COSTS IN TOWNSHIPS :

A CASE STUDY OF PHOENIX

by

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ABSTRACT

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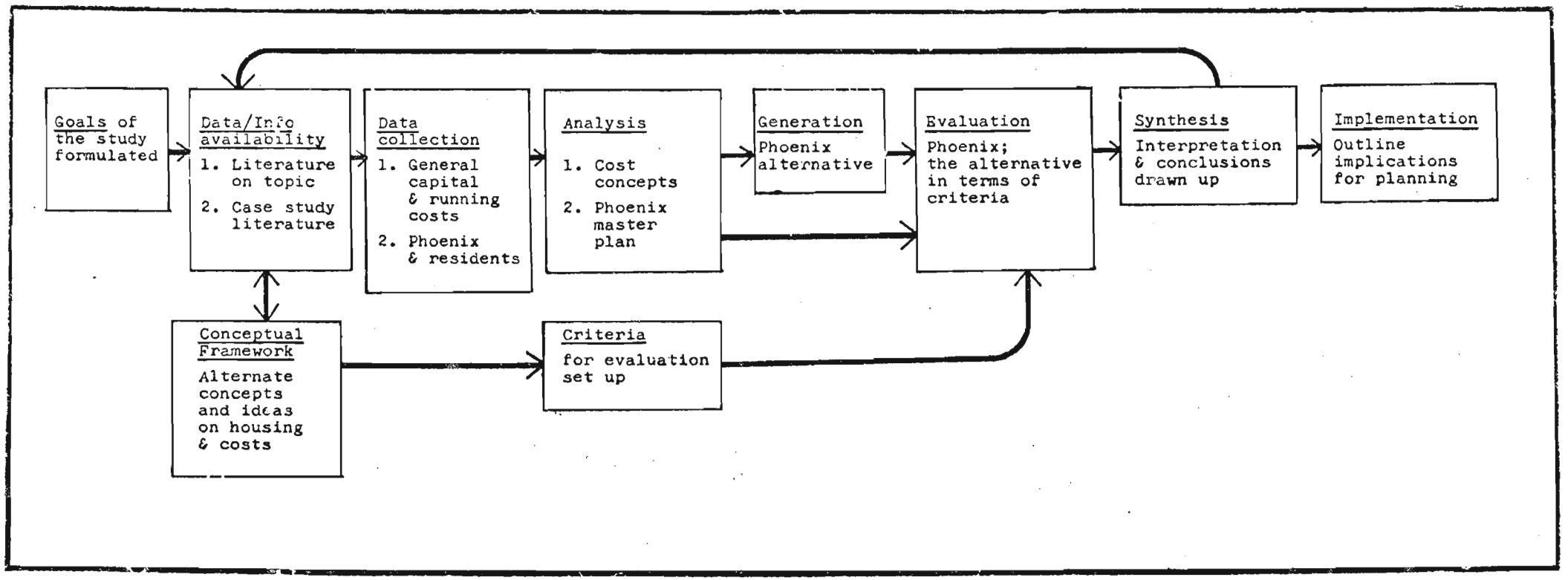
The aim of the dissertation is to examine the costs in township housing and to identify some major issues and concepts by means of a case study for consideration by planners.

The study is divided into three main sections. The first deals with some concepts of cost, the need for cost awareness, and a justification of the dissertation topic. The South African low income housing policy is also discussed insofar as it is of concern for planners.

The second section consists of a case study of the Phoenix New Town design. An alternative to that of the Phoenix design is put forward and both are then evaluated in terms of criteria specifically formulated for that purpose.

The last section concerns the conclusions of the case study, and contains some policy and design implications for planners.

SEQUENCE FOR EXECUTION OF THE PROJECT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Data/Info availability
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for evaluation set up

CHAPTER 1

INTRODUCTION

1. INTRODUCTION

1.1. Priorities in township design

It is the purpose of this study to investigate the cost implications of township design. Social, environmental, political and economic goals are an integral part of the planning process which reflect themselves in the physical layout and plan of the development being undertaken, and it would be difficult to grade these goals in order of importance. In South Africa a great deal of importance is currently attached to political goals and it will be argued that this could be in conflict with other planning goals. Economic goals seem to take on a low priority amongst planners and this study will seek to provide reasons and methods for rectifying this state of affairs.

1.2. Costs in the public and private sector

Cost viewed as either a constraint or as a high priority decision area in township development is equally as important for the public sector as it is for the private sector. However it is more critical for

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the private developer than it is for the public developer.

The private developer is a business concern and as such is assumed to be motivated, if not entirely, at least partially by the profit motive. This is borne out by the accountancy profession which defines a business concern as a profit seeking enterprise. And as profit accruing from a development scheme is a function of both its revenue and its expense, the private concern attempts with each project to either increase the revenue, decrease the expense or as is usually the case, combine both the former and the latter.

The case of a township developed by a public authority is somewhat different. The public sector does not operate for its own profit but attempts to provide a service to the public. The service that is provided may be financed from the project itself, from income accruing from projects other than the project being undertaken, from property rates levied on local ratepayers, or from grants handed down from central govern-

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ment. Thus the revenue and expense factor in the development per se is not as critical for local government. Unlike the private concern, the success or failure of a development project in economic terms does not affect the continued existence of a public authority; if a private concern showed a loss on development schemes undertaken, it would go out of business. This is what is meant by the term critical.

On this basis it can be asserted that township development costs are equally important to both the public and private developer; but these costs are only critical to the private developer.

1.3. Goals and objectives for the study

The study attempts to achieve two broad goals, namely:

(1) to illustrate the need and importance of cost awareness in township design; and

(2) to highlight some basic principles in township design which could aid planners in designing more economically.

The objectives necessary to achieve the

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first goal are:

(1) to examine the principle of subsidization;

(2) to investigate various principles associated with cost; and

(3) to examine the origin of expense items.

In order to achieve the second goal the objective is to examine the relative merits of a case study design (Phoenix township) and an alternative solution to be put forward.

1.4. Conceptual framework

Design method is the study of all aspects of urban design from the layout of vehicle and pedestrian transportation routes to the choice of dwelling types. Land economics applies the broad principles of economics specifically to the principles of land use.

This study integrates the concepts of design method with those of land economics. Land economics can be studied by itself as an independent discipline but no so design method. As design method is the ultimate physical expression of many different social, economic, political and environmental goals, a certain

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understanding of these fields is required in order that none of these goals are contradicted or defeated. It is not operationally practical however, to incorporate these widely diverse disciplines into a single field of study and it is for this reason that the artificial separation is made.

However, the separation has the danger of leading to neglect in the other areas of concern. This dissertation seeks to re-establish the importance of viewing design method and land economics as subsets of the same topic; an attempt is made to highlight some key issues that successfully achieve the goals of both design method and land economics.

1.5. Conclusion

This study is an attempt to analyse the cost factors influencing township design with a view to creating a greater awareness amongst planners of the importance of the costs pertaining to their development designs, if not to themselves then to the community that they purport to serve. Also, a case

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study (Phoenix) and an alternative to the case study will be examined for cost effectiveness of design; the results of this examination will be analysed to isolate pertinent issues and concepts for designers and planners.

CHAPTER 2

THE NEED FOR COST AWARENESS

2. THE NEED FOR COST AWARENESS

2.1. Development finance and township ownership

In any discussion on the financial aspects of township development schemes it is as important to identify who is paying for the development as it is to identify the actual cost structure of the entire project. Without such a distinction, the numerous 'hidden' subsidies and public funds of all descriptions cannot be isolated and computed to arrive at the total cost, and an unrealistic figure could be derived.

In the case of a scheme involving a private developer and a 'private' client i.e. a client unassisted by public funds, it is simple to see who bears the cost of development and at what stage. Initially, during land purchase and construction of the development scheme, the cost is borne by the developer (usually with the assistance of a credit company). Later when the scheme nears completion, user-residents purchase dwelling units from the developer thus taking on the cost of the project themselves. The dwelling units' cost

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would include all utility service costs relating to the particular unit together with the developer's profit.

If an owner is defined as that person wholly or partially (in the case of co-owners) financing a development scheme, the owners in the above example are firstly the developer and, at a later stage, the residents. This example may be self-evident, but the existing confusion as to the financers, and the owners of developments, is witness to the fact that it is anything but superfluous. Thus an an attempt will be made to clarify the source of this confusion, which is to distinguish the cost-bearers from the 'owners'.

In the case of a public development project, i.e. a project whose cost is initially borne by the entire community, the initial 'owner' is more often than not, the local authority. Here the initial cost bearers are firstly the entire rate-paying public under the local authority, and secondly to a lesser extent, the entire

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tax-paying community under central government; this is due to the fact that certain central government monies are channelled through to the local authorities.

Later when the housing units are sold off to the private market, the matter is somewhat simplified in that most of the costs of development are transferred to the residents, thus once again placing the costs of goods and services in the hands of the actual consumers. These exclude roads, sewers and many other utilities which remain 'public property', the costs of which are not always entirely transferred to the residents. Sometimes the costs are unrealistically low which is a sure sign that only some of the development costs have been transferred to the users, the remainder still being borne by the rate-paying public. This situation is further complicated if financial assistance in the form of low interest rate loans or subsidies is made available to the 'purchasers'. The reason for this is that subsidies and loans are made from public funds.

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Public funds are monies held by a public authority, in this case a local authority, in trust for the public to be used as and when deemed necessary or expedient by the local authority. The fund is raised by levying rates or taxes. Thus a subsidy given to a land purchaser is simply money which was previously in the hands of individual ratepayers. A loan is money 'borrowed' from the ratepayers, but if it is paid back at a lower interest rate than it would normally have earned on the open market, the lesser interest repaid amounts to a partial subsidy.

2.2. Criteria for economic success

If the consumer could afford to pay all the costs of the development, that is full payment without any form of government subsidy or public funding, and could also take over the entire development costs from either the developer or the public body who initially finances the scheme, the project could be termed economically successful. An economically successful scheme is not necessarily one with a low cost, but rather one which gives value for

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money; or "one which offers the greatest value in terms of amenity in relation to the cost consequences". (P.A. Stone 1974, p 141).

If a group of people wish to live in a better environment, the only alternatives open are either to design and carry out the project in such a way that their money could purchase more than what they have at present, or to create a scheme beyond their financial means. The latter alternative would necessarily require that the rest of the community has to pay for what the residents cannot afford. The first alternative is economically successful while the latter is not. The only valid assessment of the cost of housing is a long range one that accounts for the direct and indirect cost to both the user and the community over the lifetime of the housing (R. Untermann and R. Small, 1977)

It is not the purpose of this study to query the philosophical base of wealth redistribution, but rather to emphasize the importance of self-sufficiency in development schemes as being the only term reconcilable

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with economic success. Subsidized schemes are by definition therefore necessarily economically unsuccessful, although in terms of current philosophy they could be termed successful when viewed in a much wider social context. For example a subsidized scheme may assist in achieving the goal of poverty reduction.

Some contemporary economists seem to think that the economic success of development projects are not important to the community. For example Stone argues that the amount of subsidies can be ignored when the assessment is being made from the point of view of the community, although not from point of view of the developer. Such arguments dont hold water as subsidies are paid not by the public authorities but by the community itself; and when any assessment is made from the community's viewpoint, all factors affecting the community are required to be considered.

2.3. <u>The results of uneconomic township developments.</u>

Townships undertaken on an uneconomic basis may well fool people into believing that they were successful ventures, but only in the

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short term. The public authority and ultimately the community, will suffer growing deficits as more and more uneconomic projects are undertaken. As either the ratepaying community or the township residents (often not the same in South Africa because of the Group Areas Act) will have to pay for this. The economic failure will be felt in the longer term by all those concerned.

This argument is reinforced in a newspaper editorial entitled 'An expedient to be avoided' (E.P. Herald, 17 August, 1979) in which the chairman of the East Cape Administration Board, Mr. G.C.K. Erasmus made a prediction that drastic increases in service charges would have to be imposed on township residents. The reason given for such increases was that the Board had to cover a growing deficit. Mr. Erasmus pointed out that money recovered from site rentals was not enough to cover even maintenance expenses. The editorial concludes that at a time when the majority of township residents are suffering acutely from the ravages of inflation, it is unacceptable that they should be made to pay

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for the increased costs.

Even though written about black townships in the Eastern Cape, the 'drastic increases in service charges' and the 'ravages of inflation' are no less applicable to townships of all race groups and in all provinces in the country.

2.4. Conclusion

In the light of this argument for economic townships, this study sets out to learn as much about design costs as practicable; and whether out of regular public policy or out of necessity due to a dearth of public funds, the goals of this study remain the same for public authorities. (See Section 'Goals and Objectives'.)

CHAPTER 3

LOW INCOME HOUSING POLICY

3. LOW INCOME HOUSING POLICY IN SOUTH AFRICA

3.1. Introduction

Development schemes in South Africa (including the Phoenix case study) are subject to what can be termed the 'national low income housing policy'. "Since housing market activities take place within the general framework of national and urban development, the context within which policies are drawn up and applied has important implications for both supply and demand factors influencing housing"(O.F. Grimes, Housing for low income urban families, 1976, p92). Because of the direct and profound effects that this policy has on any housing scheme, including the quality of the residential units, it is important that this policy is evaluated.

The failings of South African housing policy are mentioned as well as some of the alternative policies as recommended by D. Dewar, O.F. Grimes, and G. Maasdorp.

3.2. Failure of housing policies

3.2.1. What is a slum?

Maasdorp argues that empirical evidence suggests

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a fundamental difference in perceptions between planners and slum or squatter dwellers. What may be a slum to a planner may not be so to the occupant. Empirical studies reveal that squatter settlements:

"1. provide housing which is often of a substantial quality;

2. house a substantial number of people engaged in the wage sector, even including professionals;

3. provide considerable local employment opportunities of a productive nature through the operation of the 'informal' sector, notably in construction;

4. provide incomes which are sometimes higher than in the wage sector; and

5. have not given rise to the outbreak of any epidemic." (Maasdorp, 1977, p 5.)

3.2.2. Standards

"The officially-perceived extent of the so-called housing problem is intimately linked to the question of standards." (Maasdorp, p6). These standards relate to both the qualitative and quantitative dimensions of demand. People should be allowed to determine their own priorities with respect to the level of accommodation required (D. Dewar, 1977).

/Grimes .....

Grimes says that misconceived building standards can contribute to depressed living standards of the poor, and inappropriate regulations which set standards too high for income levels, will reduce the amount of housing that is available for the poor at prices that they can afford.

In South Africa squatting is not accepted. The bulldozing of squatter settlements (Modderdam) and the construction of public housing estates (Phoenix, Mitchells Plain) still appears to be the policy that is implemented.

3.2.3. Protectionist policy

"Construction materials tend to be costly, particularly in small countries with a relatively low level of industrial development that have chosen a highly protectionist policy". (Grimes, p 92). South Africa is relatively large with a high level of industrial development but it does have a severe protectionist policy, - aggravated even more by the economic sanctions against the country. Grimes notes how countries with open economics such as Hong Kong and Singapore have benefitted from the cheapness of their construction materials.

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3.2.4. Labour policy

In South Africa severe pass and migration laws prevent or at least hinder the natural flow of workers to regions with labour shortages. Also, there are strict laws and regulations governing entry into the building trades; in this matter private organisations, such as the Master Builders Association, as well as the government are to blame. "Far from protecting the rights of the workers, such restrictions limit housing construction and thereby reduce employment below the level that could be sustained with more liberal policies. In some countries onerous licens- and inappropriate inspection procedures create monopolistic and oligopolistic privileges for construction firms, which also may inhibit housing construction." (Grimes, p 93). The by-laws and building regulations of South Africa have no regard for any development which does not at least match the public housing estates' standards.

3.2.5. Rent control and subsidies

"The use of rent controls to prevent private individuals from capturing socially caused gains and to mitigate the imperfections of housing markets has a long and unsuccessful

/history .....

history in developed as well as developing countries." (Grimes, p 98).

Rent control forces returns on investments which are below the market levels. The result is disinvestment and the deterioration of the housing through reduced maintenance; the housing stock also depletes due to lack of entrepreneurial opportunities.

3.3. Alternative housing policies

3.3.1. Security of tenure

Any housing policy must as a basic prerequisite stimulate security of tenure. Empirical studies show that security of tenure is the single most important factor for the success of housing policy; Dewar writes that it is critical for the growth of healthy, self-supporting communities.

Ownership of land in South Africa by blacks is restricted to the homelands; the 99 year leasehold system is the latest attempt by the government to create security of tenure.

3.3.2. Living standards

The end product must be enabling and have high

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performance living environments, measured in terms of the satisfaction of human requirements and not in terms of the quality of physical housing stock. But most effort is put in the wrong place - the house; this can usually be better and more cheaply handled by the individual. The real effort is required where the individual cannot help himself; for example the public/private space interface. (Dewar). In this regard, alternatives to the public housing estates are more appropriate; these include:

1. squatter upgrading - legal recognition, security of tenure and provision of services are examples;
2. site-and-service schemes - plots are surveyed, levelled and serviced;
3. core housing - provision of washing and toilet facilities or basic shelter.

If mass housing schemes are undertaken, the following criteria should be observed:

1. housing standards to be consistent with incomes;
2. building designs to be flexible (to allow for easy conversion so that space per household can be increased over time);
3. locations to provide easy access to employment

/opportunities .....

opportunities and public transport facilities; and

4. housing policy must recognise the housing problem as being the provision of living areas which provide the inhabitants with the full range of opportunities to which they are entitled in an urban place, and not merely provide accommodation. (D. Dewar, and O.F. Grimes.)

