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A model for the densification of an inner city suburb : a case study of Jeppestown, Johannesburg

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Standards Act, The Slums Act and the Health Act (Behrens, 1993). By insisting on large plot sizes, these Acts aimed to exclude lower income groups from intruding into cities.

Other Opportunities

Other opportunities for increasing residential densities would be to reduce road widths, especially where the number of car owners may be low. However Calderwood (1962) notes that the savings in road area are limited. Reductions in the size of communal spaces such as school grounds, parks and play fields could also be contemplated, but this could easily lead to the creation of slums. There is, however, no clear connection between reduced public space and slum clearance, for some of the worst slum areas have excessive amounts of public space. Much of this land is untended and unused. Another option is to reduce garden space. This, however, results in less space for alterations and additions (Calderwood, 1962). Another method of increasing the number of residential units is the conversion of non-residential to residential units (Levy, 1991). For example, a proposal was recently made in Italy to convert a large, old and unused building formerly used by Fiat to manufacture cars, into a housing complex. Residential densities may also be increased though the legal construction of additional dwellings on existing plots. This is usually done in response to the household's changing needs (Arrigone, 1995). Arrigone (1995) notes that this approach does not make a meaningful contribution to the overall density at city level as the scope for additional dwellings is often limited.

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This chapter has shown that the advantages of higher residential densities relate mostly to cost savings and increased accessibility to urban opportunities. Disadvantages relate to high-rise rather than higher densities. Thus, by avoiding high-rise development, the negative impacts of higher densities can be minimised while the positive effects are maximised. The survey of international and local literature revealed a significant body of theoretical knowledge relating to ways of densifying urban areas under different conditions and circumstances. No comprehensive, practical, methodological planning approach could, however, be established. This has served to confirm the need for a model for the

management for increased residential densities, applicable to South African conditions. In the South Africa context, both the development of vacant land on the periphery and land within urban areas will therefore be needed in order to meet the housing demand. Densification within existing urban areas is therefore only a part of the answer to meeting the housing shortfall - it is unlikely to make a significant contribution to the total housing shortfall, especially if one is to avoid the high-rise approach to achieving densification, where a pleasant living environment is often not achieved. Chapter 4 endeavours to utilise the information presented in the Literature Survey to develop such a model.

CHAPTER 4: METHODOLOGY

This chapter outlines the methodology developed in constructing a model for testing the feasibility of increased residential densities in inner city areas. The chapter is divided into a number of sections, each describing the steps that were used in order to examine densification options. Firstly, however, the model is located in the context of a broader interventative exercise, so that it is clear how the model links to other components of the planning process.

The model forms only a small part of the total development planning process in that it would arise out of a broader planning process involving consultation with planners and the community, as well as the implications for demands on social facilities, infrastructure and financing. While it is recognised that a considerable increase in the population would have significant implications for demands on social and public facilities, these needs would not necessarily have to be met in Jeppestown - spare capacity could also be explored in surrounding areas. Prior to the implementation of the model, the local area would therefore need to be analysed within the context of the larger sub-metropolitan area within which it is to be located. This would indicate the extent to which densification is necessary and viable at a broader urban scale. In Chapter 1, the major reasons for densification in Johannesburg were outlined (page 4), thereby placing Jeppestown within the larger sub-metropolitan context. This was followed by a summary of the major reasons for choosing Jeppestown (pages 7 and 8) which served to highlight the need for densification in the suburb. Against this background, intervention in an area such as Jeppestown would also be guided by a number of goals relating to the long term social and economic development of the current and future population of the area.

Scenario-based Approach

A scenario-based methodology provides the basis to examine densification options. There are four main steps in this process. The first involves the description of existing conditions in the study area such as land use, stand sizes, densities and socio-economic characteristics; the second, the identification and evaluation of land that is available for densification; the

third step involves the formulation of appropriate housing options necessary in the development of scenarios by assessing the demand for housing, and the fourth, the evaluation of scenarios in terms of densities achieved, quality of life and dwelling costs.

Geographical Information Systems (GIS)[3] and spreadsheets[4] were used to increase the accuracy and speed of the task. Spreadsheets were particularly advantageous in the scenario-based approach as a large number of iterations were possible. The GIS software packages were used to store, analyse and present the data required in all of the steps mentioned above.

