re-assembling the city : rapid transit as catalyst

Karen Ann Fortmann

A thesis submitted to the Faculty of Architecture, University of the Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree Master of Urban Design.

Johannesburg 1994.

declaration

I declare that this dissertation is my own, unaided work. It is being submitted for the degree of Master of Urban Design in the University of the Witwatersrand, Johannesburg. It had not been submitted before for any degree or examination in any other University.

Karen Ann Fortmann

Johannesburg 1994.

acknowledgements

For the challenging insights and support, Dr Roger Boden ...
For immense patience and understanding, my parents ...
For financial sponsorship, Johannesburg City Council ...

and many others ...

thank you !

abstract

The fountainhead of the tramways in South African cities occurred a century ago, when Johannesburg, in particular, experienced horse-drawn trams in the early 1890s. From a rough Babylon, this city has henceforth experienced *significant changes in time and space, failing to avoid* the desecration of racial segregation and the associated spatial ramifications. The contemporary city is thus charged with the task of reconstruction and integration to redress the effects of past actions.

In parallel, the renaissance of the tramway worldwide, in the form of rapid transit, has brought to light an opportunity to be exploited in the process of *re-assembling* the fragmented urban form. The catalytic and associated ripple effects of rapid transit on the urban environment in nearby proximity is considered critical to both the sustainability of the system and to the environment through which it operates.

The underlying approach incorporates the notion of linking history and precedent as a means of instructing future designs. The process is concerned with definition, decomposition, analysis of intermutual links, and *re-assembling* the whole, to achieve a higher level conceptual abstraction and understanding. Such an understanding could facilitate the urban designer to maximise the catalytic benefits of a revived urban element.

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one

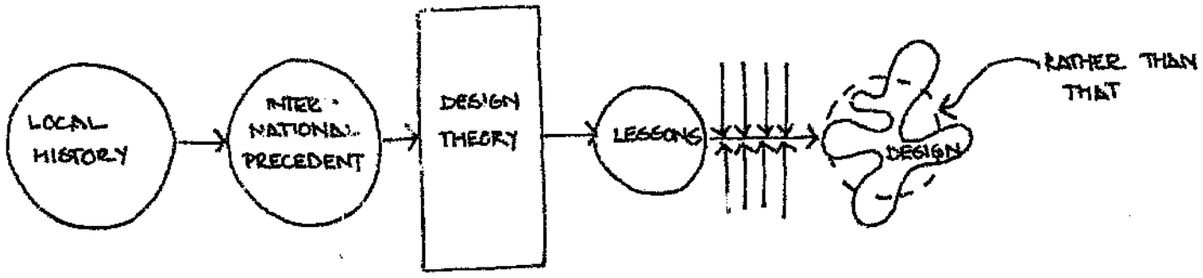
introduction

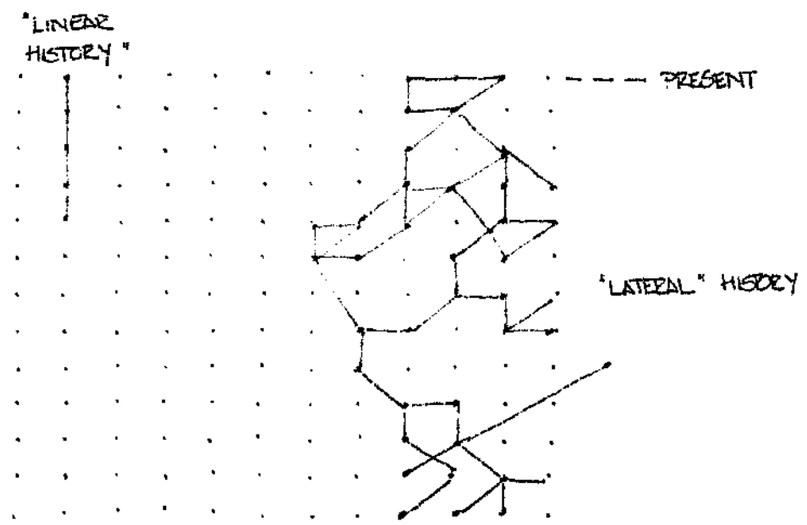
1.1 THE CITY RE-ASSEMBLED : THE RENAISSANCE OF THE TRAMWAY

The exigency faced by the contemporary South African city is that of *urban reconstruction*. In moving beyond the neo-apartheid city, opportunities need to be sought to remedy the presently disjointed and dysfunctional urban form, due to past manipulations under both colonial and apartheid regimes. The *renaissance of the tramways*, or popularly referred to a rapid transit, is considered in this dissertation to be a device which could contribute towards the *re-assemblage of urban form* (after Kostof, 1992). Rapid transit, if applied, within and integral to. a broader framework of urban reconstruction, could be used as a restructuring device in the process of reparation of the South African city, and that its application as part of such a process can have positive catalytic impacts on the urban form and society.

While the focus is on the integrating role on the urban environment, and the positive catalytic impacts on the surrounding urban environment, the corollary applies. The very sustainability of the system is reliant on the construct of this supporting urban environment. Inclusive in such an environment would be a mixed land-use core, with a substantial proportion of residential land use, and rippling outwards from the epicentre, other necessary and supporting uses in the urban environment, such as community and recreation facilities. The mix and thresholds pertaining to the sustenance of rapid transit is largely dependent on the context. For instance, a rapid transit route operating in an inner city area would vary from a suburban context.

Interest in the role which rapid transit may partake in restructuring was sparked in response to recent interest and investigations into the feasibility of a light rail system for Johannesburg's inner city. In particular, a pilot study route was proposed, connecting the Westgate Station to Rockey-Raleigh Street in Yeoville. It is the contention of this thesis that both the actual route selected and the approach adopted, is problematic.





"LINEAR" (SEQUENTIAL) VS. "LATERAL" (THEMATIC) APPROACHES TO HISTORY (AFTER RAPOPORT, 1990).

1.2 METHODOLOGY : HISTORY AND PRECEDENT

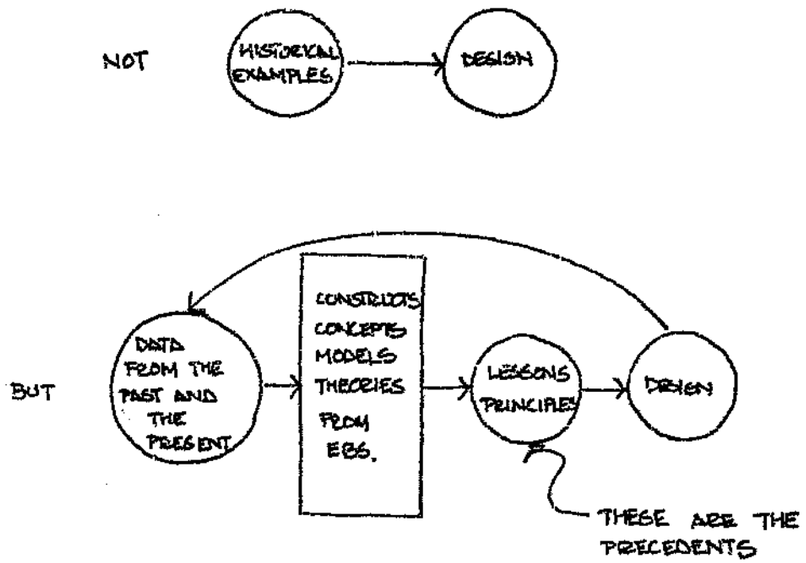
The methodology adopted seeks establish a link to the process of re-assembling of the dichotomised urban form of the South African city. In this regard, this dissertation relies heavily on Rapoport's (1990) underlying "theory" of Environment-Behavior Studies (EBS), which approaches the implications of the study of the history of the built environment and the use of historical precedents for future designing.