3.4. Conclusions

The policies ought to be related more carefully to the incomes of potential occupants. Failure to do this will force the lowest income families to either take in lodgers to meet rentals, or to seek alternative accommodation. The first alternative leads to overcrowding, the second to squatter settlements, both of which results are deplored by the authorities. (Maasdorp)

The South African government will have to subsidize township housing even more than it has in the past in order to bring it within reach of the lower-income groups. The alternative is "to provide a mix of housing which can cater to different income groups and tastes, varying from site-and-service schemes with minimal facilities all the way

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through to conventional township housing. Existing investment in housing could be protected and dislocation avoided by opting for squatter upgrading." (Maasdorp, p23).

In the case of the Phoenix case study, the wisdom or otherwise of the decision to create the housing scheme is an issue too complex to be dealt with in this study. However, assuming that a housing scheme is the most appropriate policy, Phoenix is tested to see how it stands up to the housing scheme criteria mentioned in section 3.3.2.

CHAPTER 4

COSTS IN TOWNSHIPS.

4. COSTS IN TOWNSHIPS

4.1. Origins of costs

Before analysing the various specific capital and running costs associated with the construction and operation of a new township development scheme, a brief look will be taken at the origins of such costs in broader economic terms.

The two economic categories of 'expense' for a client are:

(1) goods (materials, land), which constitute the physical content of a development; and

(2) services (labour, entrepreneurship), which comprise the organisation and execution of a development.

The various consultant engineers, architects, and contractors also have their own expenses such as the overheads of plant and offices; however these manifest themselves in the amounts that they charge for their services.

The concept of developer's profit is a source of confusion requiring clarification;

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the confusion relates to how profit is sometimes seen not as a wage, but as an extra amount over and above wages which get charged to the community. The developer is the person who recognises the possibility for a development scheme in the economy. He initiates the entire scheme, takes upon himself the financial risk, and sees the entire venture through to completion. The developers profit is a function of his time,his effort and innovation, and his risk; in economic terms this is a service. The same argument applies to the price of entrepreneurship. An entrepreneur is a person who undertakes a business or enterprise with chance of profit or loss; in other words he is the person seeking to invest his money profitably. Usually the higher the risk, the more profit he requires. This is also a service.

4.2. <u>The effect of the economy on costs</u>

The prices charged for goods and services depend on the state of the economy and the government's fiscal policy.

A tightly depressed economy generally

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results in cut-throat competition, lower prices, and thus higher standards of work and materials. Conversely, a thriving or booming economy is one in which work is freely available and less competition is present; this results in higher prices and lower standards of work and materials. It cannot be concluded that, because of lower prices in a depressed economy, the standard of living is increased, the reason being that the higher interest and loan rates charged make money more expensive. Likewise when finance for township schemes is readily available in booming times, the price and wage levels are correspondingly higher.

The effect of this phenomena is to make any costs quoted in connection with a development scheme out of context unless viewed together with the current state of the economy.

Interconnected with this are the government's fiscal policies. The altering interest rates previously mentioned no longer move in response to the state of the economy; today the phenomena has been reversed. Governments now set down maximum and minimum

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interest rates which has the effect of controlling the state of the economy and thus determining the price paid for money. This is just one (the most powerful) of the tools by which the government directly affects prices. It is also for this reason that the argument was not seen as the 'effect of costs on the economy'.

4.3. Capital costs and running costs

To the user-residents of any residential development, the running costs involved in day-to-day activities are of as much importance as the purchase price or rental paid for accommodation there. For purposes of this exercise capital costs and running costs are loosely defined as follows:

1. capital costs are the costs of obtaining a good ; and
2. running costs are the costs of using and/or maintaining a good.

4.3.1. Capital costs in townships

The capital costs in townships are listed in this section under 11 main categories:

1. Undeveloped land: this is the purchase price of land prior to the inclusion of any planning, construction or land surveying fees.

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The final price of the land before any construction takes place includes the urban design or planning fee, and the land surveying fee for 'laying out' the land as designed.

Public authorities do not acquire land at the same price as do private developers. The reason for this is that the public authorities have the power of expropriation, under which the land owner does not have the choice on whether or not to sell his property, nor may he determine the amount that he will receive for the land. The amount that the expropriatee receives for his land is not the market price, but a price estimated by the authorities to be the amount that would be agreed upon by a willing buyer and a willing seller prior to notice of the intention to expropriate.

A private developer, who does not have the power to expropriate may only acquire land through the open market. It is likely that an unwilling seller will occasionally be encountered; in such a case, a developer would have to raise his bid for the land. The revised value of the land would in such a case exceed the 'value' that would otherwise have been fixed by a local authority or expropriator.

2. Mass excavation and levelling: this is the cost of altering the shape and levels of the township land in large masses, and it is usually carried out by very heavy earthmoving equipment. This operation is not executed to a high degree of accuracy, but precedes the accurate earthworks involved in obtaining site-level platforms, road construction, sewerage excavations, foundation trench excavations, and other similar earthworks. This cost can also be included in the purchase price of the land.

3. Utility services: these are the costs of supplying all the lots with water supply, sewerage drainage, stormwater drainage, electricity, and vehicle and pedestrian access. The water, sewerage, stormwater and electricity reticulation costs all include excavation for trenches, the labour and materials of pipe and cable laying, recompacting the earth in the trenches, and all the jointing and connections.

The vehicle and pedestrian utility services include the cost of roads, sidewalks, street lighting, signposts, street furniture and all the excavations for these services.

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The length of the utilities per dwelling unit increases with an increase in density, and even though the maximum capacity of the utility (pipe size, cable thickness or road width) increases over a given area, the dimensions per dwelling unit remains constant.

4. Open spaces: these are the costs of establishing grass, trees and shrubs, erecting playground equipment and benches, in all public, semi-public, private and semi-private open spaces. These spaces are sports fields, play grounds, play lots, parks, and all private and semi-private open space. In the case of public and semi-public open space, the costs are borne by the public authorities; in the case of private and semi-private open spaces, the costs are borne by the land owners.

5. Shopping and commerce: these are the design and erection costs of the retail, wholesale and office components in a township. These services are in the form of individual shops, shopping centres, office complexes, community centres and town centres.

6. Social services: these are all the costs associated with planning, designing and con-

/structing .....

structing educational institutes, libraries, health services and certain government institutions (for example, police stations, post offices).

7. Industry: these are the private costs of land, building and plant, and the constructing of industries. The costs can also include private infrastructure such as rail and road utilities.

8. Town centre: these are the costs of designing and constructing the layout and infrastructure of the town centre. The individual buildings fall into one of the other cost categories such as 'shops and commercial' or 'social services'.

9. Dwelling units: this is the design and construction cost of the dwellings. Maintenance and repair costs to certain dwellings and utilities are not entirely independent of the capital costs, although the relationship is not directly proportional. Finishes, such as face brickwork, are more expensive than stock brickwork that is plastered and painted. However, facebrick wall require little or no expense on maintenance whereas plastered and

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painted walls require re-painting every 4-5 years. The same argument applies to most dwelling construction materials and to a lesser extent, to the utility materials (for example, a gravel road versus a tarmacadam road.)

10. Professional fees: these are costs, often legislated, which are paid to the various professions for their services; they include:
consultant engineers (e.g. civil, structural, electrical);
architects;
quantity surveyors;
land surveyors; and
town and regional planners.

11. Costs beyond the township boundaries: these are costs that affect mainly the utility services of areas surrounding the township. For example, an extra load on a neighbouring city's sewer system due to the flow from a township. These costs are often overlooked because of the difficulty involved in accurately calculating them.

4.3.2. Running costs in townships

All the capital costs mentioned ultimately result in running costs as well. The

/utility .....

utility services deteriorate through use, corrosion and obsolescence, and thus require periodic repair and maintenance or replacement. The roads, sidewalks and open spaces, too, need to be cleaned, maintained and occasionally repaired.

The buildings and plant of social services, dwellings, and the town centre, need to be maintained by painting, cleaning and repair. Professional fees for certain services can re-occur during the life of a township, for example:

1. architects' fees for building extensions;
2. lawyers' and land surveyors' fees for the conversion of 'block housing' schemes into 'Sectional Title' schemes.

4.4. Annual costs

Another important concept is that of annual costs.

If a capital cost is split in repayments over a number of years it is termed an annual cost (in fact an annual

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capital cost), which should not be confused with running costs which refer to the use and maintenance costs of a good.

Stone argues that capital costs do not by themselves provide an adequate basis for assessing the economic impact of urban developments, but that it is also necessary to consider the annual costs. Comparisons between capital and annual costs cannot be made unless they are combined by converting them into equivalent units at the same point in time, or over a similar time period. Either the capital cost must be amortized so that it can be added to the annual cost, or the annual cost can be discounted and added to the capital cost.

4.5. Methods for financing purchase

The payment for transfer of ownership of a residential dwelling very rarely if ever takes place in the form of a cash transaction for the purchaser, but rather payment takes place via various financial institutions such as building societies, which themselves put up the finance for the contract of purchase and sale. They in turn

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require the purchaser to repay a housing bond to them over a period of up to thirty years. So any additional capital cost incurred is added to the purchase price and is spread out over a number of years in annual repayment costs. However, when running costs such as the replacement of a roof are incurred, the expense involved can be relatively large and often totally unexpected. So sometimes it may be advisable to raise the initial cost of a residential development which is anyway split into annual repayments or costs for the inhabitants, in an attempt to reduce the frequency and amounts which go toward the use and maintenance of a residential dwelling and its surrounding area. These running costs are both of the expected 'monthly bill' type and the unexpected 'contingency' type. The costs include those occurring within the private property of the home owner and those associated with areas of communal use such as parks, swimming pools and streets.

Criticism has been levelled at developments which overlook running costs. Those areas

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seem initially financially attractive to potential home owners because of their low capital costs, but end up as financial burdens for the inhabitants and alternatively result in derelict, blighted and unkempt areas which the residents cannot afford to maintain. The most relevant argument against high initial expenditure is the following: income generally tends to increase over the years thus making the annual repayments on the bond an ever-decreasing proportion of the home-owner's total income. Because of this the unexpected contingency costs would more easily be met, as maintenance costs more often than not occur a number of years after ownership of a new dwelling has passed.

The maintenance and running costs of the private homes are microscopic when compared with the costs of street cleaning, park maintenance, and general upkeep of grassed and other public open spaces. Those public spaces should therefore be prime areas for investigation when considering how to minimize running costs. All public utilities such as roads, open space and sewers are paid for by the residents (some through property

/rates .....

rates, others through direct property purchase price) and as such are theoretically capital costs. As property and dwelling units have a minimum size beyond which they cannot decrease, those public utilities are also areas of concern when attempting to minimise capital costs to residents.

CHAPTER 5

CRITERIA FOR DESIGN EVALUATION

5. CRITERIA FOR DESIGN EVALUATION

5.1. The design evaluation

The design solutions for Phoenix, one by the Durban City engineer, the other as proposed in this study, need to be objectively evaluated. From this evaluation an attempt to arrive at certain design and planning conclusions will be made.

The essential issue of the alternative design is one of residential design and not of education or shopping policy formulation; as such, the criteria for evaluation are more important and extensive for the residential aspect than for the other aspects. However, due attention to education, shopping, health, and government is given just to ensure that no compromise of quality or quantity in those services is made in the alternative design proposal.

5.2. The economic criterion

The economic success of a design solution is the overiding criterion with which the case study and the proposed alternative will be evaluated. What is meant is that in comparing two designs, the more economical

/design .....

design will be the preferred solution. The economic success of any venture is assessed in terms of the amount and/or quality of output for any given amount of input. In order that the cheapest solution will not necessarily be the preferred alternative, certain minimum standards or criteria have to be met; in other words, the amount and/or quality of output will be set down, which means that in order to arrive at the most economical solution the amount of input will have to be the factor which is to be adjusted. The inputs referred to are labour and material measured in monetary terms, the assumption being that the monetary inputs are affected by the design solution. The outputs will be regarded as being of acceptable standard if they meet the criteria listed below, and the evaluation will be on a comparitive basis regarding the relative economic success of the two alternatives.

5.3. The criteria

5.3.1. Residential

/5.3.1.1. Appropriate .....

5.3.1.1. Appropriate densities

The densities should be appropriate to the people according to their income and life-styles; densities should also be appropriate to the area in terms of climate, orientation, topography and ground conditions.

5.3.1.2. Residential function

In this case the residential area is assumed to have a dormitory function,which means that all the functions associated with the home should be catered for. These include:

(1) the maintenance of relatively low noise levels to minimize disruptions;

(2) the maintenance of a high safety level to minimize danger to residents, and theft or vandalizing of property;

(3) the optimizing of open space land use, in other words the maximizing of the amount of usuable open space.

5.3.1.3. Visual attractiveness

This is a value judgement according to the values of the assessor. As it cannot be impersonally evaluated it is of no relevance to this exercise and it must be omitted from evaluation.

/Corollary .....

5.3.1.4. Corollary criteria

The above criteria preclude any conflicting land use or activity and it is therefore also a criterion.

5.3.2. Movement

5.3.2.1. Pedestrian

The pedestrian system should minimize the average distance of travel between home and amenities (such as shopping, schools or open space) while maximizing the safety level.

5.3.2.2. Vehicular

The vehicular movement systems should aim at maximum accessibility in terms of travel time and maximum safety levels for both vehicle users and pedestrians; it should not violate any criteria for Residential Areas.

5.3.3. Shopping

5.3.3.1. Shoppers

The appropriate order of shopping in terms of travel distance (for example - a corner

/shop .....

shop in easy walking distance and a higher order shop at a greater distance), and in terms of the socio-economic status of the people being served (for purposes of this exercise in which only one community is included, this last criterion is not relevant and is therefore omitted).

5.3.3.2. Proprietors/owners/managers

In order that the provisions for shopping are actually made use of by potential proprietors, owners or managers it is necessary that the shop location ensures viability.

5.3.4. Open Space, Education, Health, Government

Open space, education, health, government and certain other community facilities are not independent of the rest of the township communities; in fact these facilities are to a very large extent predetermined by the overall New Town design. For example, the amount of space allocated to a community, its position in relation to other communities, the number and size of schools, hospitals, clinics, sportsfields, community halls and the like in the rest of the township, are all factors which imply certain solutions and preclude others.

/Thus .....

Thus the criteria for the facilities are merely that the solutions do not violate the overiding township design principles and that they conform to the minimum standards set down by those principles. (See Chapter 7.)

CHAPTER 6

METHODOLOGY FOR DESIGN COSTING

6. METHODOLOGY FOR DESIGN COSTING

6.1. Cost comparisons over time

Large scale urban developments usually take place over an extended period of time. The costs arising at different periods make comparisons between alternatives unrealistic unless a method to equate present and future sums is used. The process used to arrive at the present value of future monies is termed discounting.

When estimating the cost of a development, all labour and materials are priced out at their present value and thus even though the labour and material may only be in the future, the 'discounted' value is automatically arrived at (it is not really a discounted value). This value represents the real expenditure on the project in that it prevents any distortion due to inflation which occurs when comparing a similar unit of currency over an extended period of time. For example, it can be shown that if inflation was to continue at its present rate (12 to 14%) the price of commodities on the market would double within the next seven years; however,

/incomes .....

incomes would more or less follow this trend. Thus the commodity would remain just as easily within the reach of purchasers all other factors remaining constant; this is termed the commodity's 'real' cost. In such a case no comparison of the commodities could be made in terms of their monetary values in their respective time periods. It is the discounted present value of a future value or values that best indicates the real price of goods and services.

6.2. Assumption of independence in the supply of labour and materials

In a large undertaking such as a new town development a large demand could be made on both the labour and material supplies.

In the case of large demands for a particular type of labour force, a shortage of that particular artisan or professional in the market could result in a price increase of the labour. If a large demand is made on materials however, economies of scale through mass production could force down the price of the commodity. The converse could occur for both labour and/or material due to either competition in the case of labour

/prices .....

prices or price inelasticity of supply in the case of goods. However, for this effect to be significant, the demands made on any particular good or service would have to be very large and the supply of them would need to be relatively small. In this study the difference is unlikely to be of any great significance and only the massive repetition of building components or designs will be taken into account during the costing process.

6.3. Methodology

The designs are costed as follows: all items are measured out in terms of capital and running costs and include all labour and material involved. Where possible, items of similar units of measurement are combined to minimize calculations and unnecessary technical complication. For example, a road is measured out in square metres with a brief description of the extent of the materials and the labour. In formal quantity surveying practice however, this would have been separated out into the various trades involved.

The results of the calculations appear in Chapter 10, but for purposes of explanation

/an .....

an example is worked out below.