EXISTING CONDITIONS

Existing conditions in Jeppestown pertaining to land use, ownership, property values, socio-economic characteristics and densities were described in order to understand current dynamics, necessary in the development of the scenarios. A reference map showing cadastral information of the study area was essential in order to geographically relate all the data. The base-map was mapped at erf, not block level, since the identification of densification opportunities is at erf level. The data collection was therefore on an individual erf basis. The information was obtained from the Johannesburg City Council.[5]

Existing Land Uses

The purpose of the land use map (Figure 4.1) was to identify residential areas and the types of dwelling units for use in the socio-economic survey and the land value survey, and to assist in identifying densification opportunities. The following data was obtained: location, area (ha) and proportions of each land use type. The specific land use categories that were used was dependent on the characteristics of the particular study area. The following land

Figure 4.1: Land Use Map of Jeppestown (Source: Base map from Johannesburg City Council; Land use classification from field survey)

[3] ReGIS and MapInfo.
[4] Xcel
[5] The Land Information Department of the Johannesburg City Council.

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Land Use Map of Jeppestown

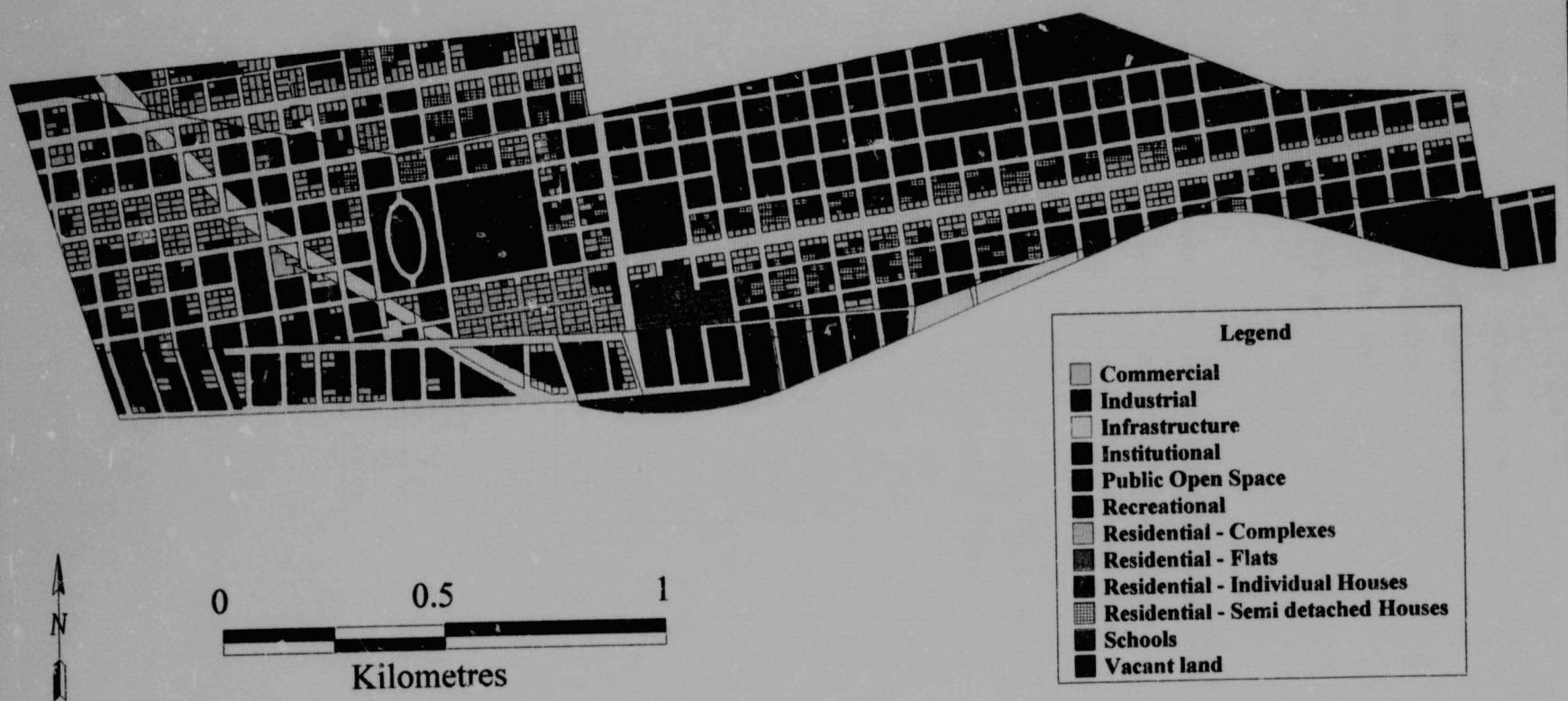

Figure 4.1: Land Use Map of Jeppestown (Source: Base map from Johannesburg City Council; Land use classification from field survey)