Rapoport (1990, p.465) proposes a rational approach which explicitly defines the relevant system of settings, decomposing them into constituent parts, studying their mutual interactions and mechanisms, followed by *re-assembling* the wh at a higher level of conceptual abstraction and understanding.

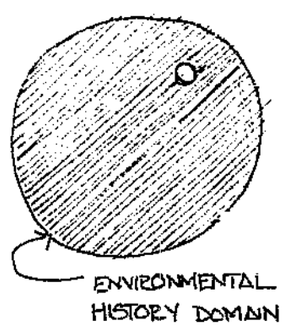
Rapoport (1983, 1990) indicates that design is concerned with creating better environments. Design also needs to be viewed as a set of hypotheses of the form: if such and such is done, the following will happen. These hypotheses thus need to be based on the best available data. This raises questions as to: what is better? and for whom? how does one know that? what can be done to ensure better design, and why? and how does one know that? how to evaluate? or improve? etc.

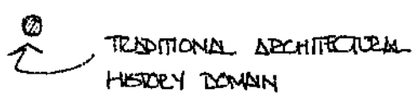
Rapoport (1990) continues in asking the question: How does the study of history change if the foregoing is the position taken in the present? A corollary of this is: how a study of history can assist to answer questions such as these? In part, changes in the way design is done and how environments evolve (selectionism) as opposed to the environment being designed or created (instructionism). While selectionism refers to a far more gradual process whereby fit is achieved, it is the latter process which is of particular concern to this discourse, in that

> *"in current design by professionals the predominant, in fact any, process is instructionism"* (Rapoport 1990, p.82).



ALTERNATIVE WAY OF LEARNING FROM THE PAST (I.E. DERIVING PRECEDENTS) (RAPOPORT 1990).





RELATIONSHIP BETWEEN THE DOMAINS OF ENVIRONMENTAL AND ARCHITECTURAL HISTORY (AFTER RAPOPORT, 1990).

The role of EBS is to enable designers to

> *" 'objectify' the knowledge needed to give valid instructions"* (Rapoport 1990, p.82).

Certain steps may be identified for a designer to follow. One begins firstly using EBS, with the body of evidence being the range of data, involving historical data. The critical aspect is that the designer does not copy products from the past, but rather translates lessons of the past, as well as inferences about behaviour based on them, into data suited to an instructionist mode.

In essence, therefore, the approach is that which uses

> *"both present-day conceptual, theoretical, and methodological apparatus and data from the past"* (ibid., p.83).

In defining the domain, there is a need to consider the subject matter to be concerned with

> *"the cultural landscape, the relevant system of settings ...* (not) *the individual building as artifact, and certainly not the individual 'masterpiece' building"* (ibid., p.465).

By the same token, the domain of this dissertation attempts to consider beyond the tramway, or rapid transit system, to embody the total environment through which such a system operates, and the sphere of impacts.

Of critical importance is the use of evidence. Rapoport (1990, p.83) notes that

> *"one obviously needs to use whatever data is available rather than carefully controlled samples. The evidence, however, can be controlled in other ways,*

for example, by showing its reference, maximizing its relevant variety, and so on".

For a 'third world' city context, this statement is meaningful, in that the urban designer can operate within restrictive parameters in terms of data availability. Furthermore, as performed herein, base of evidence is more clearly defined by the current requirements of a reconstructed post-apartheid city.

The value of Rapoport's approach, therefore, is one which facilitates an understanding of how to analyse past interventions, both locally and where relevant, internationally, to provide precedents for improving the design of modern Johannesburg.

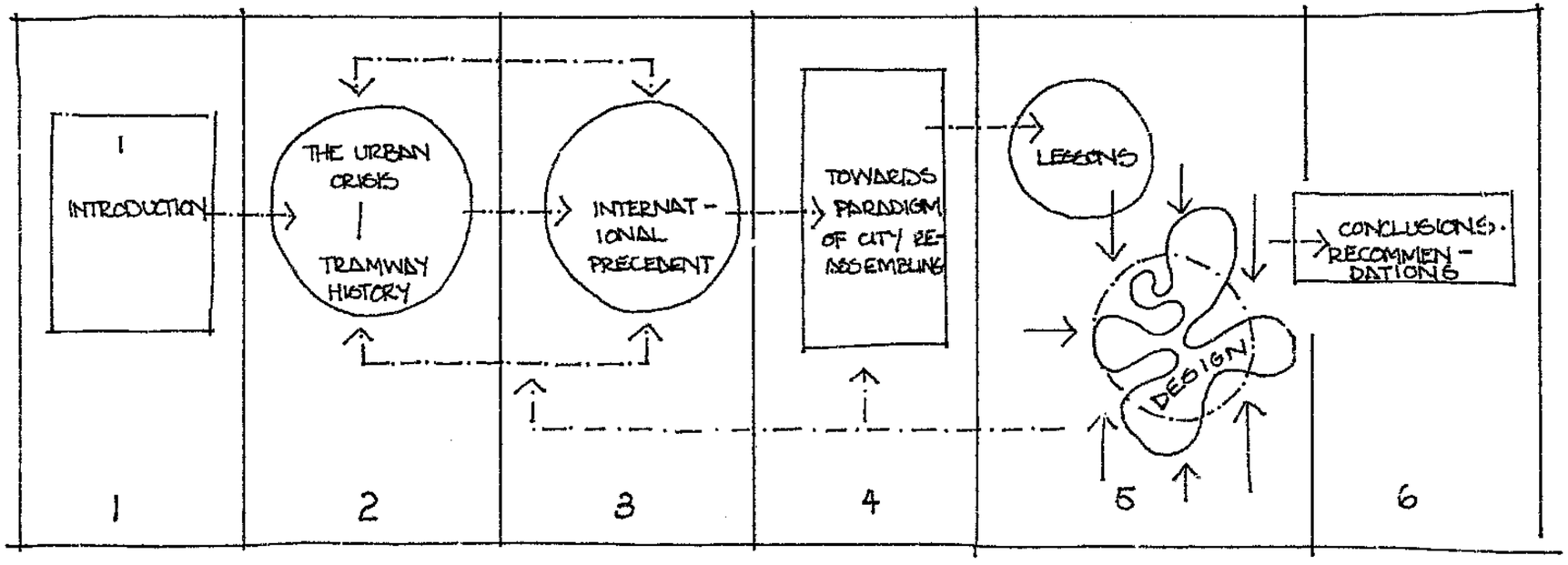
1.3 A BRIEF OVERVIEW

There are numerous arguments to support the need for rapid transit in the inner city, if approached in a holistic manner. Atkinson (in Attoe 1988, pp. 200-204) indicates that a more public transit oriented city may be justified on the basis of :

- Highway development and expansion thereof does not work.
- It makes social justice and economic sense.
- The city model which focuses on the inner city is a still valid ideal.
- It fosters identity.
- There are economic spinoffs.
- Transit systems can be customised according to context.

Based on this thinking, a more appropriate approach to rapid transit interventions in urban areas is argued for. This draws from international findings and case studies regarding specifically their interface and catalytic impacts on the immediate environment (in Chapters 3 and 4). Compounded with an understanding of local requirements and precedent (in Chapter 2), a foundation is established for re-evaluating the current approach adopted.

The response is a new vision for a transit-oriented district, which is applied to Westgate Station, Johannesburg.



METHODOLOGY

two

the urban crisis : cities at the end of the road ?

