CHAPTER 3: IMPLICATIONS AND OPPORTUNITIES FOR INCREASING RESIDENTIAL DENSITIES

In order to develop a model for the management of increasing residential densities in which planners are able to keep in tension the benefits of providing additional people and maintaining quality of life, the implications and methods of increasing residential densities needs to be addressed. The current call for higher residential densities in various policy documents requires an examination of the advantages and disadvantages of increasing residential densities. This encompasses an understanding of the likely social, and economic impacts of various densification actions. Such an understanding will enable the advantages of these actions to be maximised and the disadvantages, minimised. Trade-offs therefore need to be made between the advantages and disadvantages of various densification actions. It must be stated that the advantages mentioned for high density are not synonymous with high-rise developments.

The development of the model also requires the identification of opportunities in which densification can occur. From the literature, four main opportunities for achieving higher residential densities, were noted. The first relates to the opportunities that the land yields, either on the periphery or within the existing city, such as infill, redevelopment and subdivision opportunities. The second includes the different physical forms (vertically and horizontally) in which densification may occur, such as the use of medium and high-rise developments and informal settlements. Thirdly, densification may be achieved through increasing household occupancies. A fourth opportunity for achieving higher residential densities involves a number of implementation measures.

ARGUMENTS FOR AND AGAINST RESIDENTIAL DENSITIES

With higher densities, distances between home and work opportunities and also travel distances within a neighbourhood are shortened resulting in savings in transport costs, savings in time and even a reduction in nervous strain (Scott, 1972; McConnell, 1969).

However, this argument is only partly true since even if jobs are available nearby, many people may in fact work elsewhere (McConnell ,1969).

Public transportation becomes more cost effective at higher densities (Pistorius, 1972). High densities, up to a point, enable public services, such as roads to be provided more efficiently and economically than at lower densities. High densities therefore generally result in a reduction of service costs. In Shanghai in China, the inability of extant buildings to cope with a rapidly increasing population and the lack of a public transport system that could cater for urban sprawl, signalled the need for high density urban development in the late 1970s (Ya-Xin, 1981). In a study of engineering service provision in Cape Town, it was found that total servicing costs in infill developments would be less than peripheral developments (Patterson, 1988). Behrens and Watson (1993) note that higher density development on the one hand share land acquisition and internal service reticulation costs with a large number of households. They note that higher residential developments often require more expensive 'internal' services as thicker water and sewer pipes are required to accommodate greater loads.

Extensive quantitative research on the relative costs of sprawl as opposed to high density compact situations, was undertaken by the US Real Estate Research Corporation (RERC) in 1974. This authoritative study concluded that suburban sprawl in American cities led to significantly higher infrastructural, environmental and social costs, than planned higher density developments (Behrens and Watson, 1992). The study also showed that in terms of the capital costs of dwelling construction, a two storey walk-up apartment was almost a third of a detached dwelling. Building costs generally increase significantly above four storeys due to the need for an elevator. Studies by O'Niel (1974), Runeson (1983) and Stone (1973, 1988) point out that above four storeys, capital costs escalate with the need to install a lift and undercover parking. They generally conclude that two-storey walk-ups are cheapest to build. In the South African context, Calderwood (1962) notes that it is more economical to build blocks higher than five storeys than blocks of five storeys. This is because blocks of five storeys require the expense of installing lifts to make the fifth floor more accessible. In Europe, average blocks are between ten and twelve storeys (Calderwood, 1962). Behrens and Watson (1993), note that discussions with local developers in South Africa, indicates

that at the lower end of the market, building costs increase between 10 to 30 percent to build above-ground units.

The relationship between land needs at steadily increasing gross and net densities, is shown in Table 3.1. It demonstrates that total land savings diminish at higher densities as the amount of land needed for open space, schools etc. depends on the number of people living in the area, and not the amount of land taken up by their homes. In other words, as densities increase, these other requirements (open space, schools etc.) take up a greater proportion of the total land needed. The benefits of increased housing densities therefore becomes less and less (Ministry of Housing and Local Government, Great Britain, 1962).

