not functional at all. Yes, street lighting is provided for, but is not working.

KERB PARKING

This is by far the most common manifestation of the shortfalls of the current circulation space standards. In 89% of the residential developments visited, there was kerb or street parking. The situation was so acute in some case as in Nyayo Highrise Estate, to the extent that pedestrians had to weave their way between the cars. The street parking cased the following problems:

PLATE 5: Kerb parking that hinders pedestrians accessibility

i) Blocked accessibility to pedestrian walks

Kerb parking as shown in Plate 5 above, blocks the access that pedestrians have to shopping areas, foot-bridges and walkways, forcing residents to jump over the trenches and gutters. This poses a risk to the residents as they try to make new paths through to where they are striving to reach.

ii) Kerb parking distorted the aesthetics of the residential developments. With cars parked all over the place in no semblance to order, the aesthetics of the

estate were ruined. This makes it an eye sore to look at, both for visitors and residents alike.

iii) Pedestrian-to-car collusion. The encroachment of cars on the space of pedestrians' forces the pedestrian to walk on the roads, as they negotiate around cars parked on the kerb. This is what has led to the high number of accidents involving especially children as they attempt to cross without clear view of oncoming traffic

iv) Inconvenience to pedestrians as shown in Plate 4 where the pedestrians have to walk around cars to get to their destinations.

OPEN SPACES

Aside from the parking, the other common misuses of open space that are prevalent in residential areas are:

- Dumping of construction debris
- Dumping of garbage
- Open spaces are in a state poor maintenance
- Use as vehicle repair garages and dumping of the shells of old or write-off cars.
- Fencing off of open spaces for security reasons.

The misuse of open spaces has led to the children using the roads as play areas. The result of this is increased road accidents among the children who as PLATE 6 shows are left with no where else but the road and footpath to use as play areas.

PLATE 6: Children forced to play on the roads within the estate

Related to open spaces is the poor definition of spaces into open and circulation spaces. This has led to mixed use of the spaces as footwalks, parking, commercial

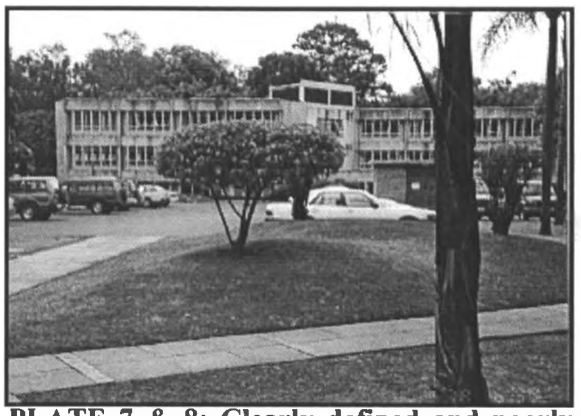


PLATE 7 & 8: Clearly defined and poorly defined circulation space within the open spaces.

sites and play areas. Apart from the safety concern of the children, this creates an aesthetic disharmony for the residents of the estates. Reference is made in PLATE 7 and 8 that show the state of defined open space in at Norfork Apartments and that of poorly defined open space at Jomo Kenyatta Airport Estate. At Jomo Kenyatta Airport Estate, the poor definition results in residents defining their own circulation space within the estate.

Again the lack of defined spaces within the estate has left the residents to decide on where to dispose their garbage/ refuse. Also left at to the discretion of the resident is the siting of vehicle repair stalls. Space needs require to be defined for space at the design stage of the residential development. In defining the space it is not recommended that the unusable tracts of land be the ones left as open space i.e. steep slopes, rock grounds and mash lands. A case is sited of Nyayo Highrise Estate, where open spaces constitutes the un-constructable land, which is too steep.

SPEED BUMPS

A visible response to the shortcomings of the existing circulation space is speed bumps and gates to residential courts. The speed bump is response by residents to increased cases of traffic accidents along the streets, which were present in 73% of the

field study sample. This goes on to say that collusion between residents and cars is at such or was at such alarming levels such that the only alternative is to control the vehicular transport. The situation of accidents is made worse by kerb-parking, because residents will have to negotiate around parked cars into the road where they face speeding cars.

Security gates within residential estates are another response by residents to insecurity. The cause of the insecurity has many roots, however one that can attributed to circulation spaces is the poor state of the street lighting within a residential development. More often than not the lighting as previously shown was found not to be functional. Cases of car-jacking, robberies, theft and mugging were some of the top of the mind reasons as to why the gates have been erected in the residential courts.

ACTIVITIES ON THE CIRCULATION SPACES – ROADS AND PARKING

The roads, walkways and parking lots were clustered in activities other than what was intended. As might be expected, road spaces were used for the intended purpose, but this was hindered or hampered by other activities like:

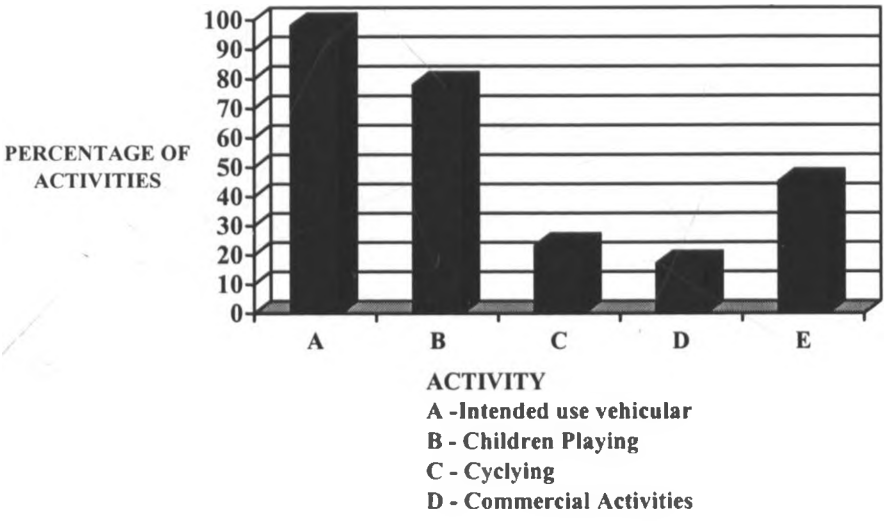
Children Are Playing. This arose from several causes like abuse of open spaces, lack of open spaces and undefined open spaces within the estates. Children cycling activities is a common activity on roads, owing to the fact that

- This activity has not been accommodated in the design of circulation spaces,

- Cars are parked on the kerb,
- Excavation activities on the footpaths,
- Territorial Markings, which is discussed further on,
- Presence of construction debris, garbage and plants or flowers,
- Poor state of open spaces.

Commercial Activities along and on roads and parking spaces is common especially

TABLE 4.3: ACTIVITY ON CIRCULATION SPACES - ROADS AND PARKINGS



in low-income residential developments or areas of high population density. This poses safety concern for the buyer, trader, pedestrians and motorist. Concern is for the health of the traders and buyers due to the contamination of food and the air buy fumes, dust, splashed water and exhaust gases from the passing cars. A probable reason for the commercial activities along and on the circulation spaces is the fact most residential developments of high population density do not in their design dive serious consideration to the provision of adequate and well places commercial centres or shopping centres. The result of this is that the need for residents to purchase perishables is met by the cropping of residential activities on and along the circulation spaces. Common commercial activities on the circulation space include selling of vegetables, grain, second-hand clothing and house-ware.

Garbage Disposal was and activity by residents that slowly encroached on the parking or road space in the estates. It thus occupies or narrowed vehicular space, making traffic flow restricted, or reducing the amount of parking space available limited. The precipitate of this activity happening on the road space is that vehicles are parked on the open spaces or footpaths, or cars drive on the footpath intended for pedestrians. This in-turn exposes the pedestrian to a higher risk of colliding with cars. PLATE 9 shows a case of dumping of refuse on parking facilities at Jomo Kenyatta Airport Estate, where parking was common on the kerb and the open spaces adjascent to the road. The situation though ironical is quite common in reidentail developments.