6.4. Example

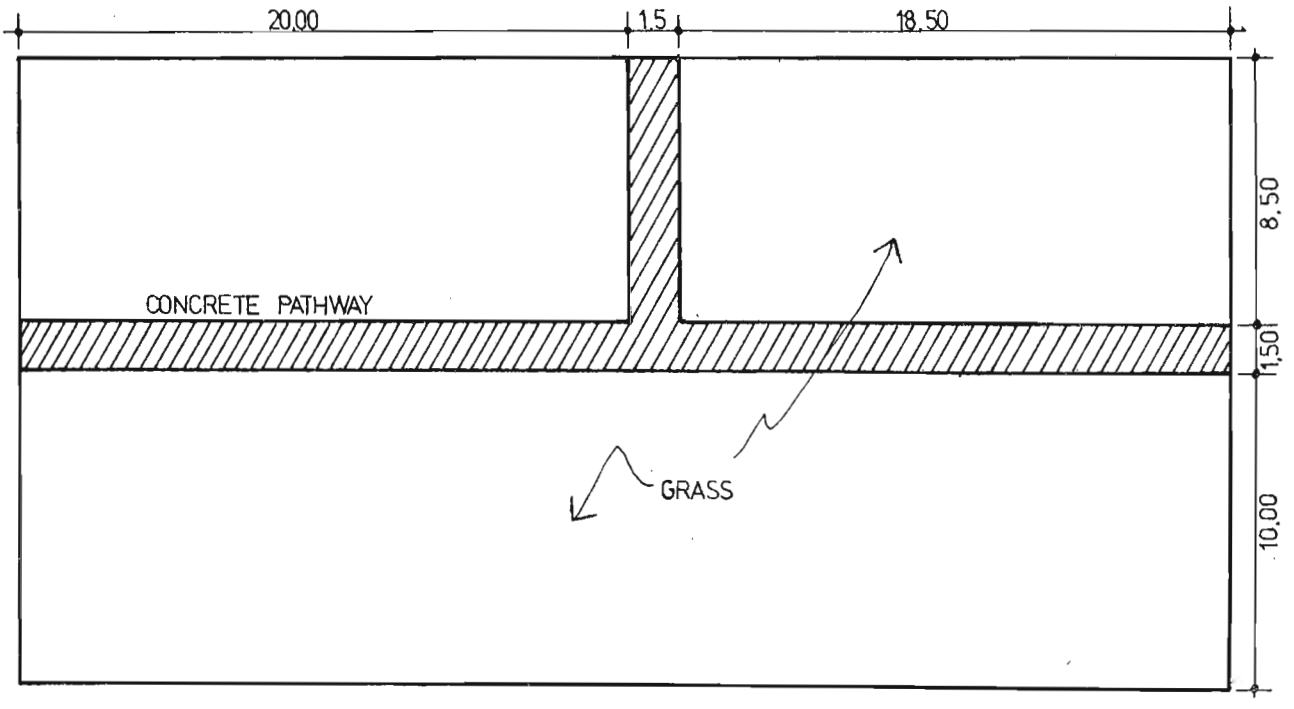


Figure 6.1.

Figure 6.1 shows an imaginary piece of land partly grassed over and with a 1,50m wide concrete pathway running across it. The items of cost are as follows:

1. Capital costs:

1. Prepare ground and establish grass. $727m^2$ (R1,50/m^2)	R1,080,50
2. Excavate trench for and including 150mm thick concrete paving 49m (R5,50/m)	269,50
	R1 360,00

thus the capital cost is R1,360 payable over 30 years at 8% per annum. Using the formula for amortization (Capital.$a_{\overline{n}|}^{1}$)

= 1,360 $a_{\overline{30}|}^{1}$

= 1,360 (0,088827)

= R120,80 per annum or R10,07 per month.

2. Running costs:

1. Mow, water and maintain lawn $727m^2$ (R0,05c/m^2/month	R36,35c/mont
2. No upkeep on pathway	nil
	R36,35c

= R36,35c per month

3. Total cost:
Capital cost plus running cost,
R10,07 + R36,35 = R46,42c per month.

/The .....

The method used was simply to multiply the quantity by the rate per metre or per square metre. The rates have been obtained from different sources (See Appendix 1.); the monthly cost of the capital costs was obtained by amortizing the capital value; this is to say, calculating the monthly figure necessary to pay off R30,00 compounded at 8% per annum over 30 years; (an 8% interest rate and a 30 year bond were assumptions.)

6.5. Case study

6.5.1. Exclusion

The purpose of the case study is not to arrive at the absolute capital and running costs of the two schemes, but to determine by calculating their respective costs relative to each other, the more cost-effective scheme. For this reason, any costs that are similar in both schemes need not be valued out. For example, the cost of electricity supply depends on the number of units to be served (number of installations) and on the area over which these units are spread (cable lengths). As the densities of the two schemes are the same, any variation in cost due to the design is negligible, and thus the electricity supply

/need .....

need not be costed out.

The exclusions include:

1. electricity supply - dependent on density;
2. land - dependent on density;
3. dwelling units - the same in both designs except for flat blocks;
4. professional fees - too complex to calculate;
5. running costs of water, sewerage and storm-water reticulation - negligible;
6. running costs of roads, parking areas, walkways - negligible;
7. running costs of dwellings - approximately the same in both designs;
8. public open space - same for both designs.

CHAPTER 7

PHOENIX NEW TOWN MASTERPLAN

7. PHOENIX NEW TOWN MASTERPLAN

7.1. Introduction

The case study is of residential community within Phoenix New Town, which is intended for Indians in the Durban metropolitan area. In order to give context to this case study the background to Phoenix's inception is dealt with; the regional setting and the more important concepts of the masterplan are also summarised. The only source of information available for this chapter is the Durban City Engineer's, Newlands & Phoenix Masterplan, 1969.

7.2. Origins of the scheme

On 4th December, 1964, at a meeting of the Pietermaritzburg-Durban Regional Planning Committee, the Durban City Engineer submitted a report on the need for setting aside additional land for the housing of the growing indian population outside the boundaries of the city. An investigation of the housing shortfall was subsequently carried out, the results of which were embodied in a report 'Indian Housing Requirements' (May,1965). This report made it clear that by the year 1980

/a .....

a total of 63000 housing units would be required to house the indian population, and not less than 30 000 of these units would be required for an overspill population. "The committee resolved to support the use of the Phoenix and Newlands areas for the housing of Durban's indian population". (Durban City Engineer, p 1.)

This proposal was accepted by the City Council in August, 1966, and it directed that the two schemes should proceed. The Department of Planning and the Department of Community Development authorized acquisition of the land and preparation of the scheme plans.

The Department of Community Development also included itself in the Phoenix development to the extent of two neighbourhoods (about 1300 housing units); this did not include residential unit No. 4.

7.3. Regional setting

Phoenix is located just north of the Durban municipal boundary on 1995 ha of land. (See Map. No. 1.) The eastern boundary is between 6 and 9 km from the sea and abutts Mount

/Edgecombe .....

Edgecombe, the south and south-west boundaries flank Kwa Mashu. Phoenix is linked to the city by a major road on the east side of the township, by the northern freeway via Mount Edgecombe, and by the outer ring road freeway to the western suburbs and Pinetown. The main North Coast rail link passes through Phoenix; two stations within the New Town serve the northern and southern areas respectively.

Industrial areas are in relatively close proximity for employment. There are industrial areas to the south of Phoenix (218 hectares), at Mount Edgecombe (218 nett hectares), and to the north at Ottawa (202 nett hectares). Residents employed in Durban will have to travel 19 kilometres by road or undergo a 40 minute train trip to get to work. Pinetown workers will have to travel 30 kilometres by road; no rail services are available for this journey.

7.4. Physical characteristics

The topography is generally undulating with about 8% of the land being too severe for development of any kind. The land rises

/from .....

from 30 metres above sea level in the south to 200 metres above sea level in the north-west corner. The main valley enters the area from the south, forking into two tributary valleys to the north-west and north-east respectively.

The soils are generally deep and fertile enough to support wooded areas. However expansive clays closely associated with geology of Ecca Shales exist in the area and are important restraints on the type of development which can take place there.

7.5. Goals and objectives

No specific attention was paid to goals and objectives in the Newland/Phoenix master-plan, but some explicit and implicit goals appear in the text from time to time. These goals and objectives are abstracted hereunder to give greater insight into the thinking that went into Phoenix New Town.

1. Social: "The community pattern will not be subject to any lowering of standards simply because the occupants fall into sub-economic or lower economic grouping." (Durban City Engineer, p 28). "To facilitate

/personal .....

personal friendship and social intercourse" (op cit, p 29).

2. Residential: ... "providing a wide enough range of housing units to meet the needs of all from the single person household to the large household". (op cit, p 21). "The principle followed is to limit vehicular penetration into the residential units without creating inconvenience in movement between house and car or by placing undue restrictions on service vehicles". (op cit p 30.)

3. Accessibility: "The siting of ..... Phoenix was subject to a number of influences amongst which was the need to ensure as short a journey to work as possible ...." (op cit, p 47) " .... reducing maximum travel times from the suburbs (to the town centre)." (op cit, p 32).

".... properly integrated public transport service operating within a network of roads and pedestrian ways so designed as to ensure adequate and safe movement for all users." (op cit, p47.)

".... imperative to provide adequate space for future parking of cars at or close to all housing units, and at all places of assembly." (op cit, p 53).

".... it is desirable that walking distances

/should .....

should be reasonably short ..." (op cit p 25).

4. Town centre: " .... the town centre should be located in a dominant position overlooking the rest of the town". (op cit,p 32).
".... harmonious blending of differing functions with particular attention paid to the separation of pedestrian and vehicular movement." (op cit, p 34).

5. Shopping: Implied objective of ——— a population large enough to support an economically competitive range of shops for convenience goods. (op cit, p 26).
Implied objective of, ——— a combined shopping and community centre. (op cit,p 26).

6. Education: Implied objective of —— a community large enough to support a secondary school.

It is significant to note that an objective, criteria or priority ranking for the cost element of the new towns of Phoenix and Newlands did not appear in the report on the master plan. This observation is itself sufficient to justify scepticism as to the amount of attention paid to the cost dimension in this project. The only mention of cost reads as follows, " .... and lastly the preparation and submission for approval by

cost factor not mentioned

/the.....

the National Housing Commission of the Master Plan and Report supported by a financial report with a broad statement of the cost breakdown and the overall cost of the scheme." (Op cit, p 29).

7.6. The design concept

This section should be read in conjunction with Map No. 2.

7.6.1. Community concept

Space to do everything in one area

The broad land use classification of space in the New Town is in terms of living, working, shopping, leisure and movement areas. The sizes, locations and linkages of these land uses were made in terms of two criteria. Firstly, the proximity in terms of movement to and from the schools and other amenities, and secondly, in terms of the minimum population required to support a single school and the convenient and economic provision of shopping facilities.

Although the rapid increase in car ownership was forseen, the design attempted to cater for walking as the main mode of intra-community travel. The maximum desirable walking distance arrived at was about 500 metres.

/With .....

With these guidelines of proximity, minimum support population and maximum desirable walking distance, the basic residential unit of a 'community' area housing eight thousand people, was decided upon; the community was divided in two approximately equal sized 'neighbourhoods'. The smallest collection of housing units contains two hundred and fifty people and is called a 'group'. The housing unit groupings have minimal road penetration and are interconnected with pedestrian ways, open spaces and areas of parking provision.

Four of these groups constitutes a 'cluster' of one thousand people. A cluster has a religious building or small hall or perhaps a nursery school and a larger 'run-about' for children. The neighbourhood comprising four clusters has a total of four thousand people which is made up entirely or in part of single detached houses, semi-detached houses, duplex units, and blocks of flats between one and four storeys. Also in the neighbourhood is an infant or primary school, two or three religious sites, a corner shop or two, and possibly a small hall.

/Two .....

Two neighbourhoods constitutes a community which, in addition to the neighbourhood facilities, has a secondary school and a community shopping centre. (See Figure 7.3.)

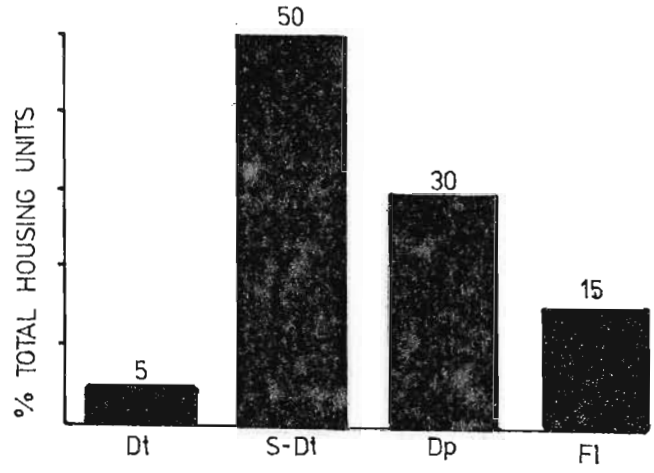
7.6.2. Residential

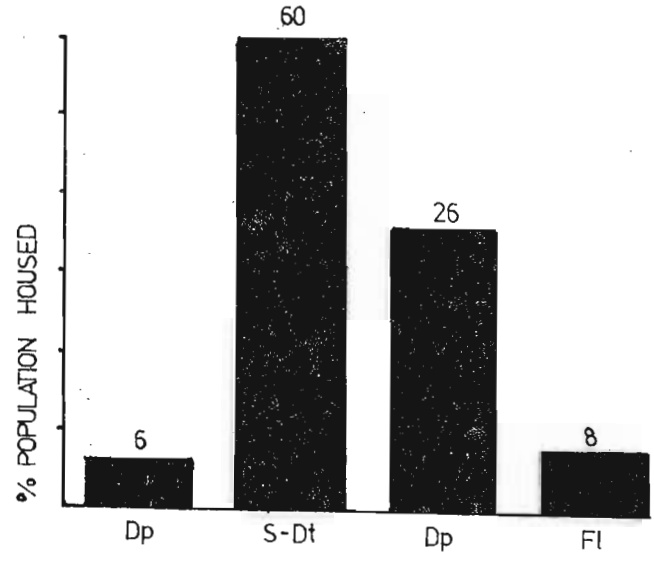
The City Engineer's master plan states that the housing allocation was planned so as to provide a wide enough range of housing units to meet the needs of all from the single person to the large household. (See Figure 7.1.)

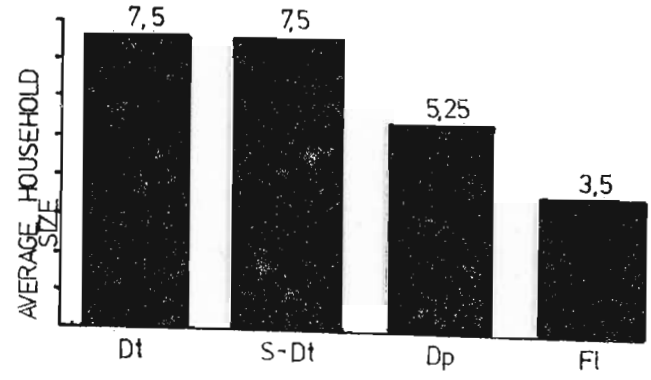
The number of bed spaces and thus bedrooms for each household size was determined from the projected household sizes for 1990. The basic approach was to house smaller households at the highest density and the larger households at the lower densities. The housing type ranges from flats for smaller households to duplexes and semi-detached houses for medium sized households and to better-class detached houses for large households. (See Figure 7.1.)

The flats were designed for between one and five bed spaces with either one living room, or one or two bedrooms with a living room. The duplexes were designed with between

/three .....