Table 3.1: Land Needed for Housing 1 000 People at Various Densities (Assuming 8 acres per 1 000 people for other land uses)

Gross Population Density (ppa)	Net Population Density (ppa)	Housing Land (acres)	Total Land Requirements (acres)	Land Saving as Density Increases (acres)
20	24	42	50	
30	40	25	33	17
40	59	17	25	8
50	83	12	20	5
60	115	8.6	16.6	3.4
70	159	6.3	14.3	2.3
80	222	4.5	12.5	1.8

(Source: Ministry of Housing and Local Government, 1952)

Higher residential densities will facilitate in limiting the amount of land required for additional accommodation, and will thereby limit the amount of space consumed by cities. Table 4 shows that very substantial savings in land have been made in Britain by quite moderate increases in density: by raising the net density from 24 ppa to 40 ppa (8 houses to 13 houses), it is possible to save 17 acres of land per 1 000 population. In South Africa, the Land Availability Study, conducted by the Central Witwatersrand Metropolitan Chamber Land Task Team (CWCM, 1992), estimated the residential land requirements for the Greater Central Witwatersrand area at varying densities up to the year 2 000. A high density scenario

of fifty dwellings per hectare would require almost three times less land than the lowest density scenario of twenty dwellings per hectare (CWMC, 1992).

Community facilities and social facilities can generally be provided closer to every home in high density developments. In low-density suburbs, shops and community facilities have to be shared by people scattered over a wide area. These facilities cannot always be within walking distance of every home (McConnell, 1969). Linked to the argument that there are more social facilities and contacts in high density areas, is the argument that life is safer in higher density developments because there are many people who will come in moments of stress or danger (there are more social facilities and contacts in high density areas). This is the view popularised by Jane Jacobs. In the early 1960s she looked at the correlation between high density development and urban problems in American cities, and found that the life style offered by high density living made cities exciting and safe places to live in. Jacob's (1962) argument reflecting less desirable aspects of American way of life, notes that there are more rapes, robberies and murders in the US suburbs than in the city centres such as Greenwich village in New York. She argues that higher densities need to be viewed as socially desirable. McConnell (1969, 413) endorses this view by stating that "redevelopment at higher densities prevents the break-up of local friendship and kinship groupe, since people can be re-accommodated in new flats in their own old districts instead of being sent to outlying estates or new towns where the wives suffer form loneliness and isolation". There are, however, opposing views: in the long-term new friendships may be established in the new outlying estates. However, even if left in the high density areas, "neighbouring may be inhibited by the new style of above-ground living" (McConnell, 1969).

But the advantages of compact cities are not universally accepted (Goodchild, 1994). For example, the advantages of the compact city for energy efficiency is open to debate in that one cannot assume that residents of such a city will travel more frequently by public transport or on foot. Much will depend on the attitudes and preferences of residents. Goodchild (1994) also notes that the contemporary trend is for individuals to travel longer distances and to travel more frequently. Concerning the scale of energy savings, Goodchild also points out that with compact cities, the savings to the individual consumer may be insufficient to persuade them to exchange suburban living for higher density living.

There are a number of negative sociological and psychological implications of higher residential densities noted in the literature. Concerning psychological and sociological factors that could inhibit high density, feelings of overcrowding, oppression, alienation, social isolation and lack of privacy have been well-documented in the literature particularly concerning the effect of high-rise structures on the inhabitants (Schutte, 1984; Rapoport, 1975; Swart 1972). According to Alexander (in Cuthbert, 1985), high density results in social withdrawal. Wirth (1938) on the other hand argues that high density increases the possibility of social conflict, because it increases both the frequency and intensity of group interaction. In both of these views, however social cohesion is threatened. All of these reasons possibly explain why the average length of stay in high-rise flats is very short. With such temporary stays, there could not be much of an intimate relationship between the inhabitants because for it has been found that the length of stay determines the depth of personal relationships (Swart, 1972).