2.1 AIMS

Why are cities under stress ? The first part of this chapter aims to provide a broad understanding the crisis which the contemporary South African city, in general, and the country's `primate' city, Johannesburg, in particular, confronts. Furthermore, while many of the problems facing the South African city are inherently local, and may be attributed to past segregationist approaches, there are broader issues faced by cities worldwide. It is becoming increasingly apparent to address the disease of the city, which has arisen due to the conflict between the city and the motor vehicle. The second part deals with the local history of the tramways of Johannesburg, which provides extractions and extrapolations of historical materialism relating to Johannesburg. This then begins to form a platform on which to select and evaluate international case studies.

2.2 THE URBAN CRISIS

> *"Apartheid legislation distorted access to natural resources, denying the majority of South Africans the use of land, water, fisheries, minerals, wildlife and clean air. South Africa's apartheid policies, combined with the underregulated activities of local and transnational corporations, contributed to the degradation of environmental resources ... Poverty and environmental degradation have been closely linked"* (RDP 1994, p.38).

While a certain amount of blame may be attributed to an apartheid legacy, the environmental condition, particularly manifest in urban areas, is a global issue. The contemporary society is addicted to speed and mobility, substantiated by Sontag (in King 1990, p.43) who, in describes the human scene as a

> *"contemporary, restless, pleasure-seeking, mobile society; mobile in every sense ... `a new sensibility rooted in extreme social and physical mobility; in the crowdedness of the human scene; in the availability of new sensations*

(GIRADET 1992)

such as speed (both physical speed, and the speed of images, as in cinema, television or video)'".

The blame has largely been attributed to the motor vehicle. Girardet (1992, p.102) notes the addictive nature of the car on the mind.

> *"As we learn to rely on them, they refuse to let go of us. As our hands grip the steering wheel, control, power, and "freedom" are within our grasp ... Cars induce an unreal state of mind. As the world whizzes by we are lulled away from mundane worries. But traffic jams and accidents kill such illusions: the darker side of car use that we try to forget".*

A similar view has been expounded by Richards (1990, p.1) who indicates that it is becoming increasing difficult to move around in cities. He furthermore adds that the pressure is mounting for places of work and living, which in turn relates to an increasing demand for roads and other transport. Transport infrastructure constitutes an integral part of the city fabric. For instance,

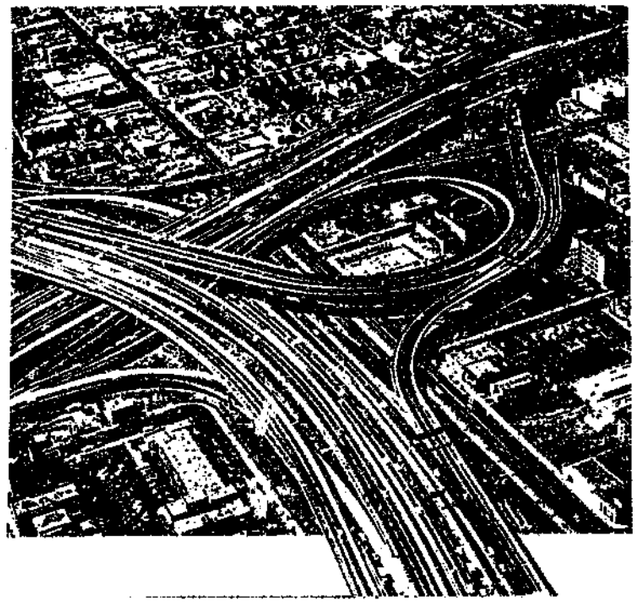
> *"roads and parking spaces already occupy a large proportion of the land within cities - up to 30 per cent of its area in Europe and often more than 50 per cent in North America* (ibid., p.1).

The impact which transportation has had on the urban form, particularly concerning the rise of middle landscape, is notable. Kostof (1992, p.59) indicates that

> *"the modern suburb, in the sense of a residential settlement for commuters, was from the very start the child of fast transportation. This is what distinguishes the modern episode of the periphery from all previous suburban activity".*

Prior to 1800, the "walking city" was characterised by a maximum girth directly related to a ten minute pedestrian walking time over half a mile, or approximately

800 metres, with horse-back riding and wagons moving at a comparable pace through narrow streets Kostof (1992, p.59). However, the bourgeois suburbia has always existed. For instance, Florence in the fourteenth century had rich estates that occupied 'extra mural' land. The Baroque period was an important phase in terms private transport for the wealthy. Taking Paris as an example, its coach numbers increased to 12 000 by 1700. The pre-taxi hackney service or the sedan chair were also popular options for those who could afford such services (ibid., p.59).



SPAGHETTI JUNCTION (GIRARDET 1992).

Dower (1993, p.31) notes that the story of the modern roads in Britain began in 1886 with the formation of the Roads Improvement Association. This period of time was marked by the preference given to the motor vehicle and its users. Three desideratum, namely convenience, safety and pleasure were of primary concern. Over time, imbalance between these three began occurring. Pleasure in travel was the first to suffer, with diminishing view from the road. Both the growth in traffic and the mix of various traffic modes began to play a detrimental role in road safety. In the 1950's the convenience factor began eroding away. This was highlighted in Buchanan's reports on the problems and impacts of vehicular congestion. Dower (1993, p.31) further notes that this attrition of convenience, safety and pleasure have been wide and varied. For instance,

> *"Roads have been widened and improved; new roads have been built; different sorts of traffic have been, to some degree, segregated; road traffic has been discouraged and even banned from some areas; road surfaces, crossings and vehicles have been made safer; ribbon development has been largely stopped; conscious effort has gone into the design of street furniture and the landscaping of motorways".*

The congestion monster has, however, not been stopped. In Britain, the solution is seen to be the building of more roads. A shift in thinking from certain quarters is emerging. The Transport Studies Unit of Oxford University investigated the effect of road traffic growth in Britain in 1989, with indication given that growth on the scale of

official forecasts would severely threaten both the fabric and quality of countryside. In addition, rural traffic could increase three or four fold in the next few decades, in comparison to a fifty per cent growth in urban areas (Dower 1993, p.32).

A range of costs attributed to roads and road transport are highlighted in this report, including:

- Human costs - inefficient energy use, misery and tension caused by accidents, congestion and noise pollution; as well as isolation and inconvenience for non-car users.
- Financial costs - attributed to road building programs, maintenance and accidents.
- Physical costs - both in terms of destruction of the landscape and liveability of communities.
- Environmental costs - insidious amenity damage from signage, lighting etc., structure of habitat, and noxious vehicle emissions (ibid., p.32).

Recommendations were made by the Countryside Commission that a new approach to the transport problem was required. Sustainability is argued to be the key concept, although this needs to be defined and elaborated on.

Behrens and Watson (1992, pp.51-51) have also indicated the costs associated with fragmented and sprawl cities in South Africa. These include capital, operating, individual, environmental, efficiency, congestion, and economic productivity costs. A recent study undertaken in the Johannesburg metropolitan area set out to compare the costs associated with transport versus land subsidisation (Bulletin 1994, pp.8-12). The underlying concern was that

> *"The density of most metropolises of the world tend to peak within five kilometres of the centre and to decrease gradually towards the periphery. By contrast, the Witwatersrand density profile peaks at 22 km and at 43 km from*

the city centre with extremely low average density up to 15 km from the centre. This increasing density gradient is the result of the constraints on land-use imposed by the now abolished Group Areas Act" (World Bank Aide Memoire, 1991).