% TOTAL HOUSING UNITS
50
30
15
5
Dt
S-Dt
Dp
Fl


% POPULATION HOUSED
60
26
8
6
Dp
S-Dt
Dp
Fl


AVERAGE HOUSEHOLD SIZE
7,5
7,5
5,25
3,5
Dt
S-Dt
Dp
Fl

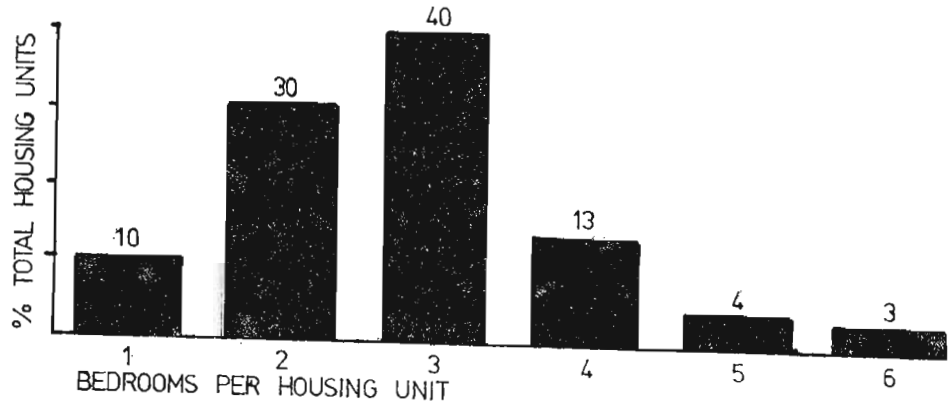
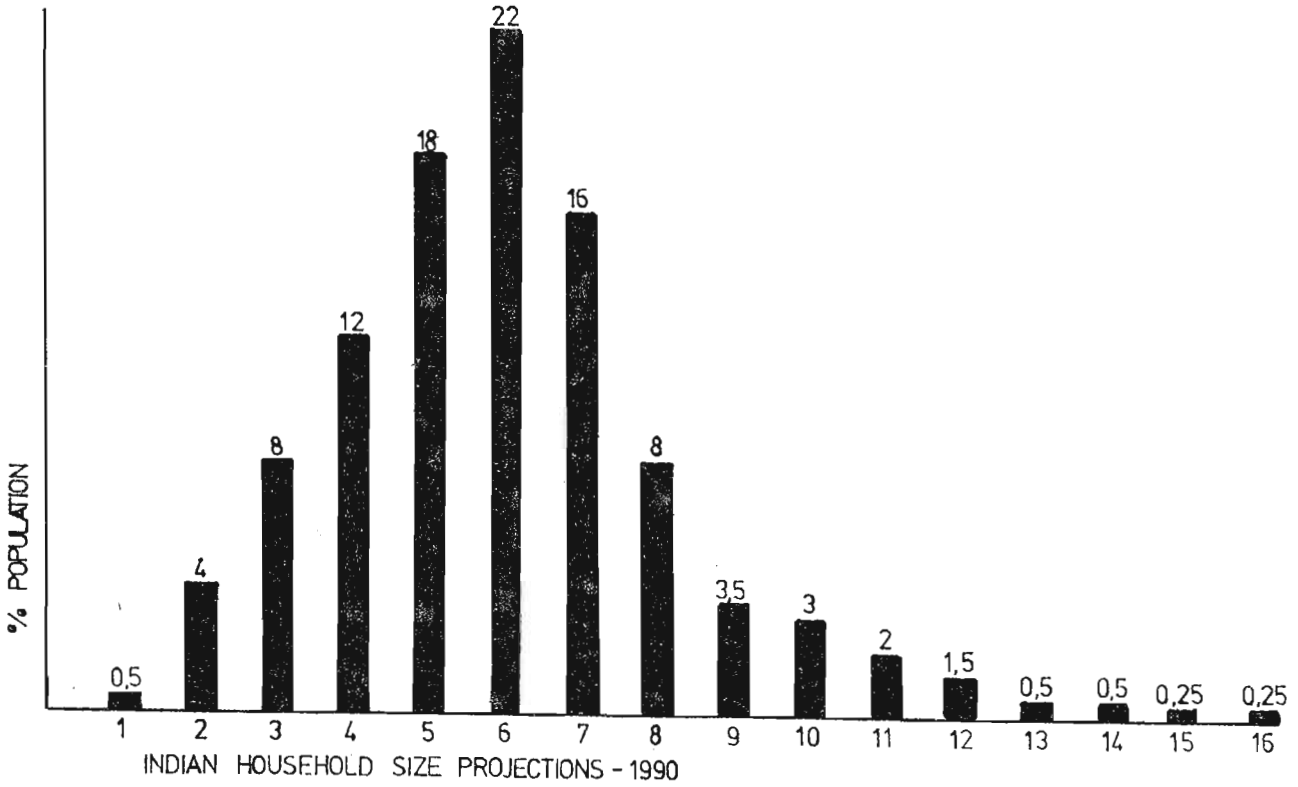

% TOTAL HOUSING UNITS
40
30
13
10
4
3
1
2
3
4
5
6
BEDROOMS PER HOUSING UNIT

Figure 7.1.


% POPULATION
0,5
4
8
12
18
22
16
8
3,5
3
2
1,5
0,5
0,5
0,25
0,25
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
INDIAN HOUSEHOLD SIZE PROJECTIONS - 1990

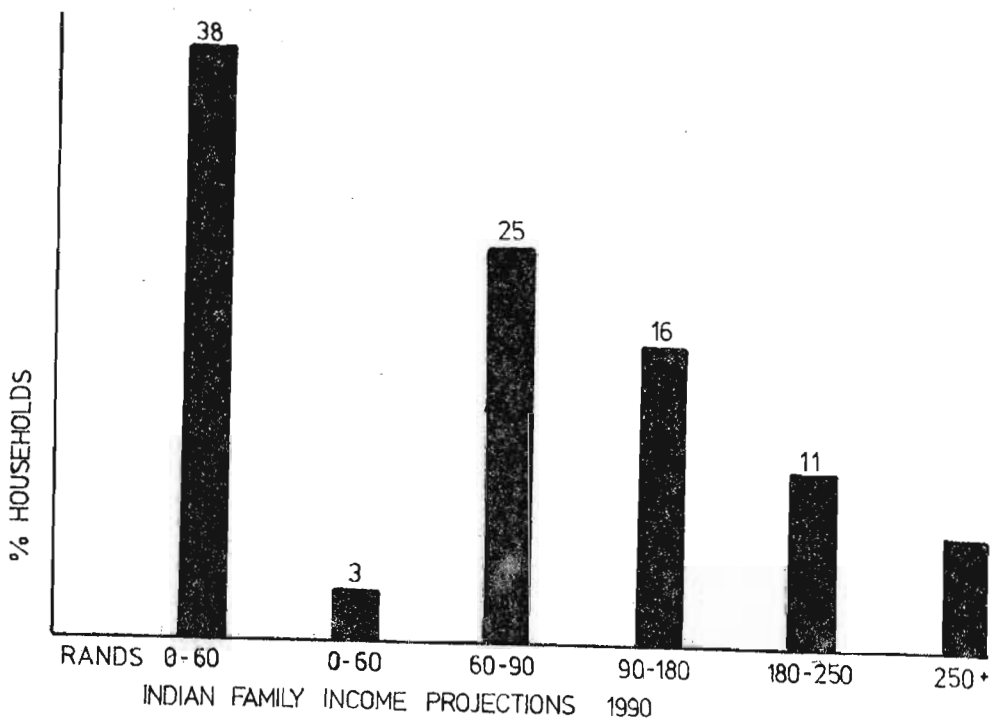

% HOUSEHOLDS
38
3
25
16
11
RANDS 0-60
0-60
60-90
90-180
180-250
250+
INDIAN FAMILY INCOME PROJECTIONS 1990

Figure 7.2.

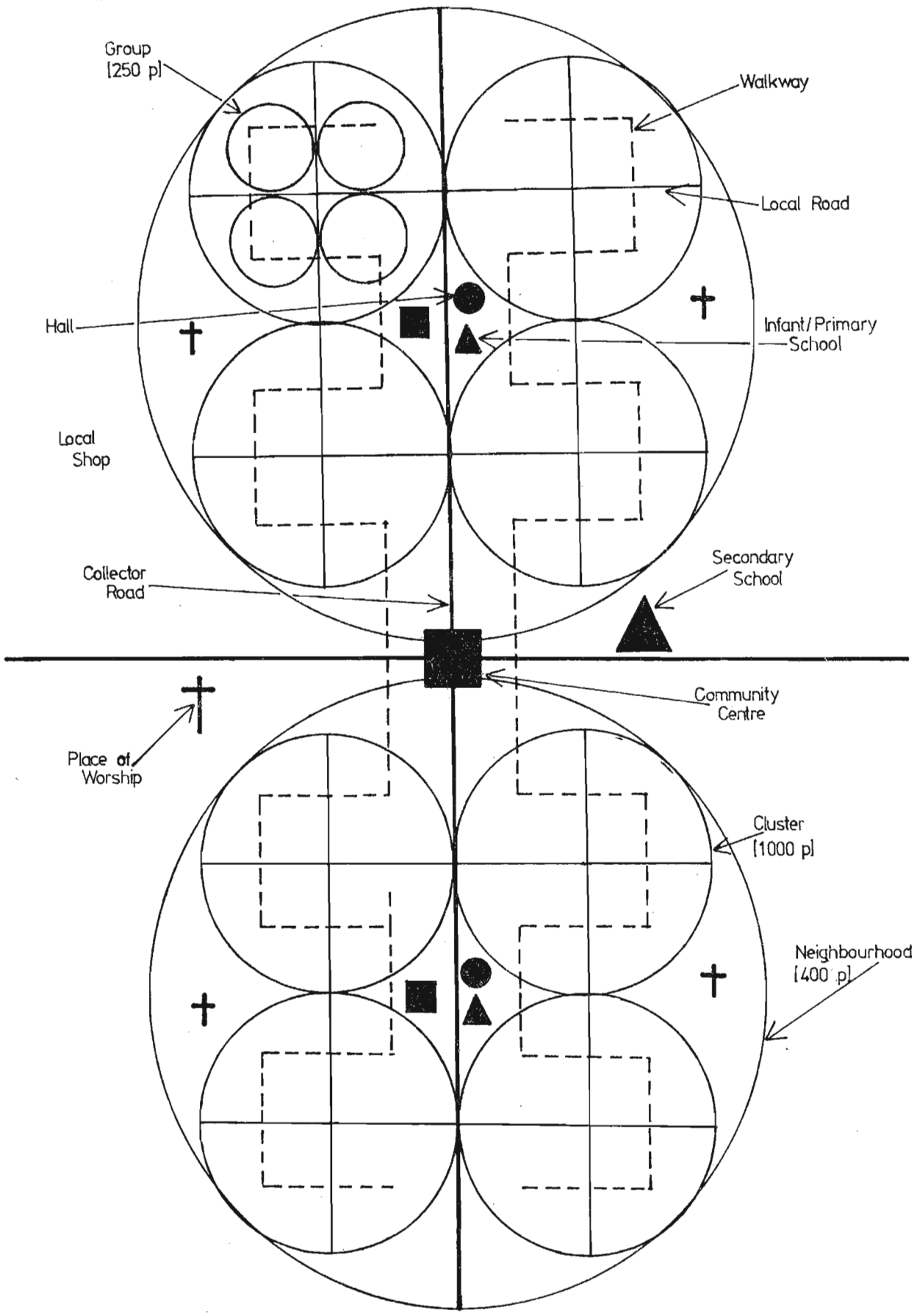

Group
[250 p]
Walkway
Local Road
Hall
Infant/Primary
School
Local
Shop
Secondary
School
Collector
Road
Community
Centre
Place of
Worship
Cluster
[1000 p]
Neighbourhood
[400 p]

Figure 7.3.

three and seven bed spaces and they had between one and three bedrooms. The houses have bed spaces that range between five and nine and have between two and four bedrooms.

The density is sixteen units per nett site hectare for four storey blocks of flats and special homes for the aged, all to provide for a range of one to five person households. Duplex units in blocks and terraces have a density of nine units per nett hectare for between four and seven person households. Semi-detached houses occur at thirteen units per nett hectare and detached houses at nine units per nett hectare; both detached and semi-detached houses are for six to nine person households and larger.

The percentage apportionment of different dwelling types and sizes is as follows:

Bedrooms	Living Room	Flats	Duplex	Houses
-	1	1	-	-
1	1	6	3	-
2	1	8	18	-
3	1	-	9	26
4	1	-	-	24
5	1	-	-	5
		15	30	55
Average household size		3,5	5,25	7,50
Overall average 6,225				

Figure 7.4.

7.6.3. Education

The proportion of children of school age to the average family size was 1 to 3, and thus the following standards were adopted:

1 infant/primary school per 4,000 people

1 secondary school per 8,000 people.

The land requirements were provided by the Department of Public Works. The Durban City Engineer then analysed these requirements for siting on lands of various slope, as follows:

Gross areas (Ha)

	Flat Land	1:15 Land	1:8 Land	Total
Infant/primary	1,62	1,82	2,43 =	5,87
Secondary	2,83	3,64	4,45 =	10,92

The Director of Education was in agreement that the playing fields could be shared by the rest of the community.

Land for a teachers' training college was reserved although some of this falls outside of the Phoenix boundary.

7.6.4. Medical

A hospital site of 20 ha has been set aside in central-eastern Phoenix. The standard of one clinic per forty-thousand

/people .....

people required by the Durban Department of Public Health was adopted, and a total of four reservations were made within Phoenix, one forming part of the municipal centre in the town centre.

7.6.5. Shopping

Shopping facilities were determined in terms of the shopping floor area required by the serving population. The standards adopted were between 0,65 and 0,70 square metres of shopping floor area per person, and were determined by means of an analysis of shopping characteristics in the white areas of Durban.

As the percentage of shopping carried out in local and community areas was expected to drop from an estimated 40% to 30% of the trading, the design standards adopted were as follows:

0,28 m^2/ person in small centres
0,42 - 0,48 m^2/person in the town centre.

The small centres are the corner shops and community centre shopping. "A population of 4,000 people could not be expected to support an economically competitive range of shops for convenience goods but double

/that .....

that population could well meet that requirement and probably even demand a wider range of goods". (Op cit, p 26).

7.6.6. Community Facilities

Groups of residents (250 persons) would be allocated small amounts of open areas for leisure and play. The community facilities for clusters (1,000 persons or 4 groups) were to include a small playing area, a public telephone booth, a post box and a creche or a nursery school. The facilities in a neighbourhood (4,000 persons) would include three religious sites, possibly a small hall, a small park, a playing field, a few shops and a site for a future filling station. The community centre (8,000 persons) would include in addition to its shopping and service trade sites, an area reserved for social and cultural use and an occasional large mosque or temple, a community hall, a filling station and post office facilities.

7.6.7. Recreation and open space

The recreational requirements of the indian people were largely planned for by taking note of the recreational similarities between the indians and the whites.

/The .....

The standard assumed for Phoenix was 2,02 ha of usable open space per thousand persons within the community areas, with the exception of a small portion of the playing fields allotment area allocated to the central sports area. See Figure 7.5.

Open Space Use.	Area Allocated (ha)
Playing fields (in communities)	0,81/1000 persons
Playing fields and swimming pool (in central area)	0,20/1000 persons
Playlots (small children)	0,36/1000 persons
Footways, small areas of open space, larger areas of open space	0,65/1000 persons
Sites for indoor recreation	In community centres
Woodlands, river areas, vistas, walking and climbing	8% too severe for use
Golf course	May be in the 52 ha strip on western boundary
Narrow parkway strips	Along all major roads and bus routes.

Figure 7.5.

7.6.8. Transport and movement

There is an existing double-track electrified railway passing through the eastern portion of Phoenix with a station in the south of the New Town and at Mt. Edgecombe in the north-east. The travel time to Durban's central station is about 40 minutes.

/Two .....

Two provincial main roads pass Phoenix on the south west and on the east. The distance to the Durban city hall from the new town centroid is 23 km on the North Coast old main road and 27 km on the North Coast freeway. The bus service has an intra as well as an inter-town service. The bus service to Durban is generally regarded by the residents as being too expensive for regular commuting use, but it is seen as a valuable backup when the rail service is not immediately available. (Source: personal informal surveys). In order that the movement system of the New Town works, the buses are required to pick up the bus travellers within 500 metres (maximum acceptable walking distance) of their homes and transport them to and from the railway stations, town centre and major recreational areas.

A footpath system will link homes with the community centres and pass places for the bus services. Parking is provided for cars at or close to all housing units and at places of assembly. Parking for residents is generally at a collective parking bay within close proximity of the residential units. See Figure 7.6.

/7.6.9. .....

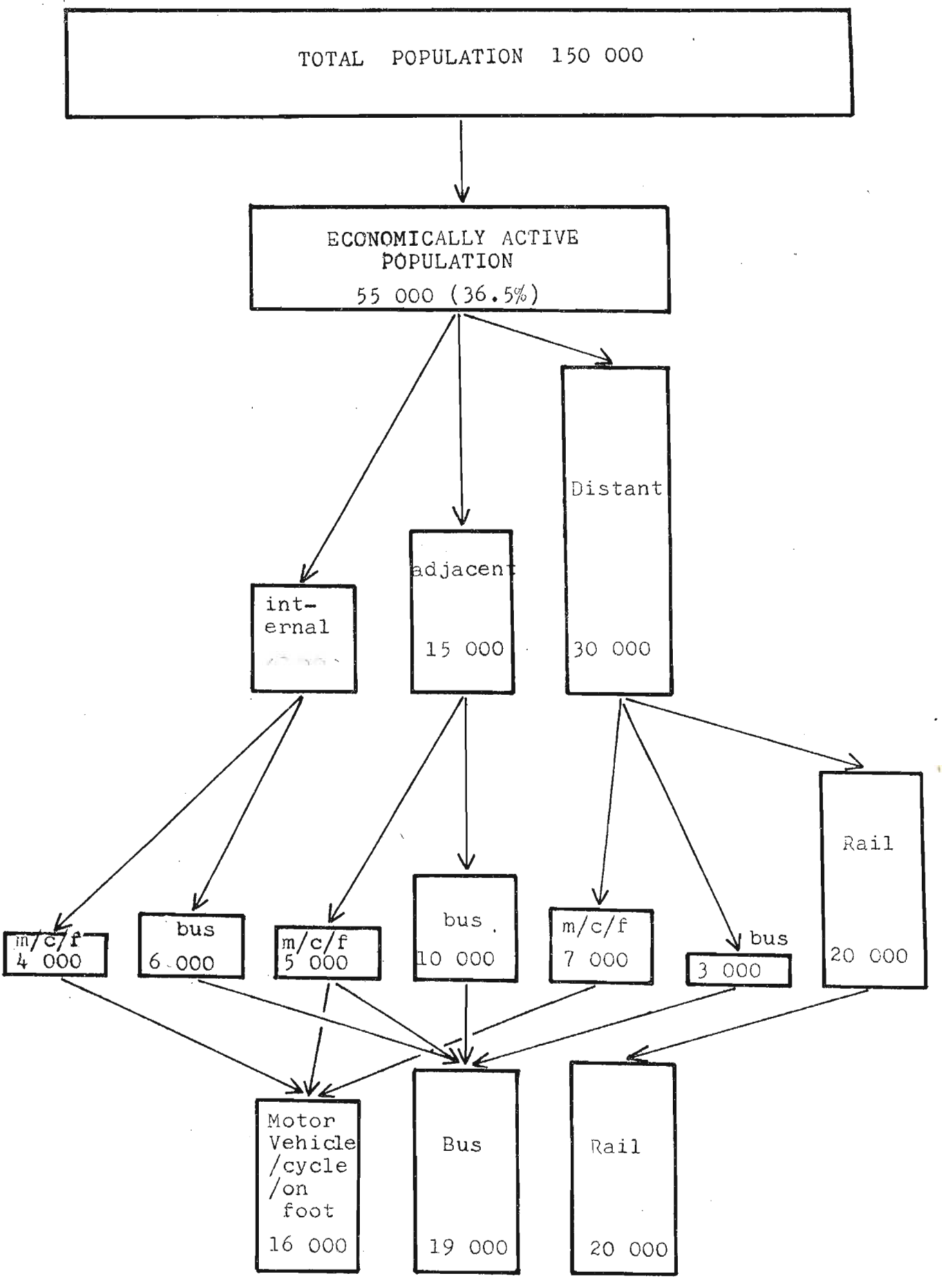

TOTAL POPULATION 150 000
ECONOMICALLY ACTIVE POPULATION
55 000 (36.5%)
int-
ernal
adjacent
15 000
Distant
30 000
m/c/f
4 000
bus
6 000
m/c/f
5 000
bus
10 000
m/c/f
7 000
bus
3 000
Rail
20 000
Motor
Vehicle
/cycle
/on
foot
16 000
Bus
19 000
Rail
20 000

Figure 7.6.