use categories were used: Residential (detached housing, group housing which includes semi-detached, cluster, townhouses, old age homes and flats), industrial (light and heavy), commercial (shops, offices), infrastructure (roads, railway stations, railway lines), educational (primary, secondary and tertiary), institutional (municipal, health, police stations), recreational facilities (recreation centres, health and sports clubs), open space (parks, golf courses) and vacant land (undeveloped stands).

The land use information was obtained from photo interpretation (1:10 000 photos), field survey and existing land use maps. The data was verified by means of visual inspection (8 visits to Jeppestown) and other secondary sources such as maps. The land use information was plotted onto the cadastral map of Jeppestown and was input into Regis. Once the data was captured into Regis, it was exported into another GIS programme, MapInfo, for analysis and presentation. Table 4.1 shows the existing land use proportions in Jeppestown.

Table 4.1: Existing Land Use Proportions in Jeppestown

Land-use	Number of Units in Study Area	Area (ha)	% of Gross area
Residential	847	51.7	25
Detached and semi-detached houses			
Flats & cluster housing	470		
Business /commercial		20.6	10
Industry		31.1	15.21
Public Open Space		5.7	2.78
Recreational facilities		0.7	0.34
Schools		15.6	7.66
Institutional		3.1	1.55
Vacant land		3.8	1.9
Infrastructure		71.31	35.4
TOTAL:	**1317**	**203.6 ha**	**100%**

Existing Ownership

The ownership of all erven in Jeppestown were identified and mapped (Figure 4.2). Ownership has implications for cost and ease of property acquisition. An assumption was made that land owned by the state is easier and cheaper to acquire than land and properties owned by private individuals or private companies. According to the Cape Town based Development Action Group (DAG 1993), public land provides an important opportunity to bring down the direct cost of housing to low income households as the land can be provided at a subsidised rate. Information on ownership was obtained from the valuation roll (Johannesburg City Council, 1994). The following ownership categories were used: state, the Johannesburg City Council, Spoornet, private individual, private company, religious institution, welfare organisation.

The map showed that a relatively small proportion of land is owned by the state or the Johannesburg City Council. Most of the residential land is owned by private individuals. If the ownership and land use maps were to be overlayed, it would be clear that the majority of land owned by private companies is occupied by industrial land uses.

Property Values

A land value and a land and improvement value map (Figure 4.3) was used to show the geographical distribution of values in the study area. Information on land and improvement values was obtained for 460 houses and semi-detached units, out of a total of approximately 847 houses and semi-detached houses (54 percent sample) in Jeppestown and Fairview (Appendix 1). This information was obtained from the valuation roll and input into the GIS. A 100 percent sample of residential stands was not possible as, in many cases, the improvements values noted in the valuation roll were not provided at stand level, but contained the sum of a number of values of residential and commercial properties. Careful comparison with the land use map, as well as site inspection, was essential in order to check that the values were those of residential properties and not of other land uses.