The case studies of two fictitious centralised sites (Crown Park and River Park) located 2,5 and 5 km from the Johannesburg CBD, respectively, and a dispersed settlement (Orange Farm) located approximately 42 km south-west of Johannesburg. The following broad conclusions reached in this study regarding the comparative cost of development and transportation between dispersed and centralised were made :

- The total costs incurred by a dispersed community are significantly more sensitive to the number of trips generated per person than those for a centralised community.

- From this point, it may be concluded that it would be less expensive to increase the number of trips (mobility) of the community by subsidising centralised land purchasing costs than subsidising dispersed community's travelling costs (Bulletin 1994).

In design-specific terms, suburban sprawl may be characterised by a variety of physical attributes (Duani 1991, p.10), including

- Isolated and separate land use "pods" dedicated to single uses such as shopping centres or residential clusters. These pods are inaccessible from other land uses, except with the use of a car.

- Housing is segregated in large groups of equal cost, restricting any socio-economic diversity.

- The scale and form of development is controlled by vehicular traffic, for instance with the design of wide roads, car dedicated routes, and large parking lots dominating the streetscape.

- Cul-de-sacs and loop streets occurring in pods are prominent, restricting through-traffic to a few collector streets and, as a result contributing to congestion.

- Buildings tend to have a negative relationship with the streets in being set back, and thereby insuring a lack of sense of place.

The pedestrian has been one of the major sufferers of the effects of the modern urban problem. The loss of freedom, particularly for individual city dwellers is considerable. Hillman (in Elkin and McLaren 1991, p.54) notes that

> *"The lives of pedestrians, especially children and old people are put at risk by the fact that the 'pavement network' for them is interrupted at every road intersection. Few pedestrian precincts have been created, but in any case pedestrians are rarely confined in their movements to such restricted areas, and on major roads, detours to crossings, footbridges and underpasses, which are rarely cleaned or policed, are necessary. It is noteworthy that about one in seven pedestrian casualties occurs on pedestrian crossings".*

A study carried out in San Francisco by Appleyard and Lintell (1972) indicated the detrimental effects with heavy traffic volumes had on social interaction. The study, which included field interviews and observation, was carried out on three similar San Francisco streets. It indicated an inverse correlation between the number of friends and acquaintances each individual had within the street area. The authors noted that

> *"there was a marked difference in the way these three streets were seen and used, especially by the young and elderly. On the one hand, LIGHT STREET was a lively close-knit community whose residence made full use of their street. The street had been divided into different use zones by the residents. Front steps were used for sitting and chatting, sidewalks by children for playing, and by adults for standing and passing the time of day ... HEAVY*

STREET, on the other hand had little or no sidewalk activity and was used solely as a corridor between the sanctuary of individual homes and the outside world "(ibid., p.93).

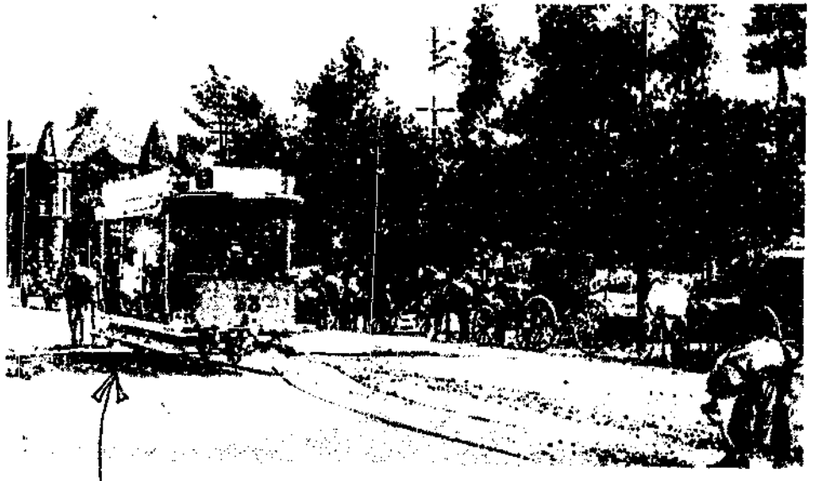
2.3 THE TRAMWAYS AND THE MAKING OF JOHANNESBURG

The focus of this part of this chapter concentrates on extracting salient points relating to the development of Johannesburg over a relatively short time period, from a colonial city, through apartheid domination, and to its current state of perpetual spatial segregation, even after the birth of a democratic State. It is not a study of historical evolution. Furthermore, several properties apropos the interaction between the tramways and the built environment, are incorporated throughout. The information base from which extractions were made include maps, timetables, and verbal discussions (not recorded herein) with people who utilised, or were familiar with the trams of Johannesburg.

Due to the nature of the study assessing the interaction between the tramway system and its spatial and aspatial context, the theoretical premise of urban morphology is considered appropriate. Urban morphology is broadly concerned with the study of the causes contributing to a particular urban form. It involves an analytical understanding of the city as that which is an existing built form; in constant flux and in a continuum of change; and thereby the implication is that the city is the focus of constant interaction between socio-political and economic forces; and the built environment in which these forces manifest.

2.3.1 The Johannesburg tramways

On a national level, the introduction of the tramway came into operation in 1886 in Cape Town with firstly horse-drawn busses and then trams. This was the first step towards the acceleration of suburban sprawl. Christopher (1984, p.83) notes that



HORSE-DRAWN TRAMCAR

SLOWER SPEEDS CONTRIBUTED TO A GREATER MIX OF TRANSPORT MODES WITHIN STREET SPACE.

(SPIT 1976).

"owing to the initial high costs of transport it was the more affluent who were able to move, hence the new suburbs beyond the city boundary were at first spacious with villa developments. However, cost reduction instituted mass transportation which enabled the working class to move. There was thus a steady outward movement of those able to do so as well as a migration into the city from rural area and from other parts of the world".

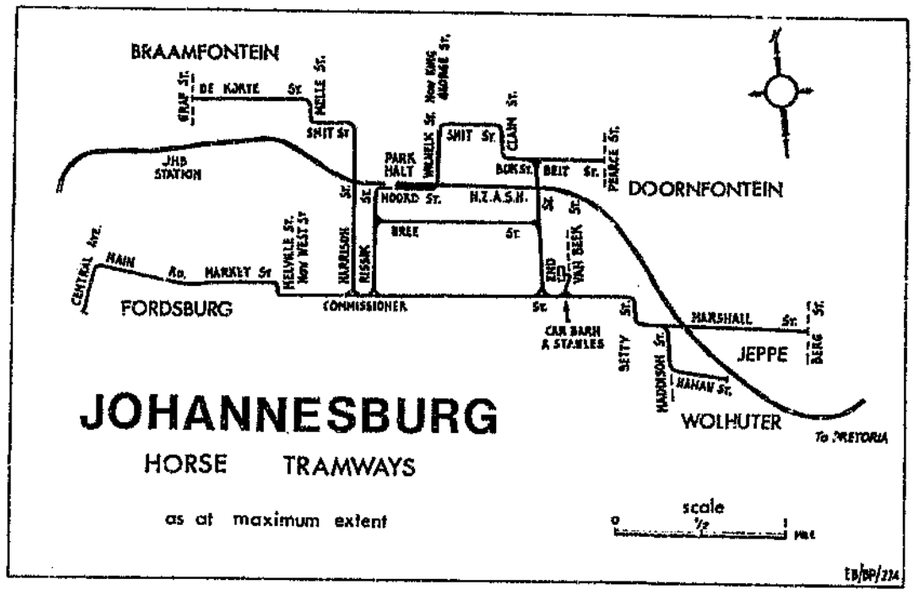
Even prior to 1920, the relationship between urban rail and tram transport, and urban development and expansion was evident. The tramway extensions and route alignments were of particular concern to suburban speculators and developers.