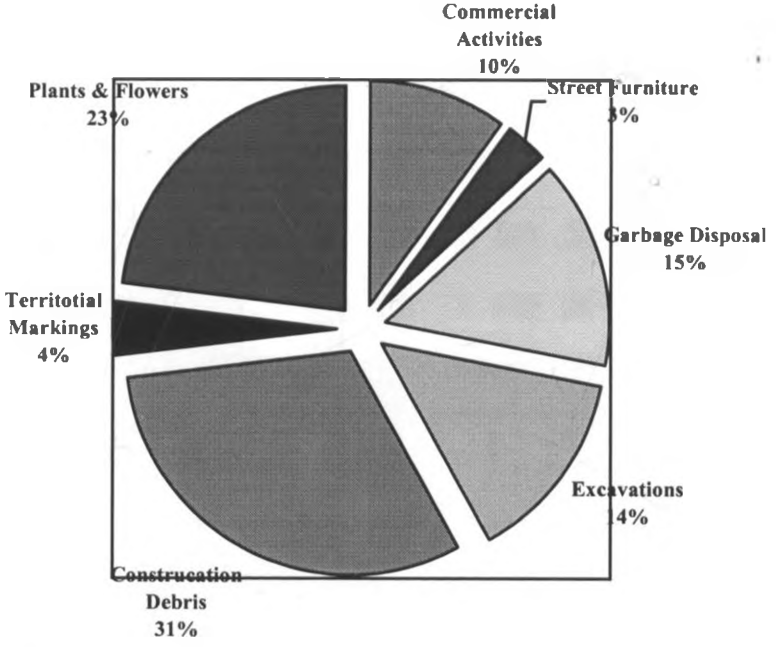
PLATE 9: Garbage Disposal on the Circulation space – Parking space

Few estates were seen to make provision for well defined garbage disposal facilities that were serviced by clearly defined roads. This is a decison that will be left to the design team noting the fact that the legislative instruments governing design are silent on the matter.

STATE OF THE FOOTPATH

The pie chart above shows the state of footpaths in about 75% of residential estates in

CHART 4.6: STATE OF FOOTPATHS IN ESTATES



Nairobi. Commercial activities mentioned are the same as the ones mentioned for roads and parking spaces previously. A comment on a local newspaper that shows the magnitude of the comment was made in the Daily Nation on the 27th of July 1999, stating:-

> " In Ngumo there is a *jua-kali* garage that leaves written-off cars partly on the pavement, forcing residents to share the road with speeding cars. The shell of the wrecks act as hideouts for thugs who waylay unsuspecting passers-by at night, surely the council should act" he says.

The implication of the statement is that the problem does exist, and calls the attention of the City Council to act in was of direct action an policy and legislation formulation.

Street Furniture in most residential developments occur in form of street light post (lamp post), electric poles, telephone poles, electric switch boxes, Telkom Control Boxes and protective bollards. PLATE 10 shows a telephone/ electricity switch boards that is surrounded by bollards intended to protect the switch box from motor vehicles. This acts as an obstruction on the pedestrian flow on the footwalk and hinders its use by cyclists. In addition, it should be noticed that the gates swing into the footwalk creating yet another obstruction to the footwalk. Fallen poles are another common occurrence on the footpath, and this stay for a longer in disrepair as

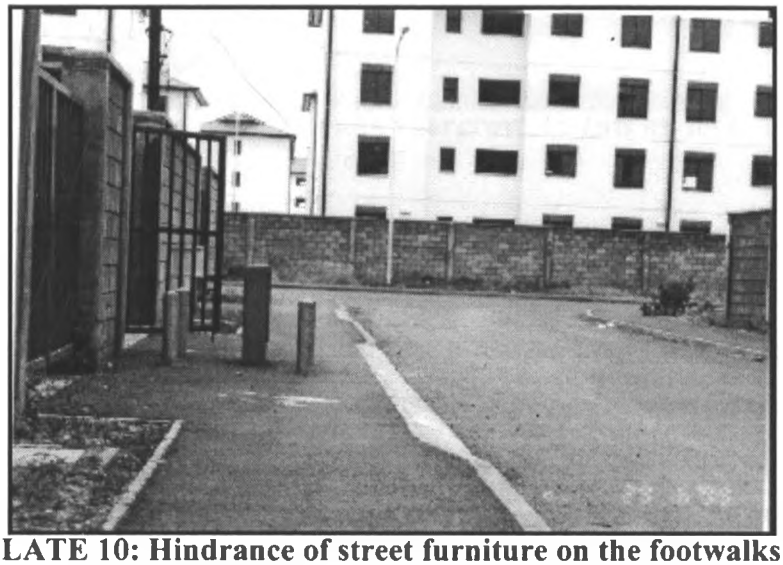


PLATE 10: Hindrance of street furniture on the footwalks

compared to those that fall over roads.

Street furniture evidently is not given much consideration in the design of footpath in residential developments. Its positioning is to the convenience of the statutory authority like Kenya Power Company and Telkom Limited, or after the need of the vehicular transport have been catered for.

Other essential street furniture like benches, aesthetic structures need to be considered and added onto the design of circulation spaces, without creating inconveniencing or obstructing the pedestrian.

Garbage or Refuse Disposal is common in most residential estates . When considered together with construction debris, 43% on footpaths (PLATE 11) in

Nairobi's residential estates can be said to have garbage or construction debris on them. This in itself raises two questions that need mention.

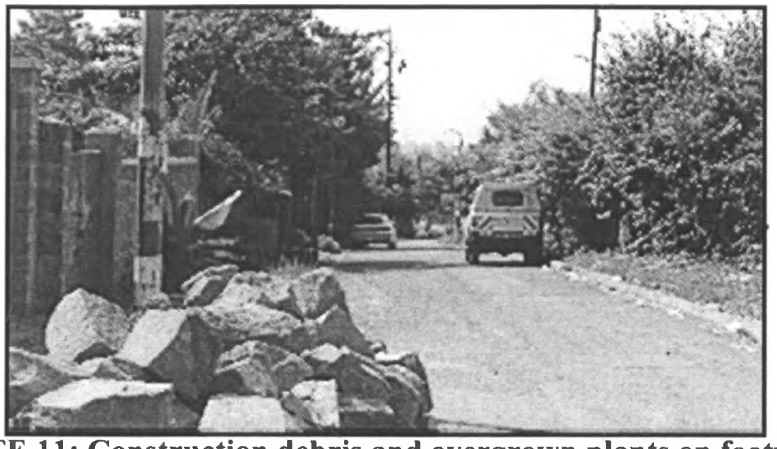


PLATE 11: Construction debris and overgrown plants on footwalk

First question is on the amount of construction activities in residential activities that is legal or that will remain acceptable. The impact of the construction debris that litters footwalks is seen in the amount of space that it claims from the footwalk, road and open spaces within the residential development. Though discussion on the surgence of construction activity in residential developments is beyond the scope of this paper, it is worth of mention that the activity needs to be harnessed through the laying down of legally enforceable procedures or by-laws and appointing adequate inspectors to ensure that they are abided to.

The second question draws attention to the design team and questions the adequacy of their designs in terms of integrating garbage disposal services into the designs. Tied to this is the design of roads and walkways in a way that facilitates the carrying out of garbage disposal and collection. Residential mannerism can to a great extent be controlled by the proper laying down of good roads and walkways leading to and away from this service.

Excavation on the walkway for services like electrical or telephone cable, pipes, storm water drainage is one of the most evident activities on the footwalk. The trenches when dug are not usually back-filled adequately, leaving gaping holes on the footwalks. Making good of the footpath is either totally ignored or done in a shoddy manner. This creates a physical obstacle that:

- Physical obstacles to pedestrians.
- Becomes a nuisance to young and elderly residents
- Cases pedestrian to walk into the road to avoid the excavation, thus exposing residents to accidents.
- Inhibits use of bicycles on footpaths, even if they are wide enough.

This calls for the legislation calling for the making good of disturbances to roads and footpaths, to be strictly enforced.

Territorial Markings in this context refers to construction of kerbs that start at the roads and terminate at the gate of the residential unit. The raised kerb acts to identify the territory and drive way belonging to a particular house. Such markings more often than not cross the footwalk, and are common in residential estates that are characterized by maisionette and bungalows. This marking have the same effects as trenches in that they create a physical barrier on the footwalk, forcing the pedestrians to go through the inconvenience of walking into the road or over them. It also inhibits the use of the footpaths by cyclists. The practice is uninhibited due to lack of mention in the existing legislation.