7.6.9. Engineering and special services

The City Engineer is responsible for water supply, stormwater drainage, sewerage, sewage treatment, refuse removal and disposal; the City Electrical Engineer is responsible for the supply of electricity.

The water supply is from the storage dams on the Umgeni River and it is treated at the Reservoir Hills Water Treatment Plant and stored in reservoirs within the New Town area for distribution.

With the exception of the rugged areas south of Mt. Moriah, Phoenix drains into the Piesang River upstream of the Kwa Mashu sewage treatment works. These sewage treatment facilities are being extended to allow for the future flow from Phoenix New Town, and any excess that cannot be dealt with will be gravitated to the Northern Treatment Works.

The area's electricity is supplied from a large substation and depot alongside the electricity supply lines which run from south to north on the eastern side of Phoenix.

The three main tributaries of the Piesang

/River .....

River on the north-west, south-west and north-east of Phoenix and the surrounding land in its lower reaches, are reserved for recreation and parklands. During urbanisation the flow in these rivers will be increased and canalization may become necessary.

Refuse disposal is handledin Phoenix by the Durban City Engineer, the frequency of service for each community being twice a week.

An area of 16 ha has been set aside for a cemetery and a crematorium; the existing houses there will not need to be demolished until they are fully amortized.

7.6.10. Town centre

A goal for the town centre was that it should be prominently situated overlooking the rest of the town. The choice was in the water-shed area off-centre to the north and off-centre to the east. The more prominent latter alternative was opted for in the master plan (1969) because of its advantages; this was subsequently rejected in favour of the alternative. This change is likely to have been at least partly due to the future extensions into Phoenix North and the

/resultant .....

resultant arterial connecting the extensions with the original Phoenix township. The main reason for the change however is the undue noise levels from the proposed international airport that would have crossed over the original town centre. Activities in the town centre include civic and public buildings comprising local authority, central government administration, justice and police, and municipal services. Religious, cultural and educational services, and the market and service trade activities, the commercial sector, hotels, high density flats and an entertainment area are also in the town centre.

7.6.11. Summary

Phoenix was planned on the basis of ranges, thresholds and standards. The ranges refer to the acceptable distances which people move in order to reach services; the thresholds are the minimum support population required for a service to function efficiently. The standards are the minimum quality and/or quantity acceptable for any service, as determined by some official authority, or as laid down in legislation.

When translated into spatial areas, Phoenix

/appears .....

appears as in Figure 7.7.

	%	Areas in hectares
Residential	34,4	686
Education	8,9	178
Town centre	3,0	59
Community and shopping centres	3,9	77
Open space and recreation	16,6	332
Hospital and reserve	1,6	32
Religious and general	4,1	81
Cemetery	0,8	16
Roads	16,0	320
Railway	0,9	18
Restraints	9,8	196
	Total	1 995

Figure 7.7.

The spatial interrelationship of all these components are laid out in Map No. 2. and what does not appear on such a large scale plan will be details out in a case study of a residential community in the following chapter.

A very subjective 'rule of thumb' indicator of residential quality in a township, is that of gross and nett population densities. This indicator is incomplete as it gives no

/indication .....

indication of housing type, open space or the level of amenity offered by various community services. However, when read in conjunction with this and the following chapter, Figure No 7.8. gives greater insight into the Phoenix master plan.

Extent of land	Housing Units per hectare	Persons per hectare
Gross overall township	12,1	75,1
Gross development	14,2	88,5
Community areas	16,2	100,8
Nett site area	38,7	240,7

Figure 7.8.

CHAPTER 8.

RESIDENTIAL UNIT NO. 4.

8. RESIDENTIAL UNIT NO. 4.

8.1. Introduction

As mentioned before Phoenix is subdivided into communities of approximately eight thousand persons. One such community is 'Residential Unit No. 4', otherwise called 'Stonebridge', situated on 84,05 ha of land. This particular unit was chosen as a case study, as it is the only community almost entirely completed and as it is fully occupied (at the date of commencement of this study) with 6,480 persons.

8.2. Location

See Map No 2.

Residential Unit No. 4 is located just off the 'Spinal Road' which is the major arterial that feeds the town. It is one of the southern-most communities in Phoenix. It's residential centroid is approximately 2,5 km from the entrance to Phoenix at the junction of the North Coast Old Main Road, and it is 4,8 km from the town centre.

8.3. Physical characteristics

8.3.1. Gradients

See Map No. 4.

/The .....

The slope has been graded into four categories: slopes flatter than 1:10, slopes exceeding 1:10 but not exceeding 1:6 slope exceeding 1:6 but not exceeding 1:4, and slopes steeper than 1:4. The most common category of slopes is that between 1:6 and 1:10, which together with the slopes flatter than 1:10, make up about 70% of the area. The other two categories both make up about 15% of the area respectively. The flatter areas occur on the ridges and higher ground while the steeper slopes occur mainly in the south, the east and along the river valley that extends up the centre.

8.3.2. Drainage

See Map No 3.

It can be seen that a prominant river valley forms a feature of this area from north to south. Similarly, two major ridges lie on either side of the river and join each other in an east-west direction in the north. The land slopes down from 100m above sea level in the north east to 33m above sea level in the south west.

8.3.3. Geology and soils

See Map No. 3.

/There .....

There are three areas with suspect soils in Residential Unit No. 4. "All three of these areas exhibit relatively steep southeast facing slopes with surface angles above 14 degrees. Area P8 is particularly steep where slope angles rise to 25 degrees or more".

"These areas are underlain by shale bedrock exhibiting the normal south eastern regional dip of between 6 and 10 degrees in approximately the same direction as the slopes and large dolerite outcrops persistently on the slopes of Areas P7 and P8, whereas lesser dolerite intrusions are indicated by the dolerite soil evident at the surface of Area P9."

"The geological and topographical circumstances of these three areas are such that any development implemented on them should be implemented with caution and adequate supervision such that suitable design modifications can be adopted in the event of seriously disturbed or leached and weakened strata being exposed in critical location by development". (City Engineer, Durban, 12th September, 1972).

/8.3.4. .....

8.3.4. Vegetation

See Map No. 3.

Prior to development the entire area was under sugar cane plantations, and as a result very little natural vegetation was left to be utilized in the design. The valleys and flood plains however, were still covered by rich indigenous sub-tropical vegetation such as cycads, paw-paw trees, mangroves and tall grasses.

8.3.5. Orientation

As the area slopes down from north to south, the orientation for development is predominantly either south west, south east or south. The possibility of residential units being orientated toward the northern segment is reserved for a few isolated areas where the slopes are very gentle.

8.3.6. Views and vistas

Good views and vistas are possible due to the undulating nature of the terrain. The sheer cliffs and steep land on the southern and eastern borders of the area overlook river valleys and distant developments. The north-south flowing river provides vista possibilities

/for .....

for development situated on its banks and on overlooking land.

8.4. The design

See Map No 5.

8.4.1. Community concept

The dwelling units generally face on to either a grassed area or on to the road, - similar to the 'group' mentioned in the concept. The grassed area is communal, usually with concreted walkways on either side of it or down the centre of it. Because of these pathways, the use of the grassed areas becomes public and semi-public as it is not for the exclusive use of the residents surrounding it.

Vehicular and pedestrian movement within the community is separated; only at crossing points of local and collector roads are the pedestrians exposed to motor traffic. The community is inter-connected with pedestrian paths which usually pass along the semi-public and public open areas; these paths also connect residential units with communal parking areas which are usually within 50 metres of the home. Access to these parking areas is off local and

/collector .....

collector roads, the only roads which penetrate the community area.

The ownership of all land is public other than the land on which the dwelling units are built. The semi-public open spaces are paid for by the residents in the purchase price of their land, even though ownership of these open spaces does not pass to them.

8.4.2. Residential

Figure 8.1. shows the type and nature of the dwelling units in the community. The units are flats, duplexes, semi-detached houses, terraced houses and detached houses. The dimension of the units are indicated in Figure 8.2.

	Flats	Duplexes	Semi-detached houses	Terraced houses	Detached houses	Total
Number of	34	56	186	3	21	300
No. of dwelling units	264	336	372	14	21	1 007
Occupancy rates	3,50	5,25	7,50	7,50	7,50	N/A
No. of people	924	1 764	2 790	105	158	5 741
Residential density (Unit/nett ha	31,53	31,53	18,62	18,62	12,90	N/A
Residential density (nett ha/unit)	0,03	0,054	0,054	0,054	0,078	N/A
Residential density (people/nett ha)	141	141	140	140	97	N/A

Note 1 : nett hectare excludes only shops, roads, reserve sites, community centres, places of worship, creches and servitudes.

Note 2 : the total population figure of 5,741 does not correspond with 6,480 persons, the figure mentioned in the master plan.

Figure 8.1.

		Unit sizes (in metres)	
		End Units	Inside Units
Duplexes:	1.	6,900 x 5,025	6,900 x 4,950
	2.	6,900 x 4,825	6,900 x 4,750
	3.	7,500 x 5,975	7,500 x 5,900
Terraced houses:			
	1.	7,000 x 7,075	7,000 x 7,000
	2.	7,500 x 5,975	7,500 x 5,900
Semi-detached houses:			
	1.	8,20 x 7,275	
	2.	10,40 x 7,275	
	3.	9,40 x 11,525	
	4.	8,450 x 11,125	plus 3,50 x 4,950 (irregular shape)
Detached houses:		9,400 x 11,600	
Flats:	1.	7,900 x 18,500	
	2.	7,900 x 18,500	plus 7,900 x 18,500 (double unit)

Figure 8.2.

8.4.3. Education

Two infant/primary schools and one secondary school serve the area; in addition there are three creches. Both the schools and the creches are situated on local level roads. The areas of these facilities are indicated in Figure

		Area (in hectares)
Infant/primary school	(precinct D)	2,31
	(precinct A)	2,32
Secondary school	(precinct E)	3,79
Creche	(precinct D,A,F)	0,02
	Total	8,48

Figure 8.3.

8.4.4. Medical

The community is served by one clinic which is situated within the community centre. The space reserved for it is 0,02 ha. The Phoenix hospital is situated on the Spinal Road and is approximately 1,5 km from the centroid of the area.

8.4.5. Shopping

Shopping facilities were determined in terms of the shopping floor area required by the

/serving .....

serving population. In this community the shops take the form of two double convenience-level shops (2 sites) and an area set aside in the community centre. The individual areas are not specified in the master plan but their combined areas add up to 1600 square metres. Both convenience-level shops have road frontage, one on a collector road (Stonebridge Drive) and the other on a local road (Cardinal Road).

8.4.6. Community facilities

1. The community centre is made up of a community hall (site approximately 0,3 ha) and a complex containing shops, a clinic, a cinema, a library, post office facilities and reserve sites for sundry extension (2,40 ha). In addition two public telephones and two post boxes are scattered about within the community area.

2. Four sites of worship are provided. Two of the sites are 0,40 ha in area, and the other two are 0,20 ha and 0,10 ha respectively. All worship sites have access from local roads.

3. Three play-lots, each 0,01 ha in area, are provided for the community. Two of the play lots have access off local roads and one has no road frontage at all.

4. Informal, passive open space in the form of flood plains and over-steep land is present

/in .....

in the south and east of the community. These areas are not true community facilities but they do provide views and vistas for the residents. The other open spaces are more 'active' and include a recreation playing field in precinct B, a sports field in precinct G, and tennis court and a bowling green close to the flood plains in the south.

5. Lastly a petrol filling station of 0,01 ha is situated off Stonebridge Drive.

8.4.7. Recreation and open space

The community is served by open space land use in the areas as shown in Figure 8.4. Ownership of all the open spaces mentioned below is by the public authorities, and all the maintenance is carried out by the Department of Parks and Gardens.

	Number	Area (ha)	Total area (ha)
Recreation field	1	1,16	1,16
Sports field	1	1,20	1,20
School field		Not specified	
Bowling green	1	0,25	0,25
Tennis court	1	0,25	0,25
Playlots	3	0,19	0,57
Grassed/planted open spaces	N/A	41,39	41,39
Woodlands/rivers/vistas	N/A	8,73	8,73
Road reserve widths	N/A	6,63	6,63
		Total	60,18 ha

Figure 8.4.

There is 60,18 ha of open space in the community; this calculates out to be 0,01 ha per person.

8.4.8. Transport and movement

8.4.8.1. Vehicular system

A collector road divides the area more or less down the centre from the north to the south, but veers off in the south to communities two and three in the east. Two curvolinear shaped local roads serve the areas to the east and west of the local road respectively.

Parking for private motor vehicles is provided in the form of large communal parking lots with pedestrian pathways linking them to residential units. The road surfacing is always tar-macadam, and the parking lots are either of concrete or brick paving.

A bus service operates in the area but is private and much more costly than the rail service. The bus routes are not the same as they were intended to be in the design; they were intended to run along the major collector, but instead they run along local roads and even into the parking lot in the extreme south west. The

/railway .....

railway station is about 1 km from the community centroid and a regular train service operates during the day.

8.4.8.2. Pedestrian system

The community is criss-crossed by paved pedestrian walkways which interlink communal parking lots with residential units. The walkways which pass the fronts of the dwelling units provide access to the community centre, the schools and the shops with the minimum amount of roadside walking. The paths usually pass through semi-public and public open space, and are often duplicated on both sides of the open spaces.

8.4.9. Engineering and special services

8.4.9.1. Water reticulation

Every dwelling unit has water supply from the townships water reticulation system. (See Maps Nos. 6 and 7. The water mains run below the roads and enter the 'neighbourhood' space under the pedestrian walkways. Each lot has its own connection from the public main on to the private property.

8.4.9.2. Sewerage reticulation

See Maps Nos.6 and 7. Unlike the water supply,

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the sewerage reticulation passes from one private property to the next before flowing into the mains in the semi-public spaces. The network is not under pressure and follows the contours to ensure gravity flow; the system does not run under the public roads.

8.4.9.3. Stormwater reticulation

See Maps Nos.6 & 7. The stormwater reticulation utilises gravity but does not flow into the township mains; stormwater drains into the streams and rivers, but as the housing design does not generally orientate the units about the streams, pipes are laid which lead the stormwater from the units to these valleys.

8.4.9.4. Electricity supply

All dwelling units are supplied with electricity and the walkways have lighting from overhead gumpoles. This service is not analysed in detail as it does not form part of cost-evaluation.

8.4.10. Summary

The design of the community is neither a linear concept nor a true cluster concept. A linear design is one in which all the units have road access and a cluster design is one

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in which the units are either clustered around an open space or clustered around a parking area.

The Phoenix design has dwelling units lined on either side of an open space which is used by the entire community. The fact that this open space is not for the exclusive use of a small group of residents means that it is not a true cluster. Neither is a group of dwelling units clustered around a parking area; the parking areas although communal, are far removed from the actual units.

Thus the design appears to make use of the open spaces in a way similar to the Radburn concept, but where the Radburn design clusters the units around a parking and service area, this design does not.

CHAPTER 9

ALTERNATIVE RESIDENTIAL UNIT

9. Alternative residential unit

9.1. Introduction

In order that the alternative design concept may be compared with the residential unit No. 4, the alternative holds all the variables of the design constant except for those specifically altered in order to incorporate the alternative concept. For example, the road systems change but the number of dwelling units remain the same; this has the effect of allowing a direct cost comparison between the two road systems without any adjustments having to be made for the different densities. Any similarity in design should be seen as a purposeful feature of the alternative design and not as a direct transfer from the original layout.

Only design elements which are significant for comparative purposes (Residential Unit No. 4 with the alternative) are detailed out. For example, electricity layouts which are governed by the number of units and the area of distribution need not be specified, as no significant cost difference would occur.

9.2. Design concept

See Map No 8.

/9.2.1. .....

9.2.1. Community concept

The essential feature of the alternative design relates to ownership. The ownership of nearly all the land is private and operates under a system of 'Planned Unit Development' (PUD) and Sectional Title.