Ownership Map of Jeppestown

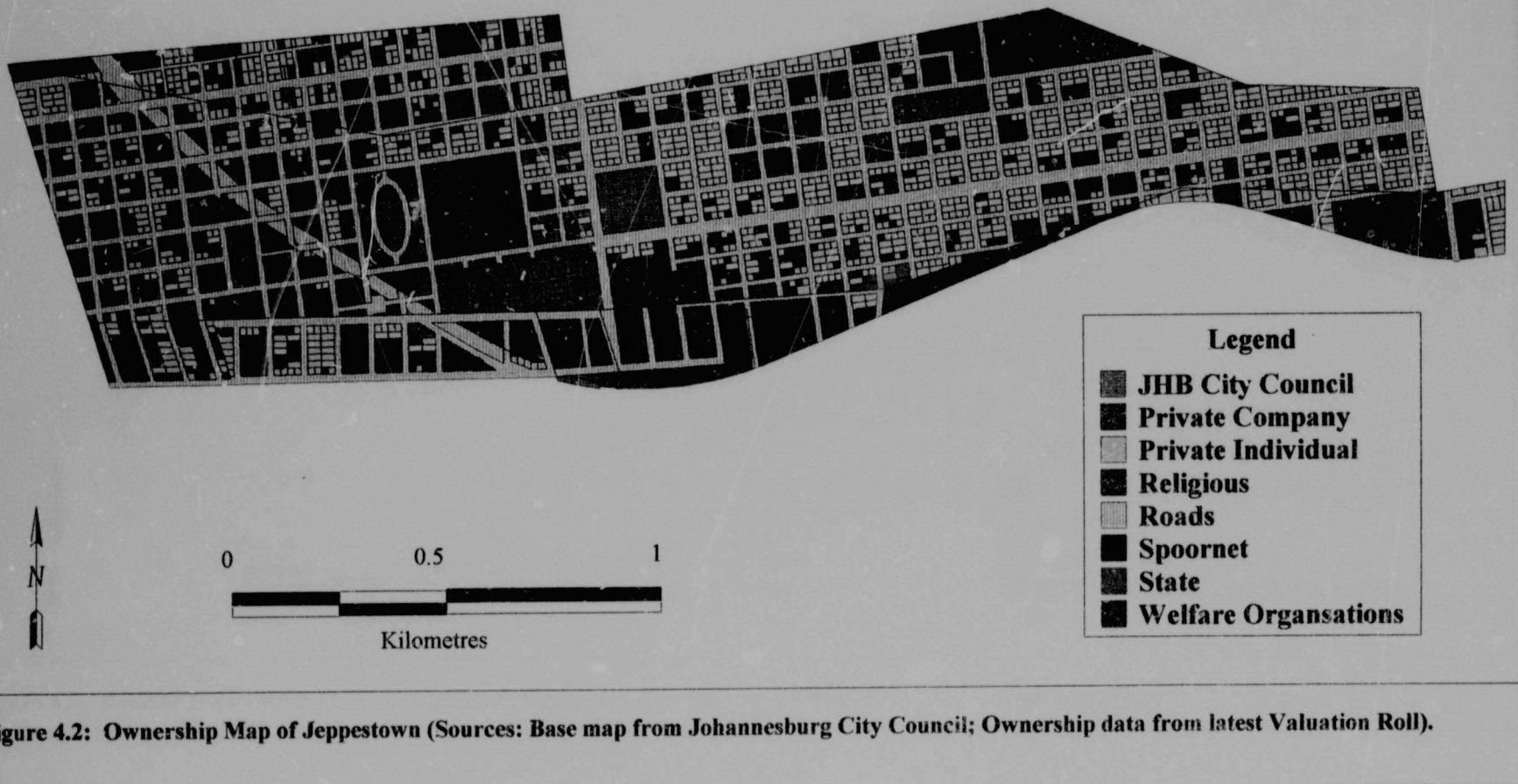

Figure 4.2: Ownership Map of Jeppestown (Sources: Base map from Johannesburg City Council; Ownership data from latest Valuation Roll).

Ratio of Improvement to Land Value per Stand Size Category for a Selected Number of Residential Sites



Figure 4.3: Ratio of Improvement to Land Value per Stand Size Category for a Selected Number of Residential Sites
(Source: Base map from Johannesburg City Council; Property values from the Valuation Roll, Johannesburg City Council)

The ratio of improvement to land value was particularly useful in that it indicated the degree of suitability for redevelopment of the residential sites. If the value of the building is less than the value of the land, this could indicate an opportunity for demolition and redevelopment (Johannesburg City Council, 1994). Figure 4.3 shows that most of the residential sites that were sampled in Jeppestown are favourable for redevelopment.

Socio-economic Characteristics of Area

Socio-economic information was primarily used to calculate population densities, to inform the decision concerning the target population and to determine affordability levels. Occupancies[6] were used to determine existing population and were used to inform the target occupancy decision, which in turn affected the achieved scenario populations. Population figures were used to calculate changes in population densities. Income levels of the existing population influenced the choice of income levels of the target population which in turn influenced affordability. The number of habitable rooms was determined in order to enable the calculation of target occupancies.