STREET SIGNS

As might be expected, the street signs were evident in only about 30% of the field study. Majority lacked and signs whatsoever that identified a road, confirmed the right of way or cautioned motorist and pedestrians. Lack of street signs makes it more difficult for a visitor of even the resident to navigate the estate or locate a residence. Legislation exists to this regard but it is not enforced in residential developments.

4.5 PROBLEMS ENCOUNTERED IN THE FIELD

a) Financial

Due to the inadequacy of finance, the researcher had to limit the number of questionnaires administered to various groups owing to production costs and cost of

administering and retrieval of the same. Therefore the advantage of covering a large sample of the targeted population was lost.

b) Time

The time available for the research also had a bearing on the sample size selected. With more time, the researcher would have been able to cover large proportion of each population. Some questionnaires also had to be disregarded because the respondents demanded more time than the research program could allow.

c) Delay in research authorisation from City Hall

The researcher had to apply thrice for research authorisation form the City Town clerk. This was in order that he may be allowed to peruse development plans and administer questionnaires to City Council officials in the department of City Planning and Architecture. The last application was made on 1st July 1999 to which the research authorisation was received by the researcher on 14th July 1999. (See Appendix IV)

d) Unavailability of City Council Officials

This forced the researcher to make many visits to the council offices before he could finally get the officials. The researcher also had to do a lot to convince these officials to volunteer information owing to ongoing allegations that they had become lax and corrupt in the carrying out of their duties.

Definitely, some felt that the research was a threat to their employment.

e) Hostility and unwillingness of the residents

This research evoked allot of suspicion from the residents owing to the current state of insecurity in some residential areas. The researcher came under bombardment of allot of hostile questions especially when measuring the dimension of roads and footwalks, plus when taking photographs of the situation on circulation space. Due to this, fewer

questionnaires were administered in some residential developments like Dandora and Koma Rock Estates.

f) Communication Barrier between the researcher and residents

Some of the questions asked to the residents in the questionnaire administered seemed quite difficult for them to discern. The researcher had to explain in length the purpose of the study and them the question to some of the respondents, and this could have resulted in the distortion of information.

C H A P T E R F I V E

C O N C L U S I O N S &

R E C O M M E N D A T I O N S

CONCLUSIONS

The hypothesis held by this research was that "The current standards and constraints as stipulated in the current Legislation or Building Codes, Planning Law and Road Design Manuals do not in totality cater for the Circulation Space needs in residential estates." It would be safe to conclude that the hypothesis does hold water in that the provisions made for Circulation Spaces in existing statutory instruments provide in most cases a bottleneck for better Circulation Space design, while in other cases the instruments are silent. This leaves the interpretation of the requirements to the design team or the developer.

The social, economic and environmental implications of constructed circulation spaces have led to development standards and constraints. While most planning and design requires a trade-off between desired benefits and the available funding, techniques and standards have not been addressed to meet the trade off. This research paper has studied the posterior implications of current circulation space layout as dictated by the existing statutory instruments.

What this research has established the following: -

Legislation and Policy

-There are about 16 different legislation that have an impact on housing developments with contradictions or duplicating implications. There exist several agencies and actors who though with specific roles have different interested and hardly complement each other. A good example is cited is where Planning regulations and policies are under the Physical Planning Department of the Ministry of Lands and Settlements; National Housing Policy is under the Ministry of Public Works and Housing; the Public Health Act is administered through the Ministry of Health; while the Ministry of Local Government is in-charge of Building By-law of the Local Government Act. All this result in a conflict of interest by the various actors.

-Inability to translate legislation and policy to ground-level decisions may be due to restricted availability or even absence of particular resources in the right place at the right time. Complications also arise out of the fact that the resources are rarely under the immediate control of the planners and policy makers, meaning that policy implementation is consequently on the degree of co-operation achieved by the planning section of the local government and the other local government authority departments.

-Co-operation of the local government and national public corporations, private sector individuals, groups and corporations, is a complex logistic and political operation in some cases.

-Other factors at work in the implementation process of the existing legislation, is the variation of interpretation of written building regulation. Interpretation if statements is according to the motives of the interpreter. The translation of the often-abstract policy wording into active meaning will be different between planners and politicians, economists' conservationists and developers. (Cloke Paul [6]) Any such variation is extenuated in the numerous special cases requiring decisions by local government authorities.

-Certain applications of residential developments may not conform to establish policy but will receive the backing or silent approval of local government authorities as "one-off" developments in special circumstances. Nyayo High Rise Estate, along Mbagathi Road.

-The aspect of corruption is evident from the fact that developers evade the Plan Approval process with impunity.

-The developers also ignore the services of qualified consultants and the use substandard plans. The complete design team is seen as an added cost by the developer.

-Lack of qualifies site supervision leads to the construction of developments that defer from the drawings that are submitted to the Department of City Planning and Architecture.

-The Local Governments enforcement machinery is so weak that the City Council can best be described as a toothless bulldog. No strict measures are taken against those who contravene building legislation. A case is cited of Nyayo Highrise Estate that is by all standards inadequately designed. As of the 24th of June 1999, Nyayo Highrise has not been approved s a housing development despite the fact that it is in existence. It holds an estimates population of over 15,000 residents, with more flats coming up below the dam of Nairobi dam.

-Tied to the lack of enforcing power is the influence of politics in the approval process of development plans. Political interest pushing for the approval of some developments leaves the council without much option but to "approve" the plans though they are not in conformity to the development legislation.

-The abuse of professional responsibility/ ethics is evident among the design team. Despite knowing not only the laid down legislation, but also having advanced knowledge of Circulation Space design, they do go ahead to make avoidable provision in their design (some of horrendous proportion) that people will have to live with for decades to come. E.g. Nyayo Highrise Estate.

-The Local Government also appears to duplicated or ignored rather than co-ordinated the various departments within the development section

Constraints

In an ideal situation the most suitable position for the building should be selected and then vehicular access provided by bringing a road to the building. When considering the siting of a road it should be borne in mind that it consists of the carriageway, the footways or the pavements and the grass verges, if any.

The ideal however is seldom attainable in modern residential developments due to the following constraints:

i. Cost of Construction to the developer
ii. The need to utilize both frontages of buildings in residential areas whenever possible.
iii. The misappropriate amount of land which would be used for roads.
iv. The high residential densities currently made acceptable due to the great demand for housing.
v. Topography of the site. This is important when considering gradient in relation to the type of traffic likely to use the road.

RECOMMENDATIONS

POLICY

The implementation of Circulation space legislation and policy should not be symbolized as a tangled web of intrigue and corruption. Indeed the majority of decisions involving implementation are processes that should be straightforward and clearly defined to all. Vagaries of implementation clearly shape the end result of circulation spaces in residential developments.

BY-LAW

Amend and update the relevant sections of the building code, the Public Health Act, especially those to do with infrastructure standards.

PARKING PROVISION (Appendix VII)

Determine the level of parking per household in a residential development on the basis (Hefferman [1]) of :-

- Current rate of car ownership.
- Stage of household in the family cycle to determine the kind of most likely car owned.
- Socioeconomic status of the group.
- Quality of local public transport.
- Fuel costs (Current and projected)
- Availability of site area for parking.

VISITORS PARKING

Statutory instruments should be put in place to ensure that residential developments do provide for visitors parking in accordance to the number of housing units.

All areas of visitors parking should be identified on a map at the entrance of the residential developments. (Beck [4])

Visitors parking should be located at the front of houses so that a resident can see visitors approach the house. This has been well displayed in Plainsview Flats in Nairobi, where visitors' parking is not only provided at the front, but is also separated from the residents parking.

Stipulate in the residents' manual or lease agreement that residents are not permitted to park in visitors parking. (Beck [4])

USER GROUP TERRITORIES

The design team should try and ensure that each age group within the residential development has one or more outdoor spaces that are its undisputable territory and that each of these spaces is located and furnished appropriately. This will help avoid children playing on the roads of car repair going on in the main streets. (Becker [2])

FOOTPATHS

This should be made wide enough to accommodate both children on bicycles and adults yet footpaths that will avoid fast cycling. (Beamish [5])

Footpaths should connect dwelling entries with open spaces by the shortest possible routes so that the residents do not create shortcuts through activity areas like roads parking spaces etc. (Maclead [3]).