Many American planners have noted the relationship between density and high rates of mortality, suicide, psychiatric disorders, juvenile delinquency, crime and other types of breakdown. However, according to Cuthbert (1985), correlation between high population density and socio-psycho problems demonstrate inconsistent and inconclusive results. Most of the research on the influence of high density housing on man has resulted from animal studies and observation of pathologies, such as crime and prostitution. Cuthbert (1985) notes that a lot will depend on the culture of the population. Some cultures, tend to prefer interpersonal distance while others, such as the Chinese culture prefer close proximity. For example, in Hong Kong, where the average population density is 4 923 people per km^2, the inhabitants have developed coping mechanisms: the use of compact furniture, avoidance of public displays of emotion and the tendency to define privacy in terms of the group not the individual.

Sazanami (1972) also notes that studies on withdrawal and psycho-neurotic disorders cannot accurately confirm to what extent this is due to the high-rise construction, or other cultural and social factors. While Lee (in Cuthbert, 1985, 133) found that approximately "one third of the adults in Hong Kong are mentally impaired", it cannot simply be blamed on the high

residential densities. It appears as though "high density of itself doesn't produce adverse conditions in people, and only indirectly produces stress" (Cuthbert, 1985:122). High density living in Hong Kong has had more positive benefits than deleterious effects (Cuthbert, 1985). However, empirical research by Conway (in Schutte, 1984) has tended to support both views: that high densities can be detrimental to human beings and that they can be beneficial. There area many high density situations which do not cause discomfort, stress or anti-social behaviour. Rapoport (1975) states that high flats may create more behavioural problems than equally dense areas of different configuration. Swart (1972) found that neurotic symptoms were twice as common on the top floor than the bottom floor of the high-rise apartment. Respiratory infections are generally also high among flat dwellers.

Many countries are discouraging high-rise housing in favour of medium-rise high density. Two of the most densely populated countries in the developed world, Britain and Holland have reconsidered the benefits of high-rise living. In the 1970s high-rise high density housing was being discouraged in Great Britain due to increased knowledge of the effects on the inhabitants living at such densities. The Greater London Council found that 80 percent of the tenants in high-rise buildings in London were miserable in them (Blowers, Hamnett and Sarre, 1974). Most of the housing that was constructed on land reclaimed from the Zuyder Zee in Holland in the 1970s is single houses with small gardens, not high-rise developments (Blowers, Hamnett and Sarre, 1974).

Environmental requirements that are particularly pertinent to higher density housing, include an increase in noise and air pollution to unacceptable levels, inadequate sunlight, the need for acceptable thermal performance and the issue of privacy. In general, literature on these aspects of high density housing conclude that the greater the density, whether high-rise or low-rise, the more difficult it is going to be to achieve a satisfactory standard in all these aspects. The quality of life is not the only argument against high density living. Despite high-rise having traditionally been perceived as having faster completion times, it has been found that they take between 30 and 50 percent longer to complete than houses. This tends to increase development costs (Cuthbert, 1985).

While substantial arguments have been made against high density living, most of these arguments refer to high-rise living and so the case for higher densities than currently exist in Johannesburg, seem persuasive. This poses the question of how to best achieve higher densities in already established residential areas like Jeppestown.

OPPORTUNITIES FOR ACHIEVING HIGHER RESIDENTIAL DENSITIES:

In order to develop a model for increasing residential densities, it is necessary to identify opportunities for densification. From the literature, four main opportunities for achieving higher residential densities were noted. The first relates to the opportunities that the land yields, either on the periphery or within the existing city, such as infill, redevelopment and subdivision opportunities. The second includes the different physical forms (vertically and horizontally) in which densification may occur, such as the use of medium and high-rise developments and informal settlements. Thirdly, densification may be achieved through increasing household occupancies. A fourth aspect in achieving higher residential densities involves a range of implementation measures.