Locally, the introduction of tramways has had a significant impact on the form and functioning of the city. The relevance of understanding the history of the Johannesburg tramways is to indicate firstly the reasons for its failure and secondly as a basis for comparison of the reintroduction of such systems internationally.

The birth ...

1891 marks a time whereby the prospects of operating a successful transport business in the mining town of Johannesburg had been investigated by the ubiquitous Nellmapius. In 1889 he approached the Kruger government with a request for a concession to operate an animal powered service in Johannesburg for a thirty year period. The concession was granted as it was seen to be a boost for urban industrial development and therefore an important market for the Boer farmers in providing forage, mules and horses. Soon after the concession was granted, Nellmapius sold it to Rand Mining Company owned by Neumann, Hanau and King (van Onselen 1982, p.9).

In 1889 Neumann and his partners floated the Johannesburg City and Suburban Co. Ltd. It was believed, that this company would in future be permitted to operate a more profitable tramway system which in turn sparked off speculative interest from prominent investors (van Onselen 1982, p.9).



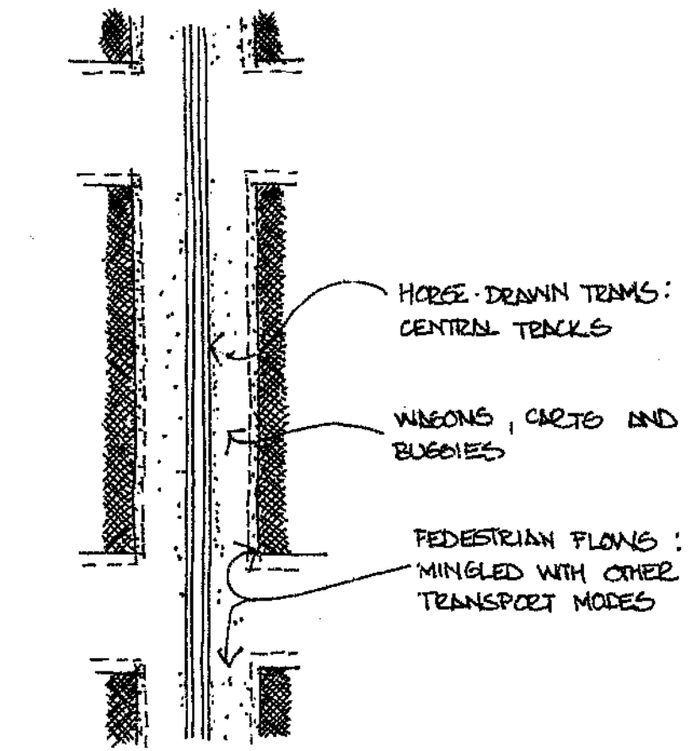
(SPIT 1976).

With the exception of a thousand pound deposit payable by Neumann, the government was responsible for the construction and operation of the line. While there was no Tramways Act, as in Britain at the time, certain specifications were laid down, including

> *"The gauge of the line was to be three feet in. and the track single, with passing places ... responsible for maintaining the space between the rails and the road for a distance of two feet on each side ... it was required initially to ballast and pave these areas only where and when the government required this"* (Spit 1976, p.10).

Construction was initiated in 1890, utilising very light grooved rail, spiked to buried wooden sleepers. The single line in 1891 was a loop from the city to Jeppes Bridge via Bree Street as well as a Wolhuter branch line opened. In 1893, a branch via Hospital Hill to Doornfontein, was opened with free rides on opening day. At later dates, the main line was extended to Belgravia as well as a branch to Braamfontein (ibid., pp.11-12). It is assumed that the colour of the cars corresponded to the particular routes served.

1891 was however, a year marked by depression and therefore after eleven months the shareholders in City and Suburban noted a dismal gross profit. According to van Onselen (1982, p.9) it was largely due to the profit figure of two thousand pounds that prompted the company directors to approach Kruger with a request of electrification of its line. The request was turned down in order to protect the long term interests of the farmers. The period 1892 to 1899 may be marked as the Witwatersrand's great lurch towards modern industrial society. It has been further noted that it was a movement which was facilitated rather than frustrated by the Kruger government. Simons and Simons (1897, in van Onselen 1982, p. 23) have indicated that



c. 1891 - 1906

"Few agrarian societies were so richly endowed or well equipped as the Transvaal for an industrial revolution. The republic attracted educated and professional men from Holland or the Cape, and was beginning to produce its own specialists. Left to itself it would have developed an efficient administration, a network of railways and roads, and adequate supplies of water and power. Far from being intractable, the burghers expanded production to provide foodstuffs for the Rand, built railways linking it to the ports, enacted an excellent mining code, kept order over unruly, rebellious fortune-hunters, repelled an armed imperialist invasion and held over the world's greatest military power at bay for more than two years".

In 1895, another application by the City and Suburban Tramway Company was submitted to Pretoria to electrify its lines on the Rand. It was again rejected. In response the City and Suburban Company decided to extend its horse drawn lines by twenty-five percent. This had a depremental effect on self-employed cab owners who now had to compete with a powerful company as well as a rise in the price of horses and forage. Similarly, an application was again refused.

In 1900, a skirmish in Kensington led to martial law and Johannesburg became a ghost town after the deportation of foreigners and republican government symphathisers.

"The tramway company's property was requisitioned and the depot became a police barracks; the tram horses were taken for military duties and all track crossing railway lines were removed, to prevent obstacles being placed in the way of military trains ... Those inhabitants who remained in Johannesburg made do with cabs and bicycles, the latter enjoying a great boom in popularity during the war. Gradually the tram tracks disappeared under layers accumulated dust " (Spit 1976, 15-16).

Metamorphosis ...

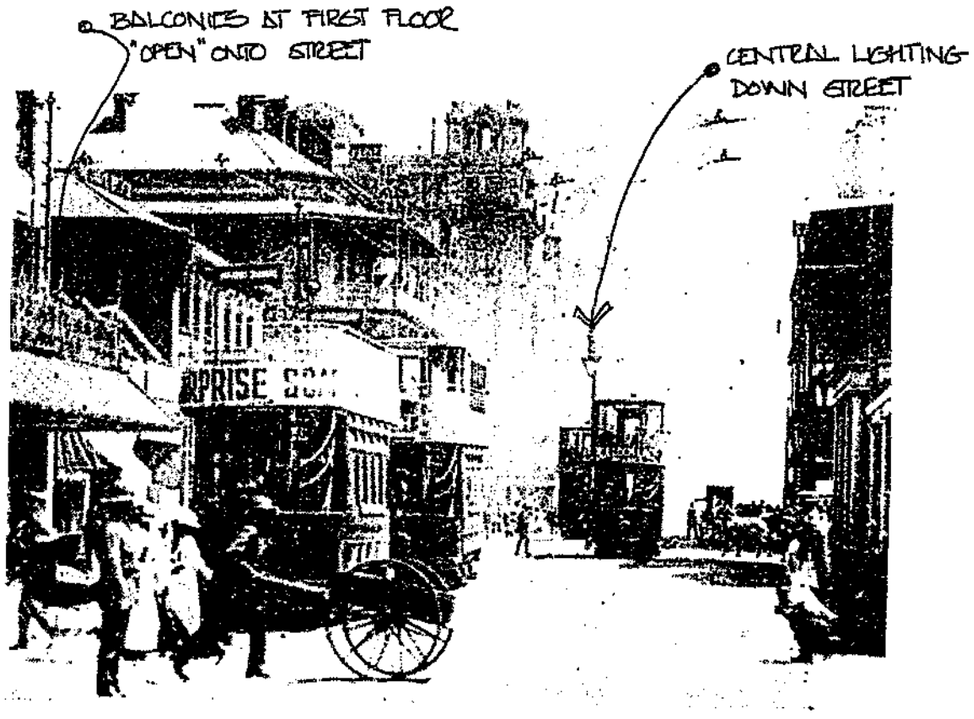
When the South African war ended in 1902, it was already recognised the previous year that

> *"The town council will thus accept the duty of providing for the welfare of workers with moderate incomes, to whom a cheap, efficient and well-regulated tramway-system is practically a necessity, tending as it does to remove the disadvantages of residents at a distance from their work ... "* (Major O'Meara, in van Onselen 1982, p.163).