FOOTPATH PRIVACY

Locate paths so that pedestrians do not violate the privacy of the nearby dwelling units. This would be by ensuring that public paths do not pass next to the window of dwelling. Where the distance between the path and the housing unit is problematic, screen with high opaque fencing or buffer planting or create a grade difference, providing that does not constitute a barrier to physically disabled residents.

LIGHTING

The Design Team should aim at selecting lighting that do not have excessive glare and generation dark shadows, in a bid to deter crime along circulation spaces.

Vandal-resistant and easy to maintain lighting fittings should be fixed to the lighting system, in residential developments that where vandalism is common place, or where are maintenance is problem.

The following social constraints when considered in the topic of Circulation Space Layout were seen to need defining and the development of a standard related to circulation systems. This were;-

a) Aesthetics
b) Congestion
c) Travel time
d) Safety
e) Activity Pattern
f) Privacy
g) Security

*

AREAS FOR FURTHER RESARCH

1. The interaction between Standards, Constraints and the built form for the separate housing types of Bungalows, Flats and Maisionettes.

2. Research into the setting of the standards for socially acceptable levels of noise for housing estates in the context of community response.

3. Effect of road traffic on residential developments in terms of air quality, noise, overcrowded roads and parking difficulties.

4. Alternative Noise barrier shields that are applicable in Kenya

5. Alternate methods of incorporating user groups (residents, tenants) at the design stage of residential developments.

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A P P E N D I C E S

APPENDIX I - **Questionnaire**

APPENDIX II - **City Council of Nairobi guidance for submitting development schemes**

APPENDIX III - **Observation Sheet**

APPENDIX IV - **Nairobi City Council Research Authorisation**

APPENDIX V -**City Council of Nairobi – Submitted Plans Comment Sheet**

APPENDIX VI - **Site Comment Sheet**

APPENDIX VII - **Parking Manual**

APPENDIX VIII - **Development Control Inspection Sheet**

Appendix I

STANDARDS AND CONSTRAINTS IN CIRCULATION SPACES IN RESIDENTIAL ESTATES

TO THE RESPONDENT: This questionnaire is designed to obtain information on the roads, footpaths and parking conditions as they are in your residential estates. The aim of the study is to obtain data that will help in creating policy for purposes of improving design of circulation spaces in residential areas. Your sincere and honest replies will be highly appreciated. Your answers will be treated with strict confidence and will only be used for purposes of research.

Date of interview: _____/_____/ 99

Case Study Estate: _____

SECTION A:

1. What age category do you fall under?

18 – 24 yrs ; 25 – 30 yrs ; 31 –35 yrs ; 36 yrs and above

(If below 24 yrs close interview and thank the person.)

2. Gender of respondents? Male ____ Female ____

3. For how long have you lives in this estate; Less than 1 year; 1 – 3 yrs; 4 – 6 yrs; Over 7 yrs

4. Total number of people living in housing units/Size of the household _____

SECTION B:

5. What is the most common mode of transports to work?

A. Work here; B. Foot; C. Bicycle; D. Motorcycle E. Car; F. Bus/Matatu G. Other

6. Number of Cars owned by household _____ Motor Cycle owned by household _____ Bicycles owned ____

   Children bicycles owned ___

7. What is traffic like on your street? Would you describe it as ___

1= very safe 2= moderately safe 3= safe 4= unsafe 5= very unsafe

8. Does it bother you __Yes __No

Appendix I

9. Is it ever dangerous on your street and around your home? (Traffic accident, incidence etc) __

   1= very safe __ 2= moderately safe __ 3= safe__ 4= unsafe__ 5= very unsafe__

10. Is the danger caused by __Mugging __Car to Car Accidents __Person and Car Accident?

11. In your opinion, is the street lighting ___ more than adequate ____adequate ___insufficient ___lacking.

12. Are you ever troubled by noise and/or vibration ___No ___Yes

13. Are you bothered by the dirt, exhaust pollution, smells and glare from headlight from car ___No ___Yes

14. In your opinion is the street too wide or too narrow ___Wide ___Narrow ___Adequate

15. In your opinion is the street __too steep __steep __adequate

16. Are the sidewalk too wide or too narrow ___Wide ___Narrow ___Adequate

17. Are the side walks ___too steep ___steep ___adequate

18. Are the parking spaces in the compound ___too few ___adequate ___plentiful

19. In your opinion are the street parking lots ___too few ___adequate ___Plentiful

20. Where do the children play if at all ___playground ___street __ Inside the house __in-doors __Don't

21. Are the streets safe for them ___Yes ___No

22. If no, why are the streets not safe for them _____

23. Is parking on pedestrian and cyclist pavement _____common ____Uncommon ____Normal

24. In your opinion, were the roads, sidewalks and parking space ___ thoughtfully designed ___Adequately-designed ___inadequately designed

25. Do you feel a sense of responsibility for the way the streets look and what happens? ___Yes ____No

Thank You Very Much

Housing type: (1) Maisionettes (2) Flats (3) Bungalow (4) Commercial cum Flats (5) Bungalow and Maisionetes

(6) 1,2 & 3

APPENDIX II

CITY COUNCIL OF NAIROBI

CITY ENGINEER'S DEPARTMENT

Notes for the guidance of persons submitting development schemes

Issue of August 1978

1. Scope

These notes cover all schemes, fom a plot entrance serving a private property or a simple subdivision of an existing plot to a comprehensive scheme opening up a new area.

These are general guidelines and Council reserves the right to impose additional conditional as necessary.

2. Plans

Plans are required in all cases and must be signed by the owner or authorised agent, and shall be dimensioned in metric units.

Four prints of each plan and an inspection fee of Shs. 100/- per subplot must accompany a subdivision application.

Rational representative fraction (R.F.) Scales shall be used (i.e. 1:200, 1:500, 1:1000, 1:2000 or 1:2500), but in any case a location plan of 1:2500 for the pre-1964 City Area, or 1:5000 for the added area, shall be part of the submission.

(N.B. scales of 1:480, i.e. 40 feet to an inch, and 1:1200 (100ft. to an inch) are not acceptable).

3. Information

The plns must show the following informations:-

(i) Location, road name and plot number.

(ii) Road reserve widths.

(iii) Contours, with their values written so as to read 'Up Hill'.

(iv) All existing buildings and their uses.

(v) All existing drainage systems.

(vi) Area of each subplot (in hectares).

(vii) Access to all subplots, with dimensions.

(viii) Distance from existing buildings to proposed subdivision boundaries.

(ix) Plot dimensions

(x) North point

(xi) Adjoining plots and numbers

(xii) In areas where flats are permitted, the total floor area of existing buildings on the plot should be noted on the plan.

(xiii) Carriageway and other features in the road reserve.

4. Layout of Road Reserves

The required widths of road reserves shall be as defined from time to time by the Council. (see first schedule).

Cul-de-sac must terminate in a minimum 12m. turning bay.

In comprehensive development schemes, a common access road 6m. wide and not exceeding 15m. long may serve not more than 3 plots. Junction corners must be truncated by not less than half the width of the joining road.

5. Service Wayleaves

Wayleaves for the accommodation within the plot of any necessary services shall be clearly shown. They shall not be less than 3m. wide (or 3m. each side of a river or watercourse - measured from High Water Mark) but may need to be larger if multiple services are to be accommodated.

All plots should have a surface water drainage route to a Council's S.W. sewer or a line of natural drainage or watercourse.

6. Footpath Reserves

Pedestrian routes through new development should be provided in relation to external and internal requirements.

Reserves should be not less than 3m. wide; but if combined with a drainage wayleave, the width must be sufficient to give not less than 2m. clear width of footpath.

7. Open Spaces

An adequate area of permanent open spaces shall be provided and developed to the satisfaction of the Council. Developers should consult with the Chief Planning Officer and the Parks Superintendent in this matter. Pedestrian routes should be related to the open spaces.

8. Street Lighting

All development to an average density of more than 1 dwelling per hectare shall be provided with approved street lighting, and with precinct lighting in courts and pedestrian ways.

9. Sewerage

All development to an average density of more than 10 dwellings per hectare, or within 60m. of an existing public sewer, shall be provided with a sewerage reticulation system serving all the plots and connecting to a Council's existing public sewer, or to a suitable treatment works.

10. Water

A suitable water reticulation system shall provide all plot s with water from an approved supply.

11. Engineering Design

In respect of Civil Engineer Works, the minimum standards of constructio required for adoption and maintenance shall be as defined from time to time by the Council (see second schedule).