Land Opportunities

Land on the Periphery

In urban areas the demand for additional housing can be catered for either by making use of vacant land on the periphery of a city, known as virgin land, and/or land within a city. Although high population densities can be achieved at the periphery of cities, this land is generally not as accessible to urban facilities and work opportunities as land within urban areas. The geological suitability for residential development may be a further constraint for land acquisition on the urban periphery (Wolfson, 1991). In central Gauteng, a vast portion of the land is underlain by dolomite which has implications for development costs. Land on the periphery would also require new infrastructure and services. The De Loor Report (1992, 218) states that the "key to achieving greater compaction, is to channel or implode new growth towards residual land parcels within the existing urban fabrics, as opposed to continually seeking virgin land further away". This involves the definition and control of a fixed urban edge which prevents urban sprawl. Such thinking is incorporated in the overall

framework of Dewar's (1984) model of activity spines and the need for demarcating an urban envelope. Research conducted by the Development Action Group (DAG, 1993) on the feasibility of well-located affordable housing in Cape Town found that well-located, higher density housing has long term cost and efficiency benefits for the city and its inhabitants. This research, however also shows that in Cape Town, income levels are such that 70 to 80 percent of African households would not be able to afford well-located higher density housing at present subsidy levels. At present , the current subsidy scheme is being reviewed by the government, thereby changing the affordability situation entirely.

In most Third World countries, low-income housing usually cannot be provided near work opportunities because of the high prices of land. One solution to this problem is to encourage 'cities within cities", which involves new high density urban areas located on the outskirts of the existing major urban areas (See Chapter 2). Compact 'cities within cities' were successfully implemented in the 1970s in Bogota, Columbia where urban development has been linked to an economic growth strategy for the country as a whole (Urban Foundation, 1990b; Rogerson, 1989b).

Land within urban areas

Within a city, the main densification opportunities are infill, redevelopment, subdivision and increases in residential occupancies. Many American cities, such as Seattle, Los Angeles, Atlanta, San Diego and Philadelphia use infill, subdivisions and demolition and redevelopment in order to intensify existing land use patterns (Rose, 1990; Beauregard, 1989; Calavita and Caves, 1990). Concentrated development along corridors radiating out from the metropolitan centre, alternating with low densities or open spaces between spokes can result in an overall increase in residential densities (Dewar, 1984; Lederman, 1967, CSIR, 1991). The CSIR (1991) note that to support an activity corridor, a minimum gross density within a 2 kilometre (km) limit is approximately 100 people per hectare (approximately 200-225 people per net residential hectare). A 2 km limit is used since 1 km on either side of the activity spine is generally accepted to be the average convenient walking distance. The corridor approach was used for the year 2 000 plan for the metropolitan Washington DC area and for the masterplan for Long Island between 1965 and 1970 (Gottdienner, 1977). The JOMET Land Use Transportation Strategy uses this concept of

corridor development - mixed land uses are concentrated along major transport routes (Johannesburg City Council, 1980).

Infill opportunities

Infill development is urban development that takes place on vacant land located within the perimeter of an existing urban area (Falconer and Frank, 1990). While this definition restricts its meaning to vacant parcels, others, such as the US Real Estate Research Corporation (RERC, 1982), have extended its meaning to 'under-utilised land' so that reference is made to whether the facilities in place have any spare capacity or not.

Meiklejohn (1992) notes that the size of infill sites can be assessed at three scales: large scale infill developments are characteristic of black townships in South Africa of the 1950s and 1960s where townships of 10 000 sites were placed on the periphery, with little success. The meso-approach involves the identification of large areas (500-2 000 sites) within the municipal area for new formal or informal infill areas. The micro-scale approach is the identification of a series of 'spot infill' areas - small areas of open land near economic niches within the city (Meiklejohn, 1992). The identification of infill sites in Jeppestown would fall into this category. Falconer and Frank (1990) comment that this type of infill development is often viewed as more desirable than development located on the periphery, especially if infrastructure is already in place.