The data was obtained from the latest census (Republic of South Africa, 1991) and two questionnaire surveys. One source was a July 1994 questionnaire survey of 125 households living in Jeppestown and Fairview - approximately 10 percent sample (CSIR, 1994b). The questionnaire survey provided information on the number of people per household, house type, number of rooms in house, the form of tenure, household incomes, work place and main mode of transport used (Appendix 2). The interviews for the survey were undertaken by Markinor (commissioned by the CSIR). [7]

The information collected was based on a random stratified sample of housing types (individual houses, flats, cluster housing) from the area. The sampling was undertaken by Statomet of the University of Pretoria. In order to obtain a random stratified sample, Statomet required the total number of units per house type, as well as the land use map. The total number of units was calculated from aerial photography and field inspection. Markinor then conducted the interviews, after which the information was processed by Statomet.

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[6] The number of people per dwelling unit.
[7] Permission has been obtained from the Division of Building Technology of the CSIR to use the results of this survey.

A second source of socio-economic information was the report from the Johannesburg Inner City study (Crankshaw and White, 1992). This study, which was approximately half the size (west of Berg Street) of that of the Markinor study area, was used mainly to supplement the 1994 study. While the data from the two surveys could not be directly compared, the Inner City study, proved to be invaluable in that it provided information that was not contained in the Markinor survey: people's housing preferences, their perceptions of their living environment, social characteristics, standards of domestic services and the use of public and private facilities. A 21 percent sample was obtained in this survey.

The mean household occupancy for individual houses and semi-detached houses in 1994 was 4.3, while the average number of people per stand is 4.8. This is because there are a large percentage of properties (51 percent) with more that one household. The 1992 survey conducted by Crankshaw and White (1992), found that in Jeppestown an average of 5.1 people live on each stand. Concerning monthly household incomes in Jeppestown, 66 percent of the total households sampled earn less than R2 500 a month. However, 21 percent earn between R1 501 and R4 000 a month. Crankshaw and White (1992) also found that the majority of Jeppestown residents earn less than R2 000 a month. The July 1994 survey found that 27 percent of the residents that were sampled live in a three-bedroomed house and 21 percent in a two-bedroomed house. These results conform to those obtained by Crankshaw and White, who found that 30 percent of the residents live in a three-bedroomed house and 17 percent in a two-bedroomed house. In this study, a quarter of the residents were found to live in bachelor accommodation.

Determination of Existing Densities

Existing densities were determined in order to enable comparison of current densities with those resulting from the densification scenarios. Gross, net and town residential densities were calculated according to the definitions provided below. These densities were expressed for both population and number of dwelling units.

- **Gross town density or overall density** is applied to the town as a whole. It is the total residential population (or accommodation) divided by the area of the

town excluding undeveloped or agricultural land but including industrial land, all public open space, all schools and all types of development.

- **Gross residential density** is the population (or accommodation) divided by the site area which includes all land covered by dwellings and gardens and most open spaces but excluding other urban uses such as industrial land, secondary schools, town parks and town centre.
- **Net residential density** is the population (or accommodation) divided by the site area, which includes all land covered by dwellings, gardens, local roads and half the width of surrounding roads and any adjacent public open space (Ste[illegible], 1952; Senior, 1984). These definitions conform to th[illegible] used by the Urban Foundation (1988)

The areas in hectares was determined from the land use map. The total number of units was obtained from aerial photography counts. Total population was obtained by multiplying the number of dwelling units by the average number of people per dwelling unit as obtained from the socio-economic survey. It could also have been obtained from the national census, or local authority population figures, if available. The number of residential units in the study area was then determined from aerial photo interpretation, and field survey for the flats.

IDENTIFICATION OF DENSIFICATION OPPORTUNITIES

A study of relevant literature pertaining to residential densities, revealed that there are three major types of land that can be identified for densification: infill land, potential land through redevelopment, and land available through subdivision, such as vacant land in the backyards of houses (see Chapter 3). While the literature also revealed that densification can be achieved by means of increases in residential unit occupancy or redevelopment of land other than residential, the thesis does not include these aspects. Figure 4.5 contains the distribution of infill and redevelopment opportunities in Jeppestown. No subdivision opportunities were found in the study area.

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