12. Plantings

An approved scheme of grass and tree planting shall be carried out in all open spaces and road reserves. Developers should consult with the Parks Superintendent in this matter.

Narrow grass verges of less than 1m. should be avoided and replaced with bituminous sealing.

13. Street Furniture

The positioning of street furniture, poles and other obstructions must be shown and should be considered in relation to other design features and services. The necessary minimum width of a footway may not obstructed by a sign post, street light column, marker etc.

14. Adopted Streets

Where a change in zoning density was made conditional upon the provision or existence of adopted streets to serve the area, it shall be a condition of subdivisional approval that t he proposed development shall be connected with Council's system of adopted streets.

15. Engineering Details

Before commencing any work, the following details must be submitted to the City Engineer for his approval.

(i) Layout plan
(ii) Longitudinal section showing centre line gradient of roads & cross sections at 30m. intervals.
(iii) Longitudinal section showing gradients of sewers and drains
(iv) Culvert sizes
(v) Typical road cross sections.
(vi) Outfall surface water drain.
(vii) All other engineering details.

Plans and long section should be to a scale of 1:500 horizontal, and 1:100 vertical. Cross sections shall be natural and usually to a scale of 1:100. The typical section may be larger to show more detail,. A key plan should be provided if necessary.

16. Inspection of Works

The developer will not be deemed to have complied with the sub-divisional conditions unless the City Engineer has been able to inspect the following stages of the roadworks:-

(i) Setting out of the works.
(ii) Excavation to formation level.
(iii) Laying and compaction of the sub-base.
(iv) Laying and compaction of the base.
(v) Placing and finishing of the base-course and the wearing course.
(vi) Alignment of kerbs and edges.
(vii) Construction of s.w. sewers or drains.
(viii) Street lighting at all stages.

He must then be satisfied that the work has in fact be carried out in accordance with the approved drawings.

In the case of other works, the appropriate officer of Council shall be so satisfied.

17. Sub-divisional Approval

Where conditions have been attached to the sub-divisional approval the applicant should inform the Council in writing when these conditions have been fulfilled. If following inspection the Council is satisfied that this is the case, a letter recommending grant of final approval and certificate of title is sent to the Commissioner of Lands and copied to the applicant.

In the case of roadworks, drainage, sewerage and street lighting thee works shall be subject to a 12 months' maintenance period, and the developer shall be required to deposit with the Council a sum equal to 10% of the cost of such work (as agreed by the City Engineer) as surety for the due performance of work necessary during this period to ensure that the said works are finally handed over in a satisfactory condition. On the expiry of the period of maintenance, an inspection will take place and the cost of any further remedial measure will be deducted from the deposit before the balance is refunded to the developer.

18. Building Plans on Sub-divisions

Plans for building works submitted under the Building Code (other than submissions which relate to work which is required as a condition of subdivision) will not be approved until all the conditions of sub-division have been fulfilled.

Where the developer wishes to proceed with the building works concurrently with the construction of roads and ancillary works which form part of the conditions of sub-division, consideration will be given to accepting a cash deposit or a performance bond to fall due in 2 years as a surety for the satisfactory completion of these works. The amount of such deposit or bond shall be 1½ times the estimated cost of the works as agreed by the City Engineer.

Neither the payment of a deposit, nor the existence of a Bond nor the fulfilment of any of the conditions therein shall influence the decision of the City Engineer when it comes to certifying that the developer has complied with the conditions of sub-divisions.

(note 4)

FIRST SCHEDULE

Provision of Road Reserves

The width of road reserves to be provided in development schemes shall be not less than the following:-

(i)	Major communication routes	60m.
(ii)	Important through-routes likely to require major treatment in the future.	30-36m.
(iii)	Spine roads and roads in commercial or Industrial areas.	25m.
(iv)	Bus routes.	18m.
(v)	Local distributor roads. (No. vehicle plot access).	18m.
(vi)	Major access road exceeding 150m in length.	15m.
(vii)	Access road (normal residential street) not exceeding 150m. in length.	12m.
(viii)	Minor access road (short cul-de-sac), not exceeding 60m.	9m.

SECOND SCHEDULE

Infrastructure Standards

Carriageway Widths

A.	Trunk and major routes not less than	7.5m.
B.	Commercial & Industrial Streets not less than	7m.
C.	Spine roads and/or Bus routes	7m.
D.	Access roads (normal residential streets)	5.5m.
E.	Culs-de-sac (not exceeding 60m.)	5m.

Footways

The standard provision shall be a 2m. wide footway on each side of the carriageway, subject to the following relaxations:-

(i) For a cul-de-sac serving less than 10 plots a single footway will suffice.

(ii) Occasional obstructions shall nowhere reduce the footway width below 1.2m.

Pedestrians shall be physically separated from moving vehicles by a barrier such as an upstand kerb, open drain or wide verge.

Car Parking

Parking facilities for cars shall be provided to the extent of $1\frac{1}{2}$ bays (car spaces) for each dwelling unit in the area. Where on-street parking is not practicable, then off-street car-parks shall be provided. Where it is shown that on-plot (private) parking has been provided, then this may be allowed against the number of public spaces. The maximum distance between a dwelling and its associated parking area shall be 50m.

Parking for commercial vehicles and for shoppers shall be in addition to the above requirement.

Design of Access Roads

The carriageways in Commercial areas, spine roads, Bus routes and Industrial areas shall be designed to meet the particular circumstances but shall not be less than specification 1 below.

Roads in residential areas shall conform to one or other of the following specifications.

SPECIFICATION 1

Areas where the zoning stipulates a minimum plot size of less than 0.4 ha.

Wearing course 25mm. machine laid asphalt.

Base course 25–40mm. machine laid bituminous macadam.

Waterbound stone base 150mm.

Compacted murram sub-base 150mm. (May be omitted if C.B.R. of subgrade is proved at not less than 12%).

Compacted subgrade – C.B.R. 4% 150mm.

Concrete kerb and channel.

Footways 100mm. murram with slurry seal on single chip seal.

On Black Cotton Soil, a waterproof shoulder shall extend 1.5m. from the edge of the carriageway.

Piped drains (min. 300mm. dia.)

All subgrade under a construction of less than 150mm. shall be treated with a Total Persistant Herbicide.

SPECIFICATION 2

Areas where the zoning stipulates a minimum plot size of less than 1 ha.

Dense carpet base and wearing course 25mm. machine laid.

Waterbound stone base 150mm.

Murram sub-base 150mm (if subgrade is less than 12% C.B.R.)

Compacted subgrade 150mm. (not less than 4% C.B.R.)

Concrete edging blocks.

Kerbs on inside curves not exceeding 20m. radius.

Footways 100mm. murram with double seal.

Waterproof shoulders on Black Cotton Soil.

Concrete lined drains unless piped.

Culverts not less than 300mm. dia.

Treat subgrade with herbicide.

SPECIFICATION 3

Areas : where the zoning stipulates a minimum plot size of 1 ha. or over.

225mm. murram on consolidated subgrade.

Open unlined drains.

The road will remain an unadopted street.

5. Flats and Maisonettes

Where flats or maisonnettes are permitted, thereby allowing more than one dwelling per plot, the average plot area for the purposes of the above classification shall be the average area available for each dwelling unit.

Appendix III

OBSERVATION SHEET

Estate:_____ Location:_____

Data

House type:
1. Bungalows
2. Maisionettes
3. Flats
4. Flats and Maisionettes
5. Flat cum Commercial

Measurements

Width of footpath: _____ meters
Width of Roads: _____ meters
No. of Parking provision: _____

Lighting:
1. Yes, provided for and functional ___
2. No, non provided for ___
3. Yes, provided for but not functioning ___

Kerb parking
1. Yes, normal occurrence
2. No parking on the kerb.
3. Occasional Parking.