Redevelopment opportunities

Increases in residential densities can also occur through demolition and redevelopment. However, in considering redevelopment opportunities in areas such as Jeppestown, the literature showed that this is often costly and can have a negative impact on the existing residents (Gilbert, 1993; McConnell, 1969). In Brás, an inner suburb of Sao Paulo in Brazil, demolition and redevelopment in the late 1970s resulted in the displacement of low-income groups to the periphery. This occurred when houses were replaced with high-rise flats, largely due to rapid increases in land and housing prices in the centre as a result of high-income demand for the central and inner suburban areas (Batley, 1982). McConnell (1969)

notes that redevelopment may disrupt an established and socially integrated community, and that some residents may not be re-accommodated in the same locality.

Subdivision opportunities

This refers to land that is potentially subdividable, such as potential land in backyards of residential stands. Arrigone (1995) notes that this approach has a negligable impact on the overall residential density at city level since the number of plots subdivided in this manner is proportionally small.

In many Third World cities, such as Mexico City, subdivisions occur illegally (Payne, 1989). In Sao Paulo, extensive subdivisions and development occur at the periphery due to high land prices at prime locations, a situation which is unfortunate since there are large amounts of undeveloped urban lots. It has been estimated that if this undeveloped land in Sao Paulo is used for housing, the urbanised area could accommodate a two-thirds increase in population without any expansion (Blitzer, Hardoy and Satterthwaite, 1981).

Within cities, infill, redevelopment and subdivision opportunities can be identified in order to increase residential densities. Besides the question of where to densify (on vacant stands, on potential land through redevelopment or on sites through subdivision), the use of appropriate dwelling types also needs to be considered.

Appropriate Dwelling Types

A number of dwelling types (single-storey grouped housing, medium and high-rise) can be used to achieve higher residential densities. Definitions of medium and high-rise differ considerably between authors. Sazanami (1972), for example, defines medium-rise as having 4-5 storeys of about 300-500 people hectare, and high-rise as having more than 10 storeys - over 1 000 people per hectare. Abramowitch (1972, 5), on the other hand defines high-rise, as a "building over five floors high". Arrigone (1995) defines low-rise housing as consisting of single or double-storey houses or walk-up apartment buildings.

Calderwood (1962) notes that the key to increased densities is in selecting the correct dwelling types: cluster housing, row housing, two, three and four storey flats are all promising from the point of view of economics, good living conditions and increased densities. The Ministry of Housing and Local Government (1952, 3) in the United Kingdom, notes that for satisfactory living conditions in any area there must be sufficient dwellings of various sizes (row housing, semi-detached, three and four storey walk-ups) to meet the needs of all the different households, from single persons living alone to large families with children.

Courtyard housing, which has been used successfully in recent housing projects in parts of Manhatten and Los Angeles, Britain, the Netherlands, Sweden and Latin Amercian countries, has recently received attention in contemporary literature. The major advantages of this form of housing is that high densities can be achieved this way, while at the same time providing sufficient access to outdoor space. The design also promotes community interaction, privacy and security (Urban Foundation, 1988). Martin and March (1972) also note that site utilisation characteristics are extremely efficient with courtyard housing.

The use of high-rise and medium-rise developments can provide substantial housing such as in Hong Kong (Cuthbert, 1985). On a net residential basis, high-rise can achieve a marked increase in population. The gross residential density, however, is not significantly increased. This is due to the space requirements for associated facilities necessitated by the additional number of people (Urban Foundation, 1988). In the Third World, the disordered nature of urban planning, as well as inadequate supply of services, have been significant constraints on high-rise high density construction. Another constraint on high-rise in the Third World is that the private sector cities generally lacks the resources to play a role in high-rise developments, compared to American and European cities. Medium-rise (2-4 storeys) is common in Britain, and in Australia, medium density developments in the form of townhouses and terraced housing, have increasingly gained professional interest and popular demand over garden city ideas (Freestone, 1989). The single storey grouped housing in Australia is typically in the form of formal housing, whereas in the Third World, a significant proportion is in the form of high density informal settlements, characterised by a general lack of enforcement of physical plans. Arrigone (1995) believes that detached dwellings built up to plot boundaries, and semi-detached dwellings, row and courtyard housing, will probably

be the more acceptable low-rise housing options to South African low-income groups. The walk-up dwellings are likely to be more suitable for middle income, single people and couples, than for families.