The turn of the century also marked the significant change in Johannesburg from a tent town to a suburban city. According to van Onselen (1982, p.164) the development of suburbs was consciously facilitated by the state. The spatial result was a dispersal of the white working class from the high rental areas of the city centre. Increasingly, the distance between place of work and residence was increasing steadily. It was at this point that Johannesburg differs from Western cities which underwent the industrial revolution. It has been noted that while Engels and others had described the deplorable conditions of the urban proletariat, they had still continued to reside and work within the immediate bounds of the "walking city". The Johannesburg condition was one whereby the proletariat spent a significant proportion of its income on daily transport requirements.

The Zuid Afrikaansche Republiek agreed to recognise the original concession granted to the City and Suburban Tramway Company. The tracks were excavated and missing portions relaid. New horses were purchased after the military refused to reinstate the company. The tramway services resumed from Market Square to Fordsburg and Wolhuter. The service to Belgravia commenced shortly after this.

The international experience, particularly since the 1870's towards counteracted the problem of a dispersed urban population by means of a horse-drawn tram service within the inner city. However, the introduction of electricity revolutionised public



MARKET STREET C.1907

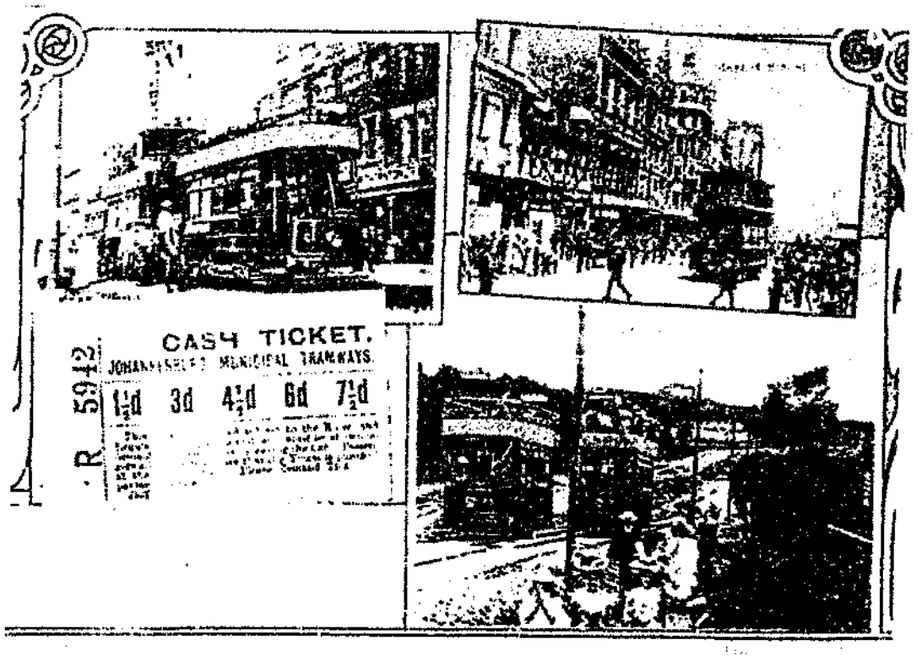
CENTRAL AREA C. 1906 (SPIT 1976).

transport. Many industrial cities throughout the world had by the 1890's introduced the electric tram or trolley. It was hoped, that the significant impacts which the electric tram had internationally could be replicated in Johannesburg. The milestone to shift towards electric tramways in Johannesburg occurred in 1903, when it was accepted by council to establish and operate electric tramways. Of relevance to this study, several of the proposals related to the tramways are highlighted:

- From Market Street, through Eloff and Noord Streets, joining the route of Market Street to Goldreich Street at Twist Street.
- From Harrison Street, through Bree and Marais Streets, terminating at the Newtown railway crossing (Viljoen Street).
- Through Jeppe Street, joining the tracks in Harrison and Troye Streets (Spit 1976, p.21-22).

The Johannesburg cabbies played a role, albeit minor in the decline in Johannesburg's urban transport until World War 1. Van Onselen (1982, p.172) noted that from the late 1880's onwards, a part of Johannesburg's growing transports requirements were met through private enterprise. The cab drivers became identifiable with common class interests. Having formed the Cab Owners' Association, they began demanding improved roads and cab ranks within their area of operation, namely that of a three mile radius of Market Square.

Segregated action against black cabby drivers was officially noted in 1897 when it was reported in the press that they be refused licences to operate. However, despite white hostility and lack of clarity regarding their legal status the black cabbies continued to operate until the advent of British rule in the Transvaal (ibid., p.173). The coloured cabbies of Johannesburg had preferential treatment to their black counterparts allegedly due to their knowledge of horses and civility to their superiors, presumably white.



A COMMERCIAL POSTCARD OF 1906 (SPIT 1976).

After the establishment of the railway in 1892 and 1895, there was an increasing need for intra-city transport, fulfilled by Johannesburg cabbies. The cabbies were then faced with a series of devastating blows including the extension of the tram lines by twenty-five percent in 1896, the increasing popularity of the bicycle by the working class, and higher prices for horses and forage (van Onselen 1982, p.175).

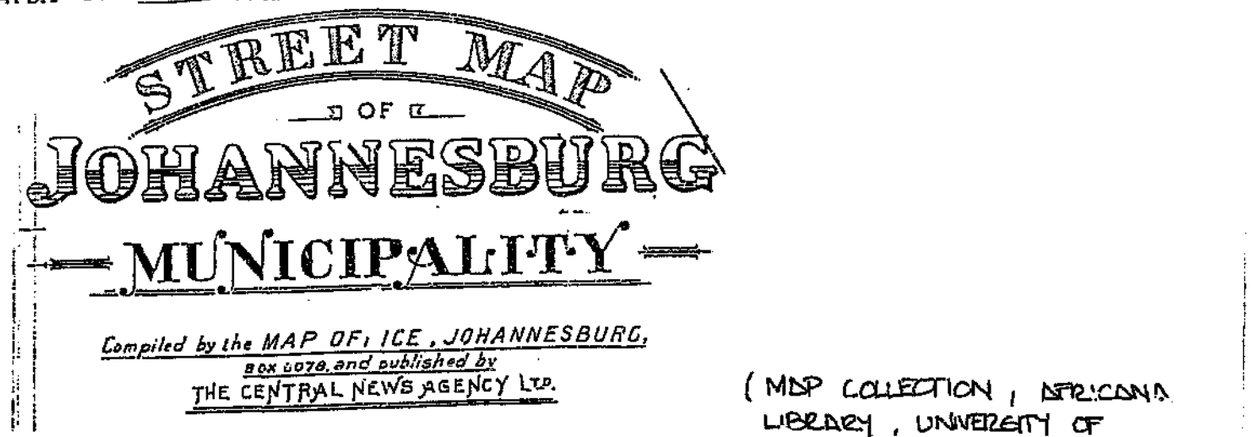
The effects of the electric tramway did indicate an increase in the number of passengers from three and a half million in 1904-05, to four and a half million in 1906-07, by 1914, in excess of thirty million were utilising the system annually.