Open spaces
1. Adequately available
2. Available but committed to other uses E.g. garbage dump, vehicle repair, construction debris
3. Private open space behind house
4. No open space available
5. Insufficient open space

Speed Bumps
1. Yes 2. No

Activity on Circulation space
1. As intended, i.e. pedestrians on walkway and cars on roads
2. Children plating on walk way.
3. Heavy cycling activity
4. Commercialization on the walkway i.e. people trading wares on the walkway

State of Footpaths
1. Commercial activities on the footpath
2. Excess street furniture
3. Garbage disposal on the footpath
4. Excavation on the walkway – services e.g. electric power, telephone, pipework, drainage
5. Construction debris
6. Territorial markings- construction projections and extended kerbs

Street Signs
1. Yes 2. No

Appendix IV

NAIROBI CITY COUNCIL

TELEGRAMS: "MUNICIPALITY" NAIROBI
TELEPHONE: 224281
EXT 2160 - Eng. (Mrs) Maundu

CITY ENGINEER'S DEPARTMENT

CITY HALL
P.O. BOX 30075
NAIROBI,
KENYA.

Ref No CE/0960/VWM/TNK

7th July, 1999

Jonathan N. Karanja,
University of Nairobi
P.O BOX 30197,
NAIROBI.

Dear Sir,

REF: RESEARCH AUTHORIZATION - JONATHAN N. KARANJA.

Your application was received on 1st July a day after the deadline set for you. Howe if you still need the information, please consult my Chief Assistant Engineer (Estates Development Section) at City Hall Room 205.

Yours faithfully,

Eng. C.M. CHIURI.
CITY ENGINEER.

COMMITTEE

PLAN REG. NO.

DATE	AGENDA NO.

RECEIPT DATE

City Council of Nairobi

CITY PLANNING & ARCHITECTURE DEPARTMENT

Development Control Section

SUBMITTED PLANS COMMENT SHEET

TYPE OF SUBMISSION

	PRELIMINARY
	FULL
	COMPLIMENTARY
	AMEN PLAN REG No

(1) PLOT L R No.		Road Street	
(2) DESCRIPTION OF THE WORK		Estate Area	
		Value	SHS
(3) AGENT SUBMITTING		Box No	Phone No
(4) OWNER OR DEVELOPER		Box No.	Phone No
(5) PLINTH AREA	STATED M² / CHECKED M²	FEE PAID	SHS / REO
(6) SEWAGE DISPOSAL	SEWER / CONSERVANCY		SOAKAGE

(7) DISTRIBUTION	F.P	Sewers	Roads	CH. F.O.	HDD	Struct.	M.O.H.	VALUE	C.T. G M	(WATER)
FIRST										
SECOND										

(8) CONDITIONS OF APPROVAL

	(a)	STRUCTURAL DETAILS		(h)	ALL DEBRIS AND EXCAVATED MATERIALS TO BE DUMPED ON SITES APPROVED BY THE CITY ENGINEER
	(b)	CANOPY AGREEMENT		(i)	REPLACEMENT OF CUT DOWN TREES AND LANDSCAPING IMPLEMENTATION
	(c)	CERTIFICATE AS TO WORKMANSHIP		(j)	SATISFACTORY CANALISATION OF THE RIVER AT THE OWNERS RISK.
	(d)	SATISFACTORY GROUND SOAKAGE SEPTIC TANK INSTALLATION AT OWNER'S RISK		(k)	STRUCTURES COLOURED YELLOW BEING SATISFACTORILY DEMOLISHED
	(e)	SAFISFACTORY SURFACE WATER DRAINAGE TO BE AGREED ON SITE.		(l)	STRIP OF LAND COLOURED BLUE BEING SURRENDERED TO GOVERNMENT FREE OF COST FOR ROAD WIDENING.
	(f)	SATISFACTORY MECHANICAL VENTILATION SCHEME BEING SUBMITTED.		(m)	TEMPORARY ACCESS TO THE PLOT TO BE CONSTRUCTED TO THE SATISFACTION OF THE CITY ENGINEER
	(g)	SATISFACTORY PLUMBING AND DRAINAGE DETAILS BEING SURMITTED.		(n)	LANDSCAPING SCHEME TO APPROVED AND IMPLEMENTED TO THE SATISFACTION OF THE DIRECTOR OF CITY PLANNING AND ARCHITECTURE.
				(o)	CONSERVANCY TANK TO BE CONSTRUCTED TO STRUCTURAL SPECIFICATIONS AND TO BE WATER PROOFED TO THE SATISFACTION OF THE DIRECTOR OF CITY PLANNING AND ARCHITECTURE.

RECOMMENDED FOR

APPROVAL/DISAPPROVAL/MINOR APPROVAL.

Signed .....

for Director of CITY PLANNING ARCHITECTURE

Date .....

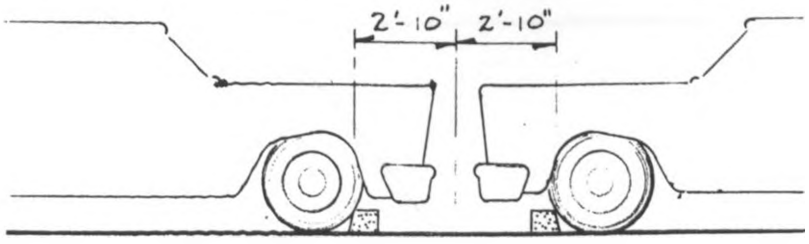
ADDITIONAL CONDITIONS

		RETURN AGENT To	DATE
(p)			
(b)			
(r)			

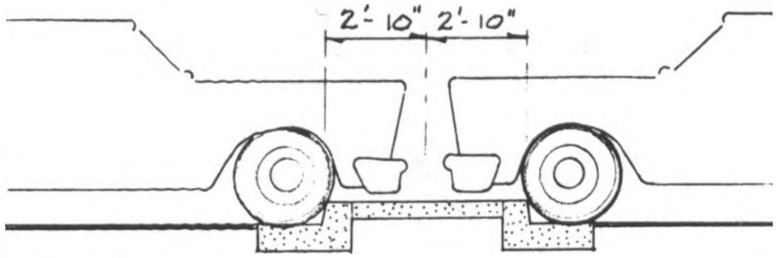
SITE COMMENT SHEET.

Appendix VI

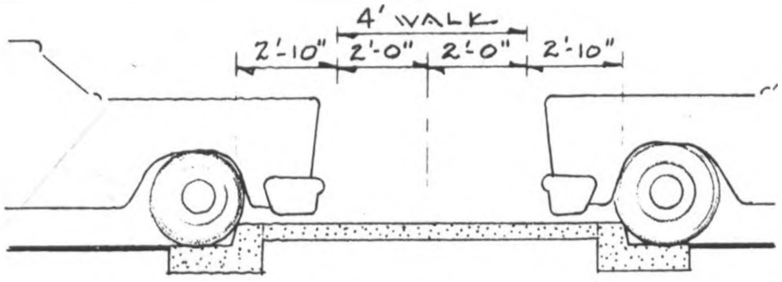
PLAN REG. NO.	ROAD	PLOT NUMBER
BT. 392	Dandora Ph.11	Plot. 20721
Check Elevation with adjacent development.		
Check Canopy levels with exisiting adjacent plots		
Check Streets and Lane accesses, and conditions of roads to plot.		
Check Levels for surface water drainage position of S.W. drains and culverts.		
Check ground floor levels in relation to pavement levels		
Check Building line siting of building in relation to adjacent development siting of servants quarters, and clothes drying area.		
Check nature of soil		
Unauthorised uses and buildings and other comments.		



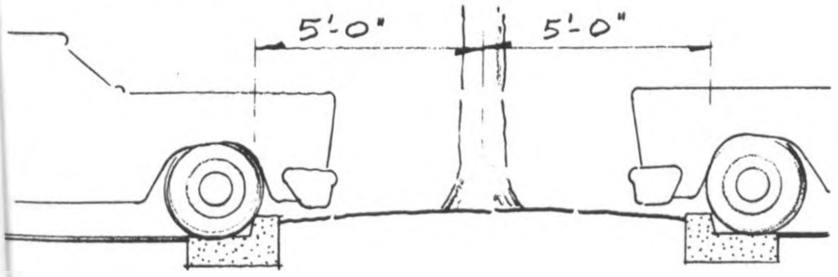
A WHEEL STOPS ONLY
SCALE 1/4" = 1'-0"



B CURB • PAVING • CURB
SCALE 1/4" = 1'-0"



C CURB • WALK • CURB
SCALE 1/4" = 1'-0"



D CURB • GROUND COVER & TREE • CURB
SCALE 1/4" = 1'-0"

A THE SIMPLEST THING FOR PARKING IS TO PAVE THE AREA WITH ASPHALT AND INSTALL PRECAST WHEEL STOPS. THE BARS HOLDING THE WHEEL STOPS DOWN WILL EVENTUALLY BE PUSHED OUT, TEARING UP THE ASPHALT, REQUIRING PATCHING OF THE PAVING AND REPLACEMENT OF THE WHEEL STOPS.