Increasing Household Occupancies

Higher population densities can be achieved through an increase in household occupancies. This is a 'natural' process occurring in many Third World countries, especially cities in Africa, where increased residential densities occurs with subletting of existing structures. This may be a result of rural-urban migration where people are seeking to be closer to natural resources or centres of industrial and economic growth. Mabin (1991) notes the rapid division of single family dwellings in Sao Paulo, Brazil. This 'natural' process is already occurring in Bertrams in Johannesburg (Mabin, 1992). While squatter camps in Third World cities consist primarily of single-storey units, they contain very high population densities, often resulting in overcrowding. In virtually every Third World urban settlement, such as in parts of Bogota, Harare, Dar es Salaam, Mexico City and Cairo, such overcrowding is evident (Gilbert and Ward, 1982; Potts and Mutambirwa, 1991; O'Connor, 1983; Devas and Rakodi, 1993). In Africa, high densities per room are typical of the single-storey houses, with most households occupying only one room. In 1976, the residential dwellings in Lagos averaged 4.1 persons per room which yielded exceptionally high household occupancies (Ayeni, 1981). A similar situation exists in Daar es Salaam where many one-roomed houses are occupied by five or six people (O'Connor, 1983).

In South Africa, black township densities are high, largely as a result of the sharing of houses and backyard shanties. The Urban Foundation (1990a) found that an average of 10 to 11 people live on a single township stand, of which 6 live in a formal house on the site and the remainder either in a shack or outbuilding in the backyard. In Soweto, up to 16 persons share sites that contain one house (Tomlinson, 1990). While it would be unacceptable to increase densities in Jeppestown to such levels of overcrowding, a slight increase in household occupancies is possible. Household occupancies in Jeppestown are presently around 4.8 per house while the total number of people living on a property is 5.1 due to subletting and the sharing of backyard shanties (CSIR, 1994b).

Implementation Measures

Higher residential densities can be promoted through the use of policy measures. Internationally most policy measures to promote higher density developments were first implemented during the 1970s as a result of urban sprawl (Behrens, 1993). Dual occupancy provisions, which allow for single erven to accommodate two dwelling units, are one of the measures promoting densification. They have been implemented in Australia cities, such as Perth, Melbourne and Adelaide and in many American cities. Provisions for subdivisions, which allows for subdivision of a larger residential erven, have been implemented in most First and Third World cities, but it has been far more enforced and controlled in First World countries. Another measure aimed at promoting higher residential densities is the use of density controls, which take the form of zoning restrictions on maximum permissible densities. In Australia, a minimum gross density target of 15 dwellings per hectare was targeted for new residential areas (Berkhout and Hill, 1992). Similar targets were set in America, such as Portland in Oregon and Georgetown in Texas (Behrens, 1993). Conditional rezoning is another way in which planners can alter residential densities. Under conditional zoning a developer is bound to meet conditions specified in a rezoning approval (Behrens, 1993). Incentive zoning is another measure that can be used to increase residential densities. This is an agreement between the developer and the municipality in which the developer receives incentives for proving additional public facilities or lower income units. In Los Angeles, where planners are directing policies towards increasing densities, incentive zoning has been widely implemented (Van Tilburg, 1992).

In South Africa, density is controlled via the Town Planning Schemes and a number of policy measures: dual occupancy provisions which allow for a second dwelling on a single erven; subdivision of larger erven; density controls in the form of zoning restrictions; incentive zoning where the developed is required to provide additional public facilities or a certain percentage of lower income units in exchange for a 'density bonus'; and increasing tax on land rather than on improvements (Behrens, 1993). Generally little use is made of incentives and disincentives in South Africa (Gardner, 1992). Certain State Acts also have a direct or indirect influence on densities such as the National Building Regulations and Building