1. The PUD operates by permitting exceptionally large plots of land to be developed; lots of 2,50 ha are not uncommon. As this transfers a considerable proportion of the road network system into private hands, it has the advantage of permitting road construction and design far below the standards laid down by the authorities on public roads. Similarly, the water supply system need not follow the public road system but can be designed within a PUD for optimal economy. The maintenance of this type of development is in the hands of the owner or co-owners.

2. The Sectional Title Act operates by making possible the individual ownership of 'sections' of a PUD (amongst other development types) and co-ownership in undivided shares in the 'common property'. The 'sections' refer to individual residential units and may include garages, servants' quarters and other units; the 'common property' refers to passages, communal gardens,

/play .....

play-areas and any other communal areas. This ownership system operates under the management of a 'body corporate' which is the legal persona of the common property.

The design variables which are altered for the proposed alternative design are: the choice of housing type, the allocation of public/private open space, the allocation of public/private services, and the pedestrian and vehicular systems.

1. the choice of housing type: no flats are included in the design as these units have been altered to duplexes;
2. the allocation of public/private open space: the emphasis is on private and semi-private open space;
3. the allocation of public/private services: because of the larger amounts of private land, more services became private;
4. the pedestrian and vehicle systems: no pedestrian/vehicle separation, but deliberate integration of the two systems; also, the parking system becomes integrated with the home.

9.2.2. Residential

9.2.2.1. Housing types

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The flat blocks in residential Unit No.4 are replaced by duplex units in the alternative; there are two reasons for this:

1. Closely associated with the community concept put forward is the concept of private open space and semi-private open space for every household. Only balconies can offer private open space in a block of flats, but this solution has very limited use; for example, gardening is very restricted by the lack of space.

2. Traditionally the indian population have extended families, which is to say, married children, grandparents and other relations tend to stay in the same house or in adjoining houses. For an ethnic culture such as this, duplexes are more suited to the needs of the indian family than are flats.

This solution is only acceptable if the duplexes are no more expensive than the flats. And as this is not possible for architectural reasons, without reducing the standards of the accommodation offered by the flats, only a saving in another area of the design will allow it. (This will be tested in Chapter 10).

/The .....

The number of duplex units and the number of rooms in them are altered to match the flat units. The rest of the dwelling units remain the same to assist with comparison. Figure 9.1. shows the revised schedule of residential units. The dimensions of the units are the same except for the duplexes; a larger size of duplex is added to the present range of duplexes to match the larger family requirements of flat dwellers.

	Duplexes	Semi-detached houses	Terraced houses	Detached houses	Total
Number of	94	186	2	21	303
No. of dwelling units	600	372	12	21	1 007
Occupancy rates	4,48	7,50	7,50	7,50	N/A
No. of people	2 688	2 790	105	158	5 741
Residential density (Units/nett ha)	31,53	18,62	18,62	12,90	(Average)
Residential density (nett ha/unit	0,03	0,054	0,054	0,078	(Average)
Residential density (people/nett ha)	141	140	140	97	139,70 (Average)

Figure 9.7.

9.2.2.2. Residential layouts

1. The design is basically a cluster concept. The dwelling units are either clustered around an open space (semi-private open space because of the private PUD's) or a parking area. Some of the dwellings fall outside of the cluster scheme because of a particular feature, such as a view on to a river, but they are still part of the PUD scheme.

2. All the dwelling units have private open space in front of them; this amount varies according to the particular design and according to how the residents wish to organise the ratio of 'section' to 'common property' on their particular PUD.

3. Most of the units are served by an access road which is private to that specific PUD.

4. The main criteria for the residential layout are: clustering, slope, view and orientation. This means that the design traded off these 4 criteria in each area of the community to the specific conditions present.

9.2.3. Education

The two infant/primary schools and the secondary school have identical areas to the original design. The orientations are the same and the shapes are very similar. The only modifications have been to allow alterations in the

/design .....

design of the local roads.

9.2.4. Medical

There is no alteration in this regard; the clinic is still situated in the community centre at 0,02 hectares.

9.2.5. Shopping

The two double convenience-level shops as well as the shops in the community centre are unchanged. The only difference is that the shop on the western side of the community now has only one side with street frontage.

9.2.6. Community facilities

1. The community hall and the rest of the community centre are now combined (no road separates them), but the area and design is otherwise identical.
2. The sites of worship and the playlots are modified slightly in positioning only, merely so that they fit into the new design.
3. The flood plains and oversteep land are unchanged, but the sportsfield and recreation field have moved slightly to fit into the design.
4. The petrol filling station has moved over

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the collector road to fit in with the new design.

9.2.7. Recreation and open space

9.2.7.1. Private and semi-private

Fundamental to the alternative design are the concepts of private and semi-private open space, and as there are no flats in the design, this is possible for all units. The private open space is directly in front of the dwelling units, and the ratio of private to semi-private open space will depend on the ratio of 'sections' to 'common-property' as adopted by each individual body-corporate.

Maintenance of the private and semi-private open space will be the responsibility of the owners and not of the Department of Parks and Gardens.

The hypothesis that the semi-private land will be more successful than semi-public land is based on the belief that an owner of a piece of land will take pride in it and attempt to care for it. This hypothesis is to be tested in Chapter 10.

/9.2.7.2. .....

9.2.7.2. Public and semi-public

The semi-public open space includes school fields, a sports field, a recreation field and three play lots. The size, orientation and position of these facilities have altered negligibly.

The public open space includes the flood plains, oversteep land on the southern and western boundaries of the community, and reserve widths of the public roads. As with semi-public open space, this open space is maintained by the Department of Parks and Gardens.

9.2.8. Transport and movement

9.2.8.1. Collector road

No alteration to the collector road was possible for the following reasons:

1. The position of entry into the community from the south was fixed by the road through community No. 3.
2. The position of intersection with the Phoenix Highway was also fixed because of another collector entering the highway to the west and because of the corner to the east.

/3. .....

3. Given the first two constraint, the route between these two points was also fixed by the steep land and the river valley in the area.

Pedestrian movement is along the reserve widths of the collector road which has a concreted walkway.

9.2.8.2. Local roads

In accordance with the concept of more private and fewer public roads, the local roads have been kept to a minimum.

1. Cardinal Road is a curvolinear shaped road serving the neighbourhood to the east of the collector road; it's point of intersection with Stonebridge Drive is fixed by the steep land on the south, and by its proximity to the Phoenix Highway in the north.

2. Acara Street is also curvolinear in shape, but now has a more rational shape to incorporate the access roads. As the schools' positions are fixed by the flat land, the road's intersection with the Phoenix Highway is to the south; the intersection with Stonebridge Drive is fixed by the steep land.

Pedestrian movement is along the reserve widths of the local road which has a concreted walkway.

/9.2.8.3. .....

9.2.8.3. Access Roads

The function of access roads is to provide vehicular and pedestrian access from the public roads to each individual residential unit. These roads are specific to each PUD; in other words, access roads may not serve more than one PUD or cross into any other PUD. Strictly speaking an access road may in fact cross another PUD, but this is dependent on the residents granting a servitude over their land, and as all PUD's have public road access, this is not necessary.

Access roads are not required to be designed to any public road standards and thus can be narrow, windy and may traverse up very steep slopes. In fact speed humps and other obstacles are an integral part of access road design; this ensures that children playing or walking on these roads will not be threatened by vehicles travelling faster than 5 or 10 kilometres per hour.

The material for access road construction for this design is concrete and in some cases gravel, although any material would be acceptable. The parking areas in front of the units

/are .....

are gravel.

9.2.9. Engineering and special services

See Map No. 9.

9.2.9.1. Water reticulation

All dwelling units have water supply from the township's water reticulation system. The water mains run below the local and collector roads and enter the 'neighbourhood' space at the connections to the private property; in other words, the pipes circulate within the PUD's for optimal design and need not skirt around private properties as the entire PUD is a private property.

9.2.9.2. Sewerage reticulation

The sewerage reticulation system is similar to that of the original design. The differences are only to serve the different positions of the dwelling units.

9.2.9.3. Stormwater reticulation

The alternative design orientates a high percentage of the dwelling units about the streams and valley. This has the result of allowing natural surface water run-off without the need for extensive pipework. Pipes are laid from the dwellings to the streams where

/run-off .....

run-off threatens dwellings lower down the hill.

9.2.10. Community centre

Very little alteration to the community centre has been made. As Cardinal Road no longer has the same shape, the community hall is now combined with the rest of the community centre.

9.2.11 Summary

The cluster concept, and the change in ownership from public to private of much of the land, are the essential features of the design. The elimination of blocks of flats are necessary for consistency in the concept of private open spaces for all units. Lastly, the car access to individual units is for security reasons and because the access road concept permits this without any extra cost.

CHAPTER 10

EVALUATION OF THE TWO PLANS

10. EVALUATION OF THE TWO PLANS

10.1. Introduction

Before the inputs to the design (labour and material measured in monetary terms) are costed out in order to arrive at the more cost-effective design, the outputs of the design (quality and quantity of the land use and design component) are assessed to ensure that the cheaper design solution meets acceptable standards. In other words, the basic designs are evaluated before assessing their respective costs; this prevents the incorrect conclusion of apparent design economy where the designs are sub-standard (refer to the design criteria set up in section 5.3.)

The portion of the community that is costed out is 6,90 hectares in area, and is indicated on Map No. 5. This area has been chosen as it is centrally located and is situated on land of approximately average gradient. (See Map No. 3.)

10.2. Residential Unit No. 4

10.2.1. Design evaluation

1. Appropriate residential density: the density of 140 persons per nett hectare is not excessive, considering that the average

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family size exceeds 6 persons with a high proportion of children, but in terms of family income, this density may be too low. (See section 11). The semi-public open spaces are not actively utilised to any large degree and if these areas, which amount to 8479m^2, are excluded from the case study area, the density becomes 160 persons per nett hectare; even this is an acceptable density.

The density is compatible with the climate, orientation and topography of the area; as the case study area has no suspect soil conditions in it, any densities are acceptable.

2. Noise levels: the noise levels in the study area are acceptably low as there are no noise generators present, other than the schools and the collector and local roads; the collector road has a relatively light flow of traffic as it serves only two other communities and it intersects the Phoenix highway at 2 points.

3. Personal safety: as there is very little vehicle/pedestrian conflict, the risk of accidents is minimal. However, there is a danger that muggings and robbery could occur along the pedestrian walkways at night, even though these paths have lighting. The reason

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is that there is likely to be very little pedestrian movement at night in a New Town which functions mainly as a dormitory to Durban. Road sidewalks generally offer more safety because of the larger dimensions and because of the likelihood of passing traffic.

4. Property security: the likelihood of theft and/or vandalizing of motor vehicles in the remote communal parking areas, is great; so much so, in fact, that the residents prefer to drive their cars over the semi-public open spaces and into their gardens rather than risk leaving them in the parking bays. As the safety of property should be incorporated into the design concept, this aspect of the design of residential unit No. 4 is inadequate.

5. Open space land use: the semi-public open spaces between the dwellings are very rarely used by any of the residents, although the public open space playlots are well used. The public open space in the river valley consists of dense bush which is not actively used; it does however provide a pleasant view. Thus the semi-public open spaces appear to be suboptimally utilised.

6. Housing type: the detached, semi-detached, terraced and duplex units appear to be satis-

factory in terms of the Indian lifestyle. The indians tend to have extended families, and duplexes allow relatives to stay in the unit 'next door'. This is more difficult in blocks of flats, as this housing type is associated with younger families; this is not necessarily the case if the flats have elevators, but cost considerations exclude this possibility. As well as the difficulty associated with elderly people climbing up four flights of stairs, there are social problems which arise when the residents have no private open space; these blocks of flats have no balconies and thus no private open space. This problem is particularly acute amongst indians who have large families and are still closely associated with market gardening in South Africa.

7. Pedestrian movement: the walkway system is very efficient in minimizing the travel distances between home and amenities such as the schools, playlots, the community centre, and shops. The safety levels of this system is discussed in Section 3.

8. Vehicular movement: the vehicular system of roads is efficient in accessibility when measured in terms of travel time. The safety levels are discussed in Section 3.

/9. .....

9. Shopping accessibility: as mentioned in section 7, the shops are within easy walking distance for residents. The convenience level shops are evenly spread within the community area and the community centre is centrally located.

10. Shopping viability: the positioning of the community centre and the convenience-level shops in relation to each other and the area that they serve, is good. The viability of these shops in terms of the serving population required, however, is an issue beyond the scope of this study.

11. Education, health and government: the three schools and the clinic meet the standards adopted by the planners. (See Chapter 7). Residential unit No. 4 has no government offices, as most of these services are in the town centre, so these services cannot be assessed. As for the engineering services, all units have water reticulation, sewerage reticulation, stormwater drainage, electricity supply, and garbage removal. Postal services and telephone services are found scattered in the community; it is doubtful whether sufficient people in Phoenix could afford private telephones to make this a viable service, as approximately half the residents fall into the sub-economic category

/and .....

and are already subsidized.

10.2.2. Cost evaluation

For a table of rates and their sources, see Appendix 1. The costing is limited to items which are different in the alternative designs. The assumed rate is 8% compound interest per annum, payable yearly over 30 years.

10.2.2.1. Roads

1. Capital costs:

- excavating, levelling and compacting under the roads,
  $5285m^3$ (R1,50/m^3) = R7 927,50;
- surfacing the local roads with tarmacadam,
  $5285m^2$ (R6,00/m^2) = R31 710,00;
- roadside kerbing on the local road,
  10570m (R1,13/m) = R11 944,10;

thus the total capital cost is R51 581,60 or R4 581,84 per month.

10.2.2.2. Parking areas

1. Capital costs:

- excavating, levelling and compacting under the parking areas,
  $11744m^3$ (R1,50/m^3) = R17 616;
- surfacing the parking areas with tarmacadam,
  $5872m^2$ (R5,00/m^2) = R29 360;

/thus .....

thus total capital cost is R46 976, or

R4 172,74 per month.

10.2.2.3. Pedestrian walkways

1. Capital costs:

- mass concrete walkways,

2008m (R5,75/m) = R11 546,

thus the total capital cost is R11 546, or

R1 025,60 per month.

10.2.2.4. Semi-public open spaces

1. Capital costs:

- establish grass and trees on and including prepared earth,

8479m^2 (R0,70/m^2) = R5 935,30;

thus the total capital cost is R5 935,30 or

R527,21 per month.

2. Running costs:

- maintain lawns and trees in a good condition,

8479m^2 (R0,11/m^2) = R932,69;

thus the total running cost is R932,59 per month.

3. Total costs:

- the total capital and running costs are R1459,90 per month.

10.2.2.5. Water reticulation

1. Capital costs:

- lay pipe with all connections in and

/including .....

including trench excavated in ground,

2049m (R12,60/m) = R25 817,40,

thus the total capital cost is R25 817,40, or R2 293,28 per month.

10.2.2.6. Sewerage reticulation

1. Capital costs:

- lay pipe with and including all connections, manholes etc., in and including trench excavated in ground,

1950m (R26,67/m) = R52 006,50;

thus the total capital cost is R52 006,50, or R4 619,58 per month.

10.2.2.7. Stormwater drainage

1. Capital costs

- lay pipe with and including all connections, manholes, etc., in and including trench excavated in ground,

1135m (R35,41/m) = R40 190,35;

thus the total capital cost is R40 190,35, or R3 569,70 per month.

10.2.2.8. Flats

1. Capital costs

- construct blocks of flats as designed,

24 no. (R4 392,86) = R105 428,64;

thus total capital cost is R105 428,64, or R9 364,90 per month.

/10.2.2.9. .....

10.2.2.9. Professional fees

The various compilation procedures for the fees of the many different professions make it too involved to accurately calculate these costs.

10.2.2.10. Total costs

The total capital and running costs amount to R32 547,44 per month at 8% compound interest per annum payable yearly over 30 years.

10.3. Alternative design

10.3.1. Design evaluation

1. Appropriate residential density: the density of 140 persons per nett hectare is the same as for residential unit No.4, and is thus acceptable. The fact that there are no semi-public spaces means that private property has increased without decreasing the density.
2. Noise levels: the only noise generators are the schools and the roads, the noise-levels of which should be acceptably low as with the original design. The access roads which penetrate PUD's have such infrequent and slow-moving traffic, that the noise levels from them should be little different from drive-ways in conventional multi-storey flat blocks.

/3. .....

3. Personal safety: both vehicles and pedestrians have the use of access roads, but as these roads are designed with many speed restricting devices, and as they serve only a limited number of dwellings, they are unlikely to be any more dangerous than the driveways and parking areas of conventional multi-storey flat blocks (R. Untermann and R. Small, 1977). There is a high degree of personal safety from muggers in PUD's, as the areas are not semi-public and therefore are not open to anyone; also, any intruders are likely to be quickly identified as being aliens to the PUD. The well-lit local and collector roads will provide a reasonable level of safety for the night time sidewalk-pedestrian.

4. Property security: there is little risk of theft and/or vandalizing of motor vehicles as parking is outside of each dwelling unit, and PUD's are private and thus exclude passers-by from the areas.

5. Open space land use: the increase in the amount of private and semi-private land is likely to be well used by the indian residents, as they are still known for their gardening and vegetable growing tendencies. The river is public open space as in the other design, and

/will .....

will also have similar view and vista functions.

6. Housing type: the detached, semi-detached and terraced housing units are unchanged and thus will be just as satisfactory as in the previous design. The additional duplexes which replace blocks of flats should, therefore, also prove satisfactory.