At the time of the introduction of the electric tramways, plans were drawn for a Radial Route Scheme as an extension of the central network. According to Spit (1976, p.27) this scheme

> *"provided for a complete circle of routes radiating from the city and covering the suburbs in such a fashion that no person lived more than 1/3 mile from a tramway route".*

This inner network was seen to form the basis of future extensions to outer areas, although in practice this did not occur fully. Of particular reference to this study, is the historical background to the eastern suburbs' routes. Due largely to the topographical nature of the eastern suburbs their shape is that of a trident. This trident consists of three valleys, bounded by the Observatory ridge and the SATS mainline. In 1906, these three valleys were controlled by three companies which were responsible for the sale of land and negotiations for service provision with the local authority. The Malvern Estates Company, the Kensington Township Company, and the Bezuidenhout Valley Township Company.

> *"each wished its suburb to be served by tramways and undertook to supply capital for the construction of track and to provide a guarantee covering the municipality against losses"* (Spit 1976, p.29).



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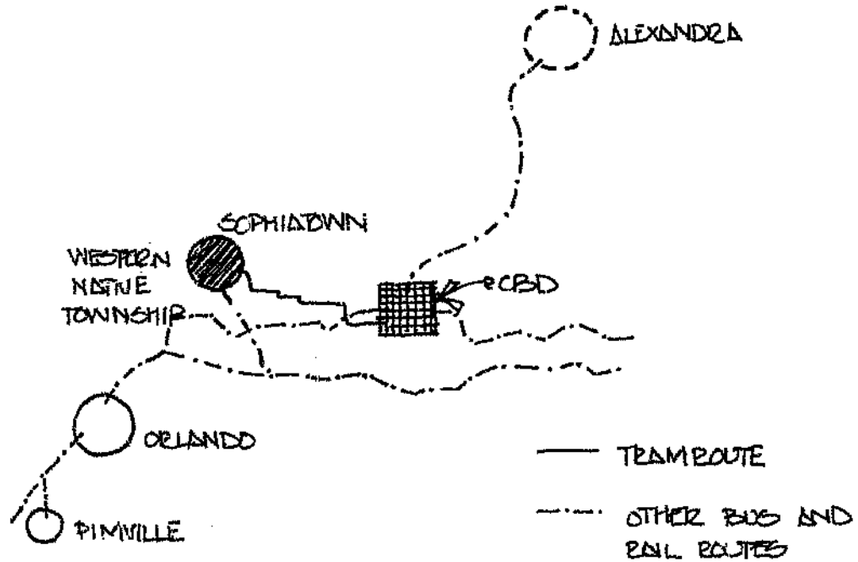
The problem arose when all the land within these suburbs had been sold off, leaving the local authority to provide lacking amenities.

An issue which has direct pertinence to the current debate regarding the pilot route proposed for a light rail system, is the continued choice of Main Street. At the turn of the century, there was a debate between Mordey and Dawbarn, and the majority of affected residents, as to the choice between Main and Commissioner Streets. The former, who had proposed the Radial Route Scheme, indicated that Main Street would be preferable in terms of the constraints faced on Commissioner Street. Reasons included that Commissioner Street would involve additional curbs affecting wear on wheels and tracks, and that an under-or over-bridge would need to be constructed at the Jeppe railway. This reasoning may be questioned in light of the fact that Commissioner Street is wide and one of the few main east-west through routes. Furthermore, it may be argued that the benefits of providing a tram system along a major movement line, would have easily paid for the costs of constructing a bridge.

The north-eastern routes are also of importance. The Twist Street route commenced in 1906, extending northwards from Kotze Street to East Avenue, culminating at the final terminus in Louis Botha Avenue in 1907. The Yeoville route began at the Kotze Street terminus, running eastward. Spit (1976, p.28) notes that due to the rather cramped street layout, the route necessitated several sharp turns. The road width in Hillbrow also necessitated the construction of single tracks in different streets for different directions. The area through which this route ran was characterised as a flat-building area, as is the current situation. Since the opening of the line in 1906, the double track into Berea always carried heavy traffic, which increased in later years as it traversed the Hillbrow-Berea-Bellevue area.



TRANSPORT ROUTES AND AFRICAN TOWNSHIPS IN JOHANNESBURG (AFTER PIRIE 1986).

Separation ...

The inherently racist approach within the tramway service appears to have begun in 1911, with the opening of a special route from the Western Native Township to Diagonal Street. This is somewhat contradicted by Pirie (1986, p.42) in noting that

> *"In 1920, the new Western Native Township was linked to the city by a single-track tram service although costing users half the Klipspruit fare, was nonetheless reported to be about a tenth of individual wages. There was an hourly service excepting between 17.00 h and 08.45 h on weekdays and after 21.00 h on Saturdays".*

The tram service did not vary from the approach to African transport, particularly with respect to the economic subsidisation required to ensure the operation of the service. In the case of the Western Native Township, the public tramways

> *"were designed "to encourage the (Africans) to move from the backyards and slum properties and occupy the houses provided for them" "* (Pirie 1986, p.43).

The service to the Western Native Township made use of rebuilt cars. Many problems were encountered on this line, including the European war, inter-departmental disputes between the Tramways Committee and the Parks and Estates Committee regarding the payment for the conversion of cars for ` native service' use.

The necessity for racial segregation for routes and cars was clearly indicated in terms of a Council resolution stating that:

1 Special cars only for natives should operate where there was sufficient traffic to warrant this.

2 In the event of lesser demand, single deck trailers should be run coupled to European service cars to cater for native passengers.

3 Native passengers travelling as servants with white passengers should sit on balconies at either end of the upper deck (Spit 1976, p.48).

Further racial differentiation was also indicated, in that

> *"on native cars, Asiatics should occupy the inside and the Kaffirs the upper deck, or vice versa. Both types of native cars were also to carry parcels"* (Spit 1976, p.48).

The situation came to a head in 1914 with increasing requests from non-Europeans to travel on ordinary service cars, culminating in a court case (Williams and Adendorff v. Johannesburg Town Council, August 10, 1914). The result was that non-Europeans could gain access to all cars. However, the Tramways and Lighting Company intended to enforce segregation via the use of notices inside the cars. This idea was scrapped after it was hinted that the Government disapproved of such an idea.

The tramways were discriminatory in many other respects. Mobility, especially for African domestic servants in the 'white' suburbs, was precluded because the tram service was racially segregated. The result was that expensive taxi travel was often the only other available option. The need for the use of the city and suburban trams by such people became apparent, particularly between 1913 and the 1930s, as

> *"concessions were sought from the municipal tramways for 'decent and deserving Africans', for those "whose habits of life are of a European standard"* (Pirie 1986, p. 43).

Fare discrepancies also existed between the domestic servant an his 'master'. For instance, while the 'master' would have paid 3d for a trip, the domestic servant may

have had to pay an amount varying from 2 to 4s for the same trip. Domestic servants often had to endure poor weather conditions in that they were forced to sit on top of an open double decker tram car.