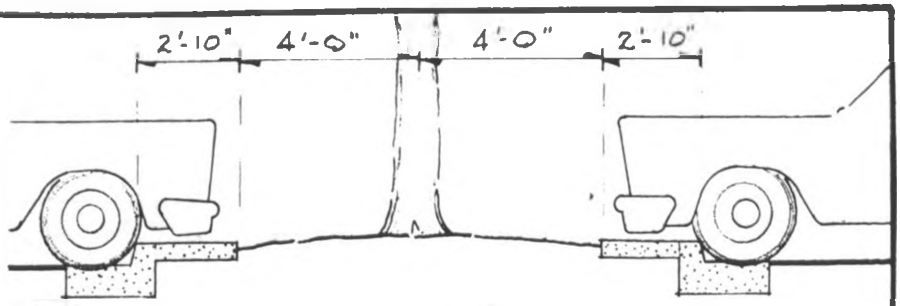
TRASH AND SNOW REMOVAL IS ALSO A PROBLEM WITH THIS DETAIL.

B GUTTERS ON THE CURB WILL HELP HOLD THEM UPRIGHT FOR THE WEIGHT OF THE FRONT OF THE CAR WILL HELP BALANCE THE FORCE OF THE TIRE STRIKING THE CURB.

C THIS AND THE PRECEDING SECTION WOULD BEST BE A MONOLITHIC POUR WITH EXPANSION JOINTS APPROX. 20' APART.

D THE OVERHANG OF AN AUTO WILL NOT PERMIT TURF IN THIS AREA. INDEED THE GROUND COVER COULD NOT BE VERY HIGH ITSELF THE 5' MINIMUM IS TO PROTECT THE TREE FROM THOSE WHO WILL BACK INTO A PARKING SPACE.

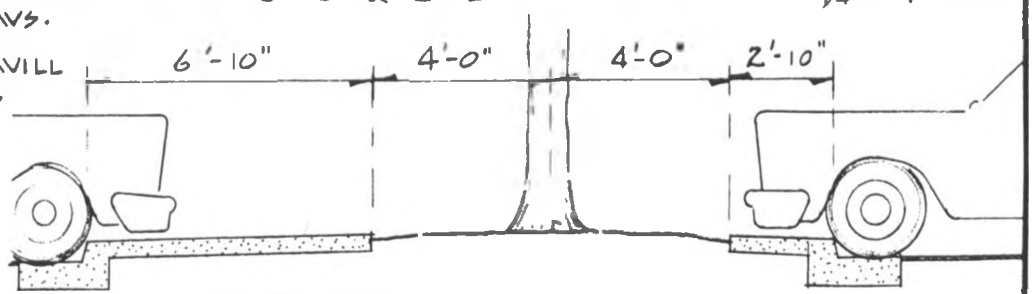
E THIS EXTENTION AT TOP OF THE CURB WILL ALLOW TURF TO BE PLANTED AND A REASONABLE LOCATION FOR SPRINKLER HEADS FOR BOTH TURF OR GROUND COVER.



E CURB • PAVING • G.C. & TREE • PAVING • CURB
SCALE 1/4" = 1'-0"

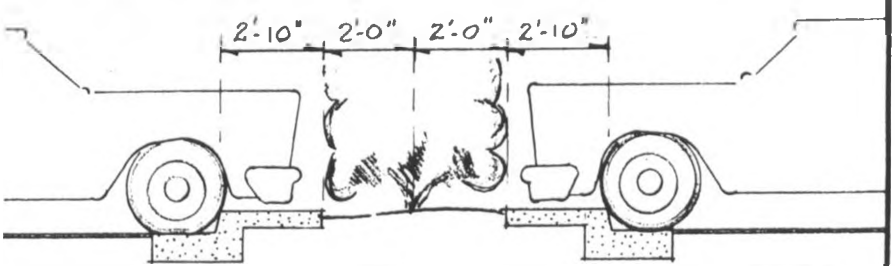
F FOR A MINIMUM WALK ALONG ONE SIDE OF THE PARKING ROWS.

CARS BACKING IN WILL BLOCK THIS WALK.



F CURB • WALK • G.C. & TREE • PAVING • CURB
SCALE 1/4" = 1'-0"

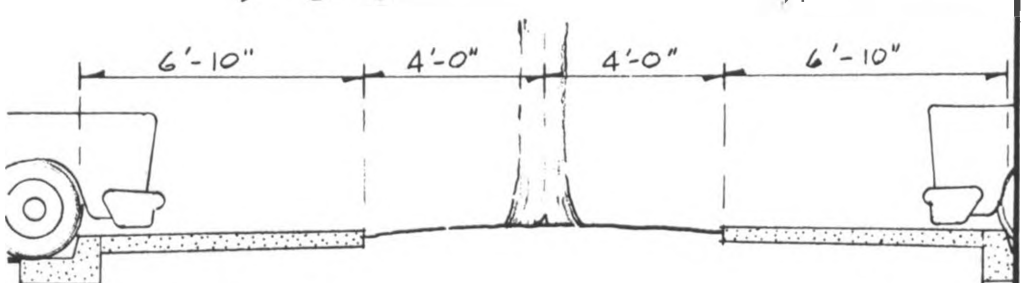
G SHOWING AN APPROXIMATELY 4' WIDE PLANT SCREEN.



G CURB • PAVING • SHRUB • PAVING • CURB
SCALE 1/4" = 1'-0"

H MINIMUM DISTANCE FOR A TREE ROW AND TWO WALKS.

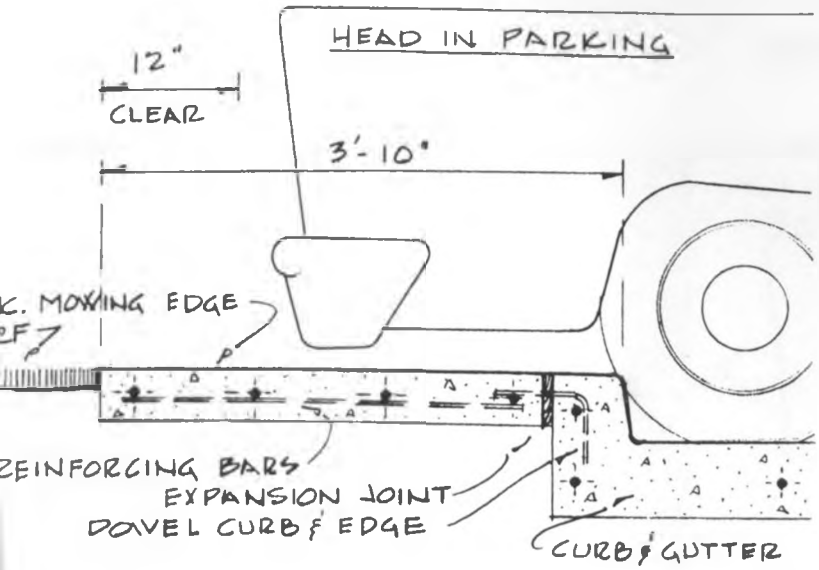
NOTE: ALL SECTIONS IN THESE TWO PAGES MUST HAVE STEEL REINFORCING AS HERE-IN-BEFORE SHOWN.



H CURB • WALK • G.C. & TREE • WALK • CURB
SCALE 1/4" = 1'-0"

LANDINGS OR WALKS ADJACENT TO CURBS SHOULD BE MONOLITHIC OR BE DOWELED AS SHOWN ON THE FOLLOWING PAGE.