7. Pedestrian movement: the pedestrian movement is via the access roads and the sidewalks of the local and collector roads; the distances to be travelled are marginally longer than in the residential unit No. 4 and are thus also acceptable. The safety levels of this system is discussed in Section 3.

8. Vehicular movement: the road system minimizes travel time within the community except for short distances just before the home on the access roads. However, the time spent on the access roads is likely to be shorter than the time spent walking from the communal parking lots as in the original design.

9. Shopping accessibility: the shops are located in the same positions as in the original design and are thus just as well located for for accessibility.

10. Shopping viability: the positioning of the shops is the same as in the original design, and is therefore just as good.

/11. .....

11. Education, health and government: as these services are unchanged from residential unit No. 4's design, they are equally acceptable.

10.3.2. Cost evaluation

10.3.2.1. Roads

1. Capital costs:

- excavating, levelling and compacting under the roads,

$5947m^3$ (R1,50/m^3) = R8 920,50;

- surfacing the local roads with tarmacadam,

$3150m^2$ (R6,00/m^2) = R18 900,00;

- roadside kerbing on the local road,

1260m (R1,13/m) = R1 423,80;

- 150mm thick mass concrete access roads,

$2797m^2$ (R3,75/m^2) = R10 488,75;

- excavating, levelling and compacting for gravel access roads,

$1015m^3$ (R1,50/m^3) = R1 522,50;

thus the total capital cost is R41 255,55, or R3 664,61 per month.

10.3.2.2. Parking areas

1. Capital costs:

- excavating, levelling and compacting for gravel parking areas,

/$11744m^3$ (R1,50/m^3 = ...

11744m^3 (R1,50/m^3) = R17 616,00;

thus the total capital cost is R17 616,00 or R1 564,78 per month.

10.3.2.3. Pedestrian walkways

None in this alternative design.

10.3.2.4. Semi-private open spaces

As the open spaces are private and semi-private they are likely to be maintained by the residents themselves at negligible running costs.

1. Capital costs:

   - establish grass and trees on/and including prepared earth,

   14563m^2 (R0,35/m^2) = R5 097,05

thus the total capital cost is R5 097,05 or R452,76 per month.

10.3.2.5. Water reticulation

1. Capital costs:

   - lay pipe with all connections in and including trench excavated in ground,

   1566m (R12,60/m) = R19 731,60;

thus the total capital cost is R19 731,60, or R1 752,70 per month.

/10.3.2.6. .....

10.3.2.6. Sewerage reticulation

1. Capital costs:

- lay pipe with and including all connections, manholes etc., in and including trench excavated in ground,

2027m (R26,67/m) = R54 060,09;

thus the total capital cost is R54 060,09, or R4 801,99 per month.

10.3.2.7. Stormwater drainage

1. Capital costs:

- lay pipe with and including all connections, manholes, etc., in and including trench excavated in ground,

716m (R35,41/m) = R25 353,56;

thus the total capital cost is R25 353,56, or R2 252,08 per month.

10.3.2.8. Duplex

1. Capital costs

- construct duplex units as designed:

24 no. (R6 950,00) = R166 800,00;

thus the total capital cost is R166 800,00, or R14 816,34 per month.

10.3.2.9. Professional fees

The various compilation procedures for the fees of the many different professions make

/it .....

it too involved to accurately calculate these costs.

10.3.2.10. Total costs

The total capital and running costs amount to R29 305,26 per month at 8% compound interest per annum payable yearly over 30 years.

10.4. Summary of results

A comparison of the relative design and cost evaluations is summarized in Figure 10.1. The residential densities and the shopping, health and government facilities were deliberately held constant in the alternative design for purposes of comparison; the reasons for, and implications of, the design and cost discrepancies are discussed in Chapter 11.

10.5 Analysis of results

In the original design all the components were more expensive than the alternatives put forward, other than sewerage reticulation, which was 96,2% of the alternative's cost, and the blocks of flats, which were 63,2% of the cost of the duplex units in the alternative design. The alternative designs were cheaper than the

/original .....

original by the following percentages:

roads	20,0%
parking areas	62,5%
pedestrian walkways	none, in the alternative (R1 026 per month)
open spaces	69,0%
water reticulation	23,5%
stormwater drainage	36,9%
total:	9,96%

The main concept of the alternative design was the increase of private and semi-private open space and the decrease of public and semi-public land. This resulted in a cheaper design for all but the sewerage component, and as this was only 3,8% cheaper in the original design, the discrepancy is likely to have been a result of a specific design solution and not because of an alternative concept.

The duplex units are naturally more expensive than the blocks of flats, but the overall cost of the alternative design is still cheaper than the original design. As the change in housing type is an issue relatively independent of the rest of the design concept, the total cost without the housing type is analysed. The costs without the dwelling units are:

/original .....

	Original design	Alternative design
1. Design evaluation		
1. Appropriate residential density	A	A
2. Noise levels	G	G
3. Personal safety	I	G
4. Property security	I	G
5. Open space land use	I	G
6. Housing type	I	G
7. Pedestrian movement	G	A
8. Vehicular movement	A	A
9. Shopping accessibility	G	G
10. Shopping viability	G	G
11. Education, health, government	A	A
2. Cost evaluations (R's/month to the nearest R)		
1. Roads	4 582	3 665
2. Parking areas	4 173	1 565
3. Pedestrian walkways	1 026	-
4. Semi-public/private open spaces	1 460	453
5. Water reticulation	2 293	1 753
6. Sewerage reticulation	4 620	4 802
7. Stormwater drainage	3 570	2 252
8. Flats/duplexes	9 365	14 816
9. Professional fees	-	-
10. Total costs	32 547	29 305

G = good design
A = adequate design
I = inadequate design.

Figure 10.1.

original design R23 182/month

alternative design R14 489/month

a saving of R8 693/month or 37,5%.

If R8 673 is divided among the 161 dwelling units, this represents a saving of R54,00 per dwelling per month. If the dwelling types are included in the analysis, the saving is R3 242,00/month or R20,14 per dwelling per month.

The professional fees are indirectly a function of the cost of the township. For example, architects and quantity surveyors both charge approximately 6% of the building costs for their respective services. Similarly, sewerage and water supply engineers, structural engineers, civil engineers, land surveyors and all other professionals, also charge a percentage fee. As this is in the region of 20%, the savings mentioned earlier could be increased by this percentage.

10.6. Mass housing criteria

A brief evaluation of the original design, in terms of the mass housing criteria mentioned in Section 3.3.2. follows. The

/alternative .....

alternative scheme cannot be evaluated, as it was held constant for comparitive purposes; this evaluation is nevertheless included to give some depth to the evaluation preceeding this section.

1. Housing standards to be consistent with incomes.

The fact that a large section of the township's housing is subsidized from public funds, is evidence that the housing standards are above the levels consistent with incomes.

2. Building designs to be flexible.

Some of the duplexes are able to be extended, but generally these architectural details have not been carefully studied and no objective comments can be made.

3. Locations to provide easy access to employment opportunities and public transport facilities.

The Durban City Engineer mentioned that, although there are industrial employment areas in the immediate vicinity of Phoenix, more than half of the working population will commute into Durban daily. The distance can be travelled on the rail service offered, but the distance of nearly 2o km seems very great

/for .....

for the motorvehicle travellers.

4. Housing policy is to recognise the housing problem as being the provision of living areas which provide the inhabitants with the full range of opportunities to which they are entitled in an urban place, and not merely provide accommodation.

Phoenix, although it has its own town centre, has primarily a dormitory function to a labour force which serves Durban. Phoenix is situated beyond the municipal boundaries of Durban and is 19 km from the central business district; this means that the 'full range of opportunies' will need to be provided by a New Town of a mere 150 000 people. If the relatively high income population of Durban (about 1,4 million) cannot support an orchestra, how much less will Phoenix be able to support? The policy directions for planners of housing development has already been outlined in Section 3.3. and 3.4.

CHAPTER 11.

CONCLUSIONS AND IMPLICATIONS FOR PLANNING

11. CONCLUSIONS AND IMPLICATIONS FOR PLANNING

11.1. Introduction

This chapter offers explanations of why the costs of the alternative designs differ from each other. Constant reference is made to the private/public ownership concept, and the chapter is structured around the more important conclusions made from the case study and the evaluations. The compatibility of increased cost effectiveness with planning is also noted.

11.2. Ownership

11.2.1. Cost effectiveness

In all but sewerage reticulation, the costs of private development appear to be less than the costs of public development (sewerage reticulation was only 4% more expensive). The reason for this lies in the fact that all design components on public land are subject to the by-laws of the local authority, whereas all private land is not subject to these laws. This is not entirely correct, as certain building elements, even though on private land, have to pass building regulations and townplanning controls. On

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this issue Grimes, Maasdorp and Dewar recommend that in the lower income categories, people should be permitted to erect structures to their own standards and not necessarily to the standards laid down by westernised bureaucrats. People must have the right to determine their own priorities with respect to the level of accommodation required (D. Dewar).

11.2.2. Other advantages

Besides the reduced costs, ownership of greater proportions of the land gives residents a feeling of pride for a larger percentage of the township. The result is that greater areas of the township are cared for and ornamented in the fashion most acceptable to the residents themselves. In Phoenix, the large tracts of semi-public land look much more formal and sterile than the imaginative treatment given the private areas. Proof of this argument can be seen in the way that the residents care for their own land. The residents also encroach on semi-public space, servitudes and public space, which means that the upkeep of the private areas is no effort to them.

The buildings owned by the Durban Corporation and let out to the tenants are never as well

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cared for as the privately owned dwellings. The reason for this phenomena is probably related to:

1. pride of ownership, and
2. security of tenure.

Dewar claims that any housing policy must as a basic prerequisite, stimulate security of tenure. He adds that security of tenure is critical for the growth of healthy, self-supporting communities; living environments cannot be improved unless people relate to and have a share in those environments.

"Almost without exception, empirical studies have concluded that security of tenure is the single most important factor without which housing policy cannot succeed. It is the most important measure of household satisfaction and stimulates personal investment in housing that would otherwise not be forthcoming. This is consistent with the finding that home-owners generally have a higher income-elasticity of demand for housing than do tenants. Security of tenure is, therefore, a vital component of any policy seeking a long term improvement in the quality of housing." (G. Maasdorp, p7).

/11.3. .....

11.3. Open spaces

11.3.1. Cost effectiveness

The private and semi-private land is a lot cheaper than semi-public open space. The reason does not lie so much in cheaper materials, but in the fact that all the labour is likely to be done by the residents themselves. Were planners to concentrate more and more on private and semi-private open space, the maintenance budget of the public sector and thus the tax-paying residents themselves, would be enormously reduced; it would also relieve the public sector of such large capital outlays.

11.3.2. Private or public?

The conclusion drawn from the cost evaluation, (Chapter 10) is that the singularly most important factor to consider when assessing the open space requirements, is that concept of ownership. Open space can be divided in 4 broad classifications in terms of ownership, namely:

1. private;
2. semi-private;
3. semi-public and
4. public.

/Private .....

Private open space is owned entirely and exclusively by a legal 'persona,' for his own use and enjoyment. Semi-private open space is co-owned by residents in undivided shares, and it is for their communal use; non-residential use is limited to guests, with the general public barred. Semi-public and public open space is owned by the entire community and is usable by all, except that semi-public land is usually for the use of a particular group or cluster of dwellings.

Accepting that private open space is more cost effective than public open space, this should be a design policy for planners to include in future townships. However, the public open space boundaries must be readily understood by all people in order that everyone is aware of the space to which he does or does not have access; another reason for boundary definition is that of maintenance. "All open space should appear to belong to somebody or to a cluster of residents. All areas should be well planted and maintained. Lack of maintenance is a sure sign of ambiguous open space". (R. Untermann and R. Small, Site

/Planning .....

planning for cluster housing, 1977, p79.)
The semi-public open space within the clusters in Phoenix does not appear to belong to belong to anybody, and as a result it is hardly ever used.

Most residents probably aspire to private open space, especially those families with large numbers of children; but this is often very expensive and semi-private open space is the next best. As cluster development can provide both private and semi-private open space, this solution should be considered in future housing schemes.

"Open space is not just unbuilt-on land; it is meant to be used and enjoyed. Every inch of outdoor space can enhance the development of it, if it is considered in the site planning process". (R. Untermann et al, pp 74 and 75.)

11.4. Vehicular movement system

11.4.1. Cost effectiveness

The system of access roads and reduced public roads put forward in the alternative design, is the more cost-effective solution. This is because private roads are not required to

/meet .....

meet the standards of public roads, and their gradients, curves and construction is below public standards.

11.4.2. Compatibility with residential functions

The function of residential areas is to provide a living environment in which people can have peace and quiet, and move around in relative safety. The purpose of roads in residential townships is to provide access to lots and not to create freeways (M.J. Rosenberg, Symposium of the development of raw land into Townships, 1978). Vehicles however, should be able to move in and out of these areas without visually disrupting them or causing unnecessarily danger areas. If the cheaper private access roads, put forward in the alternative design are to be adopted, it is necessary that these roads are compatible with the residential function.

The purpose of access roads is to provide access to individual buildings or to integrated groups of buildings; they connect the residential units to local roads and in some cases, collector roads. They should be planned so that motor vehicles using them cannot travel at speeds much greater than a fast walking pace. (R. Untermann et al.)

/Environmental .....

Environmental conditions and all the other design factors, should determine the positioning of residential units and open space which, in turn, should locate the route of access roads. "This means that access roads may bend and curve, and become very narrow, often violating good traffic planning procedures." (R. Untermann et al, p.85). This type of road does not materially affect overall travel time for the residents, as they are never longer than one or two minutes from home.

Access roads can be shared by motor vehicles, pedestrians, cyclists and can be used as a hardened play surface for children. They could even be one lane wide serving two directions; this would force one car to wait while another passed. If well aligned, children could play comfortably and adventurously without endangering themselves (Untermann et al).

In essence, these roads no longer relate directly to the dimensions of the automobile but rather relate to the whole living and commuting environment. Untermann and Small propose that environmental conditions i.e. sun, winds, view, privacy etc., determine the siting of open space and buildings and that

/building .....

building location determines the route of the access roads.

11.4.3. Woonerf

A similar concept was introduced into the Netherlands called the 'woonerf'. The woonerf is a residential area, with vehicular access by access roads which provides "the broadest range of activities for everybody: for the child, for the adult, for the aged, for the cyclist and also for the motorist. The most important activity in residential areas is not the movement of vehicles but that of children playing and adults walking, especially mothers with children. The street plays an important part in the development of children. Yet neighbourhood streets are forbidden territory for children because of motor traffic". (Royal Dutch Touring Club, Woonerf, 1978). A woonerf is definitely not a traffic-free area, nor a pedestrian precinct; in principle, all types of vehicles are allowed within it. Large vehicles such as fire engines and refuse trucks, for example, always have access to the area. Vehicle speed, as a rule, is greatly reduced, but emergency vehicles can still reach homes quickly. Although the woonerf is a solution to relatively

/high .....

high income areas in the Netherlands, some of its design characteristics could be adapted to road design in low income areas in South Africa; these are listed below:

1. The maximum distance of any point within a woonerf from the main street is 500 metres.
2. Anything, such as long kerbs, which creates the concept of segregating pedestrians from motor vehicles, should be avoided.
3. Vehicle speeds can be restricted by incorporating into the design such features as bumps in the roadway, sharp bends, narrow sections of the road and street furniture. Constructions in the roadway should be created wherever children play on the full width of the street.
4. Parking should be limited to those areas where it causes no inconvenience to other street users, and these places should be identified in the design of the paving, (in the South African context these areas could be in gravel.)
5. No woonerf road should carry more than about 100 to 300 vehicles per hour during peak periods; (in low income housing developments this figure would be considerably less).
6. Through traffic should be excluded; only

/vehicles .....

vehicles whose origin or destination is within the woonerf, should be permitted.

7. There should be no division into separate areas for sidewalks and for motor vehicles or differences in cross-section design element along the length of the road.

8. The road width can be restricted to about 3 metres; one way traffic has been found neither desirable nor necessary (Royal Dutch Touring Club.)

Provided that care is taken in the detailed design of access roads, a safer, more interesting and far cheaper service could be provided which would make up a living environment of complete integrity. (Untermann et al.)

11.5. Pedestrian movement

11.5.1. Cost effectiveness

The evaluation has shown that both alternatives are acceptable, but whereas residential unit No.4 has an expensive walkway system, the alternative has none - the latter's pedestrian movement occurs on the access roads. Thus the reason for the more cost-effective access road design is self-evident.

11.5.2. Requirements of a pedestrian system

Pedestrians require safe, continuous, pleasant

/places .....

places to walk, which are relatively free from automobile conflicts and noise, yet active enough to sustain interest and assure personal safety (R.K. Untermann, Principles and practice of grading, drainage and road alignment - an ecologic approach, 1976)

At the micro level, residents are required to walk to and from nearby conveniences such as the corner shop or postbox; alternatively, walking could simply be for pleasure or to visit friends. If the vehicular movement system is such that it allows fast moving vehicles into this micro residential area, the safety of the pedestrians, especially the younger children, will be threatened. The design solution is to either have pedestrian and vehicle separation as in residential unit No.4, or to restrict vehicle speed to a fast walking pace in which case the pedestrian system can be integrated with the vehicle system, as in the case of the alternative design.