PARKING STANDARDS (90°)

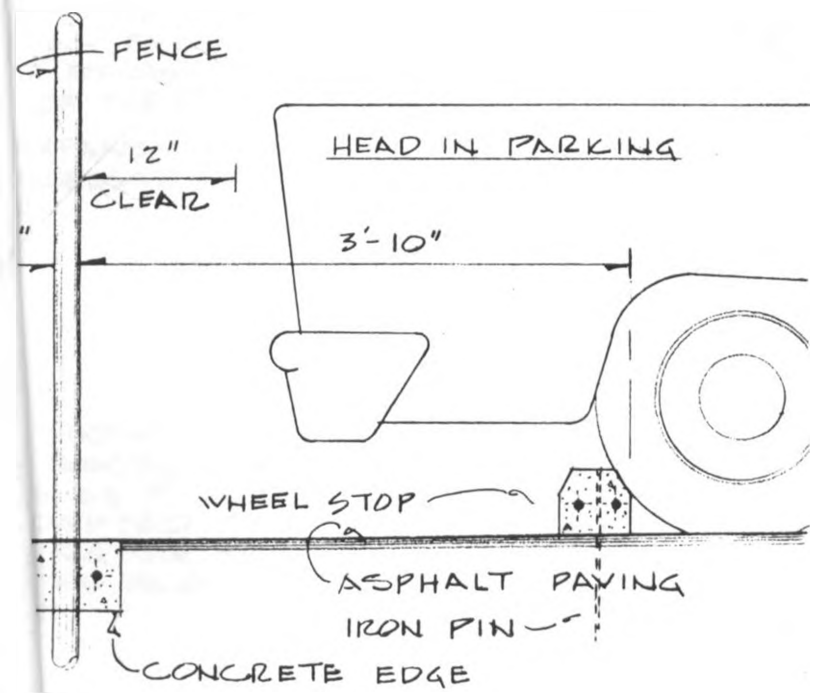


MOWING EDGE AT PARKING CURB
SCALE 3/4" = 1'-0"

I 10" TO 12" BEYOND THE OVERHANG WILL ALLOW A MOWER OR EDGER WHEEL TO RIDE ON THE CONCRETE WHILE THE CAR IS PARKED.

2'-10" FROM THE FACE OF THE CURB IS SUFFICIENT WHERE GROUND COVER REPLACES THE TURF.

THIS SECTION SHOWS AN EXPANSION JOINT BETWEEN THE CURB AND MOWING EDGE. IT IS IMPORTANT THAT IT BE DOVELED.



WHEEL STOP AT FENCE
SCALE 3/4" = 1'-0"

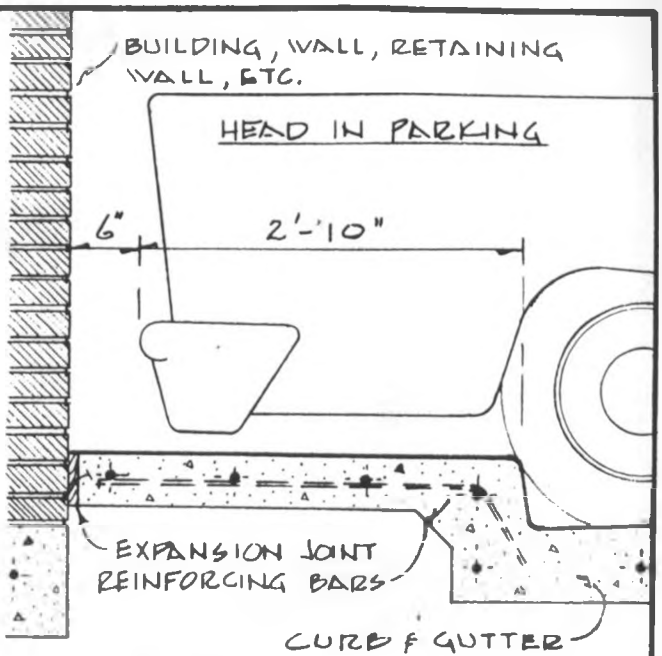
J ASPHALT MUST ALWAYS HAVE A PERMANENT STRUCTURAL EDGE; HERE THE EDGE ALSO SERVES AS A MOWING AND TRIMMING LINE BEYOND THE FENCE.

12" BEYOND THE FENCE WOULD BE A BETTER SITUATION.

HEAD IN PARK-
WHERE A
RUCTURAL WALL
URS. THIS WOULD
MINIMUM AND
ULD NOT ALLOW
THE CAR BEING
KED INTO THE
KING SPACE.

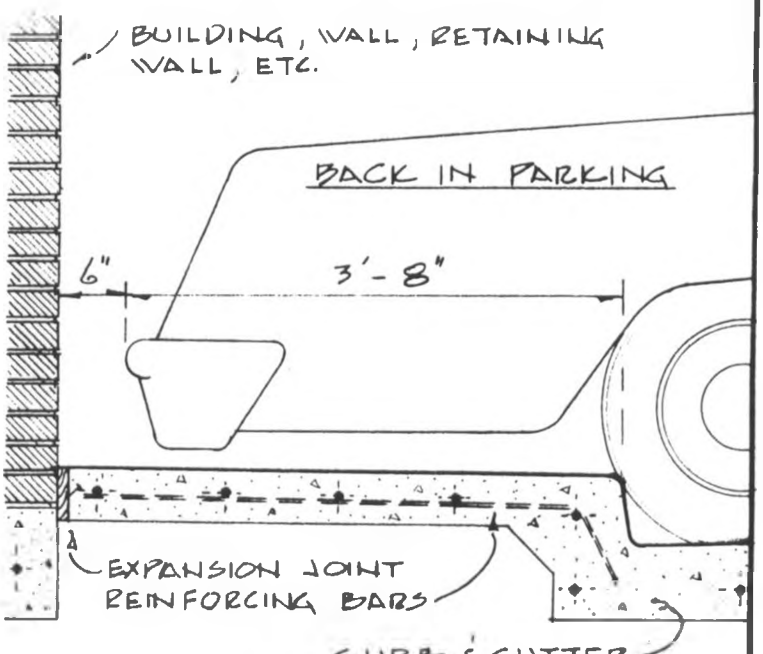
MONOLITHIC
B, GUTTER AND
NG AT TOP OF
D IS DESIRABLE
R AN EXPANSION
T AT THE BACK
OF THE CURB.

EXPANSION JOINT
ECESSARY AT THE
L.



K SECTION • PARKING AT WALL
SCALE 3/4" = 1'-0"

SHOWING THE
SECTION AS
E AS IT MUST
DAPTED TO
ING THE CAR
THE PARKING
E.



L SECTION • PARKING AT WALL
SCALE 3/4" = 1'-0"

KING STANDARDS (90°)

Appendix IX

VELOPMENT CONTROL OFFICER _____

DC/19

INSPECTION SHEET

DC PE. 23. 8.91

PLOT NO.	SECT.	L.R. NO.	EST. VAL. SHS		ADDRESS ROAD/STREET
10521/110		209	250,000/-	Off Muhoho Avenue	
PLAN NO (Registered)		CC · 310 ·		Domestic Building Maisonette.	DEVELOPMENT
APPROVED		DATE 9/11/88		TS Nandhra & Associates. TEL.	OWNER
STRUCTURAL — DETAILS APPROVED				L2 Engineering Ltd. TEL.	CONTRACTOR

DETAILS OF NOTICE	DATE OF INSPECTION			FINAL INSPECTION
	DATE	DATE	DATE	
WATER PERMIT				CHECK BUILDING WITH APPROVED PLAN
FOUNDATION EXCAVATIONS Beacons Checked				TEST DRAINS BEDDING M.H
FOUNDATION CONCRETE				TEST PLUMBING INSTALLATION
DAMP PROOF COURSE				SURFACE WATER DRAINAGE
SITE CONSOLIDATION & CONCRETE				CULVERT CONSTRUCTION & R.S DRAIN CLEARED
DRAINS TESTED				SITE CLEARANCE If Closets Removed
INTOLS				WATER STORAGE TANKS
FLOORS				ROOF FINISH
COLUMNS				CROSS VENTILATION
CANOPIES				INTERNAL FINISHING
STAIRS				EXTERNAL FINISHING
ROOFS				M.O.H. CLEARANCE WHERE APPLICABLE
BEAMS				C.F.O. FIRE OFFICER CLEARANCE WHERE APPLICABLE

BUILDING OCCUPATION CERTIFICATE

RECOMMENDED

Development Control Officer / Assistant

..... 19 .....

APPROVED

For Director of City Planning

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BUILDING OCCUPATION CERTIFICATE

ISSUED ..... / ..... 19 .....

PASSED TO

FILE ..... 19 .....

OCCUPATION DETAILS

VOL. I	BOX
VOL. II	BOX
VOL. III	BOX
VOL. IV	BOX

CONCRETE DETAILS

VOL. I	VOL. II	VOL. III