As the evaluation showed the alternative design to be the more cost effective solution, the policy of vehicle and pedestrian integration is recommended. This design policy also

/coincides .....

coincides with the access road system suggested in section 11.4.

11.6. Water supply

The water reticulation system of the alternative design proved to be more cost effective than the original design. As water supply pipes cannot cross one private property in order to reach another, this means that each lot must have a connection with the water supply main in the public areas. Because of this provision, the pipe runs have to be laid around the properties, usually under the roads. In the original design in Phoenix, the pipes were laid under the walkway system, which was made possible by the existence of public spaces between the dwellings, but this was still more expensive than the alternative. The reason for this is that the large lots (PUD's) changed a large proportion of the water supply from public into private reticulation; this meant that the reticulation could be designed for 20 or 30 dwellings without the need to avoid private lots.

This solution is compatible with the increase in private and semi-private open space recommended in section 11.3.2. and also with the ownership system suggested in section 11.2.

/11.7. .....

11.7. Sewerage reticulation

The cost evaluation showed both design alternatives to be of similar cost; and it can be concluded that the sewerage reticulation is independent of the type of land ownership involved. The reason for the cost similarity lies in the fact that the sewerage pipe mains may pass from one property to another.

11.8. Stormwater drainage

The concept that caused the alternative design to be cheaper than the original, is the positioning or clustering of dwelling units about the steams and valleys. This focusing on the natural drainage systems (valleys) largely eliminates the need for stormwater pipes, as the surface run-off does not endanger dwellings lower down the hillside.

11.9. Personal safety

It has been evaluated and concluded that pedestrian safety in both the alternatives was adequate. This, however, was safety from personal injury from vehicles and did not take into account the dangers from potential muggers. In this connection, the access roads and pedestrian walkways alongside the local and collector roads, are preferred. Developing

/a .....

a pedestrian walkway system separate from the road may create safety and security problems as patrolling is difficult, unless there is sufficient use to be self-policing. Costs are higher, as two sets of lights, land, drainage, etc., must be provided. (R.K. Untermann, et al).

11.10. Property safety

The safety levels for motor vehicles from theft and vandalizing, is very low in the original design. This is seen in the way the residents drive their cars over the semi-public open space and into their gardens. The more cost effective solution is the alternative design which consists of private parking on gravelled strips outside each dwelling, and as this is better for security reasons, it is recommended that this policy be adopted in townships.

11.11. Housing types

The cost evaluation of housing types showed the blocks of flats to be more cost effective per dwelling unit, than duplexes. However, the design evaluation indicated that the flats were not acceptable to the indian residents, and as cheapness should not be provided at the expense of product quality, it is recommended in this case, that the more expensive solution

/is adopted .....

is adopted by planners.

The housing type in the original design relates to family size; for example, houses always have a large number of rooms. There appears to be an inherent contradiction in this concept, namely, houses are more expensive than the duplexes and houses have more rooms than duplexes which means that the houses are designed for the larger families and duplexes for the smaller families. An assumption can be made that in larger families there is less income per head than in the smaller families, and this means that the more expensive houses would be better suited to the small household, and the less expensive duplexes would be better suited to the larger households.

11.12. Building materials

Although no specific mention has been made of the building materials used in the construction of the dwelling units, it is recommended that planners take more notice of materials with a higher initial cost but with a lower maintenance cost: for example, face brickwork instead of plastered stock brickwork. Corobrick constructed a dwelling unit out of

/face .....

face brickwork for the same cost as the rest of the dwellings in Phoenix, but it does not appear that this solution is to be adopted in future communities in Phoenix.

11.13. Maintenance of public places

The public places owned by the local authority in the case of a private township, are also maintained by the local authority, but the maintenance is carried out only so long as these spaces are not larger than that which is required by law.

"... the ownership of all public places in the approved private township shall .... vest in the local authority, or the Administrator in trust for any future local authority, as the case may be, for the use and benefit of the public: provided that any such investing shall not be deemed to impose any inability in regard to the maintenance of such public places other than is imposed by law." (Private township and townplanning ordinance, Chapter 3, section 25(1).)

The semi-public open space in the area evaluated in residential Unit No. 4 is approximately 8479m^2 in area, which when costed out, is equivalent to R1 460,00 per month, or R9,00

/per .....

per household per month. Even though this area does not appear excessive, the cost of establishing and maintaining it, does. The question which arises is whether this maintenance figure would have been permitted in a private township, and if not, why it was allowed in the Phoenix scheme.

11.14. Summary

Of the two designs evaluated, the alternative concept put forward is more cost effective; it also appears to be a better design irrespective of the costs involved.

If the 4 mass housing criteria, suggested by Maasdorp and by Dewar, were observed, Phoenix would not have come into existence. The Indian population would merely have moved into some of the undeveloped land within the Durban areas such as Cato Manor; however, the Group Areas Act of 1950 prevented this. "In Durban, the City Council has shown great enthusiasm for compulsory segregation and its technical sub-committee worked hard at various plans for the implementation of Group Areas." (E. Stander, Problems and Progress in the Indian areas of Durban, 1968, p.23).

Given the fact that Phoenix was to go ahead, then the most appropriate design policies should

have been adopted. This study indicates that the design by the Durban City Engineers was not as good as the alternative proposals; the essential features of the alternative design are listed below to serve as design policy guidelines for mass housing schemes where the cost factor is of vital importance.

1. Ownership: pride of ownership and security of tenure stimulates investment in housing that would otherwise not be forthcoming (Maasdorp); the personal involvement in the upkeep of private land is a solution which both stimulates pride of ownership and helps keep costs to a minimum.

2. Private and semi-private open space: a decrease in the semi-public open space and an increase in semi-private and private open space, not only proved to be a cheaper solution but a better design compatible with the suggested increase in ownership.

3. Access roads: this system of integrated vehicle and pedestrian movement is a cheaper solution that conventional public road design, as the design and construction of these roads are considerably below the expensive requirements of public roads. As a residential design solution, the policy of integrating pedestrians

/and vehicles .....

and vehicles is now being seriously considered by some planner as not only acceptable, but preferable. This design solution is also consistent with the policies of private land, and ownership.

4. Private utilities: the system of private water, sewerage and stormwater reticulation proved to be more economical with water supply, because of reduced pipe lengths required on a large private lot. The sewerage and stormwater reticulation did not turn out to be cheaper as public sewers can run from one private property to another.

5. Clustering and orientation: the cluster arrangement of dwellings results in shorter lengths of roads; this solution contributes to greater cost saving. Orientation of dwelling units on to natural drainage features such as rivers and valleys, cuts down the cost of stormwater reticulation, as the necessity for pipes is greatly reduced.

6. Private parking lots: the private parking lots outside of each dwelling is not significantly different in cost from the communal parking lots, but they provide increased security for vehicle owners. Communal parking lots are possible but unwise even when on private land, but they should be avoided

/completely .....

completely in public areas.

7. Housing types: flat blocks are cheaper than duplexes, but these dwellings should be avoided if possible in areas with such large mean family sizes.

8. Implementation: one solution that allows the concepts of land ownership, private open space, private utilities and access roads to be implemented is a combination of 'Planned Unit Development' (PUD) and 'Sectional Title'. The PUD is a large private area necessary for the physical design of the concepts, and the Sectional Title scheme provides the concepts of ownership, pride and security of tenure. The PUD system of lot ownership is well suited to the large areas of private land necessary for the cluster, utility, private open space and access road design. Sectional Title ownership is suited to the concepts of ownership, pride and security of tenure which are central to the alternative design. Semi-private open space is possible under PUD and Sectional Title.

11.15. Conclusion

"Policy-makers (in city councils and government departments) are firstly, expending scarce public funds, and secondly, devising policies

/affecting .....

affecting the lives of the lowest-income households. It is the duty of professionals, including economists, to influence the policy-makers in the right direction". (G. Maasdorp, p.24). If any of the planners in the city councils and government departments in South Africa are influenced in the directions recommended by this dissertation, the study will have served its purpose.

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APPENDIX

APPENDIX 1 Schedule of rates (in rands)

1.	Roads:	
	1. Earthworks:	1,50/m^3
	2. Tarmacadam surfacing,	
	collector road	8,00/m^2
	local road	6,00/m^2
	access road	3,75/m^2
	3. Gravel access roads	earthworks only
	4. Roadside kerbing	
	collector road	3/00/m
	local road	1,13/m
	access road	not applicable
2.	Walkways	
	Mass concrete walkways including excavations:	5,75/m
3.	Parking areas	
	1. Earthworks	1,50/m^3
	2. Tarmacadam surfacing	5,00/m^2
4.	Water reticulation	
	Mean pipe size laid in trench excavated in ground	12,60/m (av)
5.	Sewerage drainage	
	Mean pipe size laid in trench excavated in ground	26,67/m (Av)
6.	Stormwater drainage	
	Mean pipe size laid in trench excavated in ground	35,41/m (Av)
7.	Common green areas in clusters	
	Grass and trees 1. Establishments	0,70/m^2
	2. Maintenance	0,11/m^2

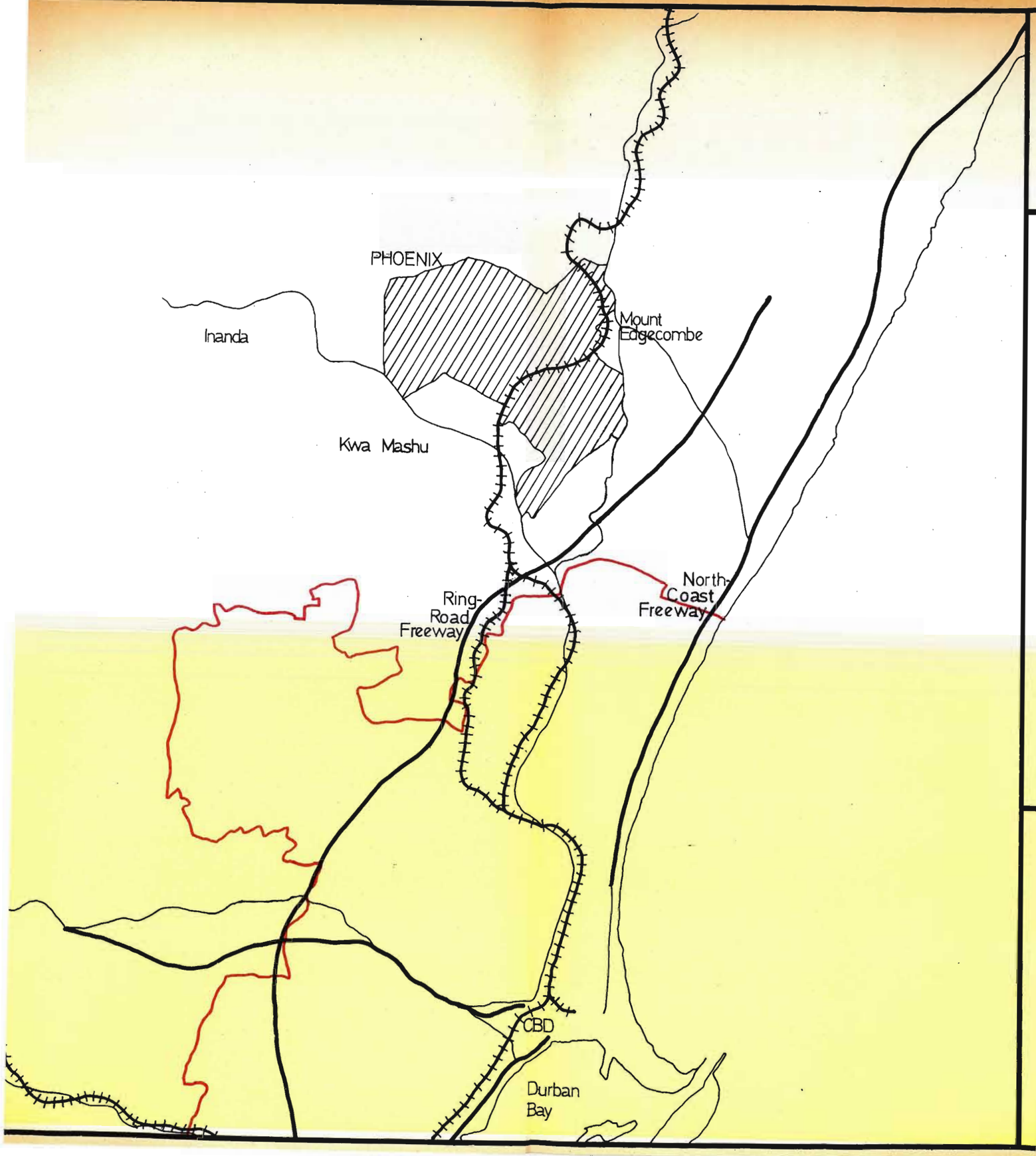
8. Dwelling costs

1.	Average cost in flat blocks	4 392,86
2.	Most expensive in duplex units	6 950,00

Source: 1. Durban City Engineer's Department: An unpublished'Report for Committee', 20 June, 1978, pp 1-3.

2. Durban City Engineer's Department. An unpublished report 'Average costs of housing units as at 8/9/1979 based on B 5948' p.32.

REGIONAL LOCATION

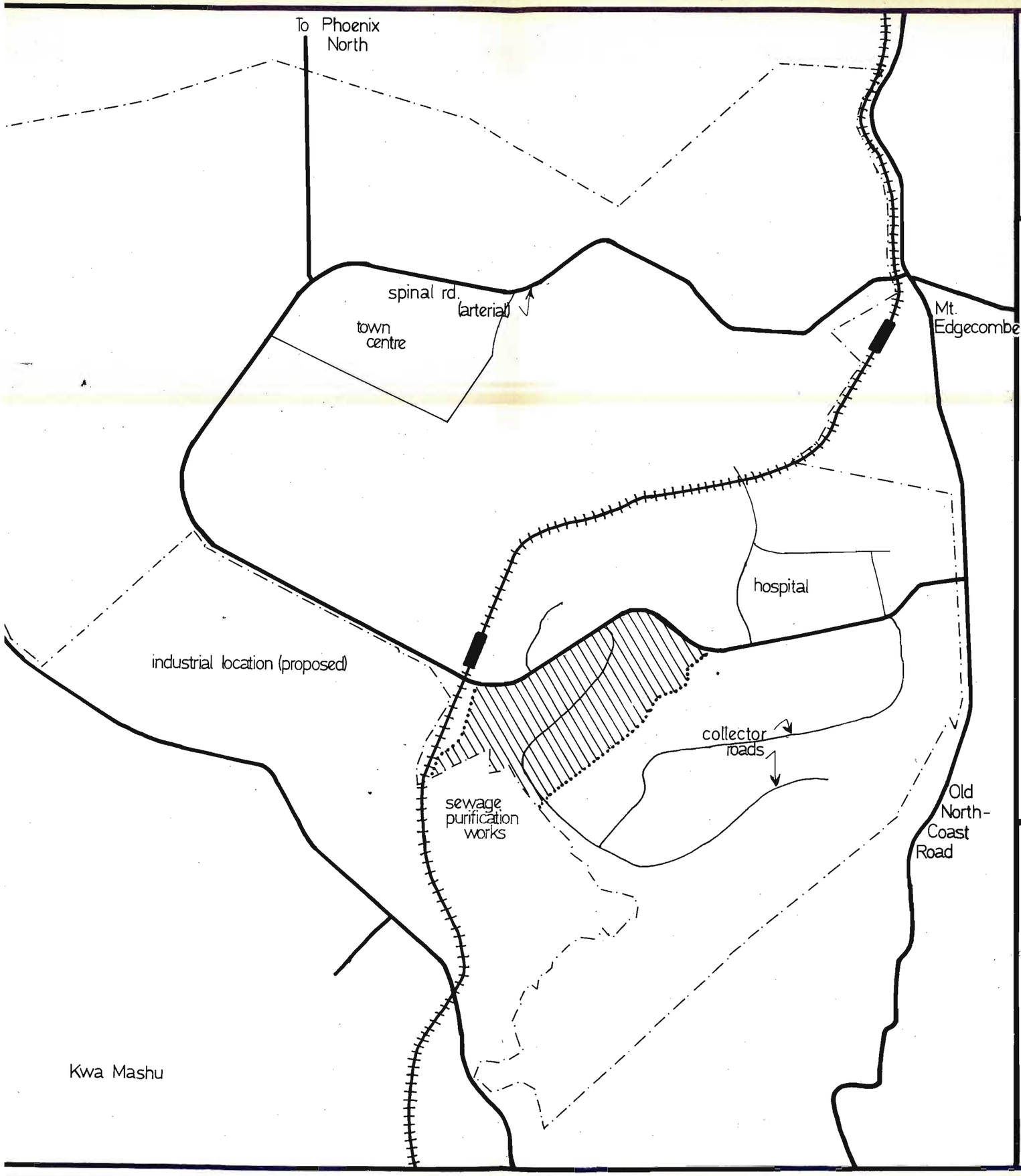


KEY

DURBAN MUNICIPAL BOUNDARY

CONTEXT OF PHOENIX

scale 1~1 000 000
map nº 1



PHOENIX
New Town

KEY

ARTERIAL ROAD
COLLECTOR

RAIL

STATION

NEW TOWN BOUNDARY

RESIDENTIAL UNIT 4

CONTEXT OF STONERIDGE

scale 1~24 000
map no 2

PHOENIX

Residential Unit 4

ORIGINAL SERVICES

scale 1~1000