Due to inadequate service and retail facilities, high costs of goods, and the lack of recreation and community facilities in areas where Africans resided, the issue of mobility became more critical. Pirie (1986, p.43) notes that

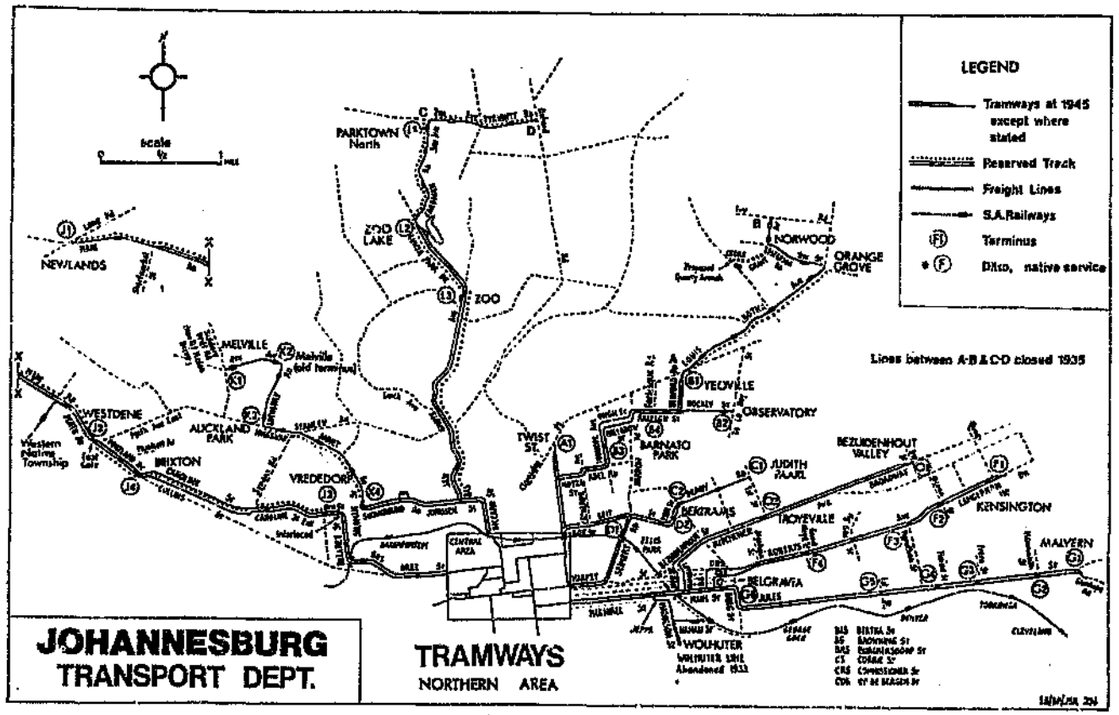
> *"Lack of mobility in the face of restrictions on the suburban dispersal and time-scheduling of social/recreational facilities for Africans compounded the inaccessibility of destinations".*

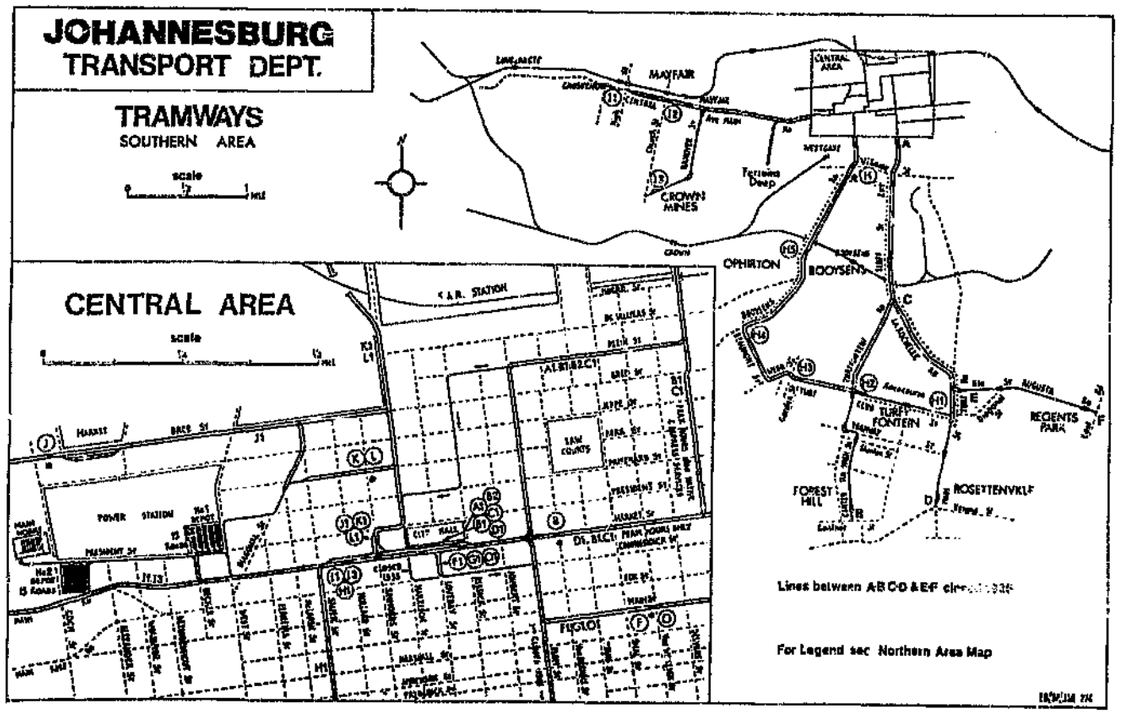
This segment of the population were forced to travel to the city centre to utilise recreation facilities or attend community or religious occasions, made difficult by limited time constraints, distance from the city centre, and high taxi fares to commute there.

The areas of Martindale, Sophiatown and Newclare, located adjacent to the Western Native Township, were under severe influx pressures in the 1930s. This in turn impacted on increasing transport demands.

> *"the municipal tram service ... (was) severely overcrowded ... (it) was reported to be inconveniently long and spasmodic, and the vehicles uncomfortable : seats had no backrests and there were no windowpanes ... Overall, the disadvantages of tram ... transport meant that many Africans diverted to buses"* (Pirie 1986, p.44).

The treatment received by Africans who used the trams was poor. They were given little consideration and were addressed in an negative manner. There were suggestions that





(SPIT 1976).

> *"white drivers and conductors resented their posting to African trams and gave vent to their feelings by being "overbearing and curt in demanding fares" "* (Pirie 1986, p.45).

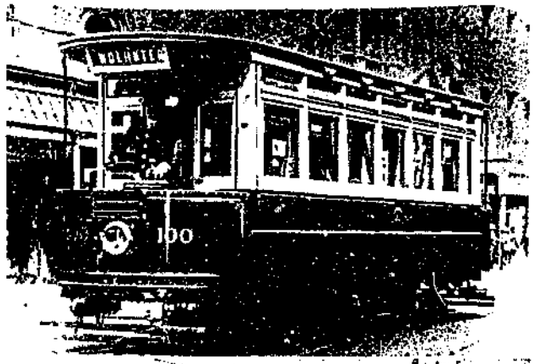
On completion of the City Hall in 1915, schemes had been proposed for the tramways system to avoid this building entirely,

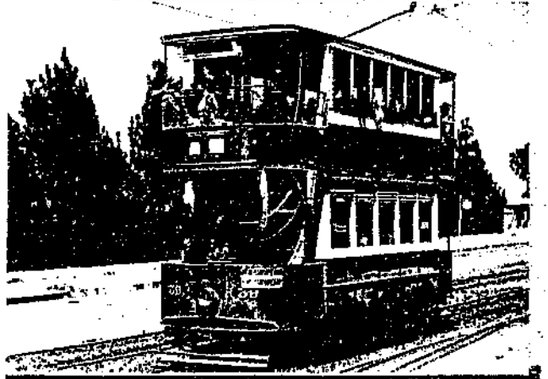
> *"so that the citizens could admire its lofty elevation unsullied by anything so mundane as a tram. These scheme (sic) would have involved loops in either Pritchard or President Streets, the narrowness of the streets made them impracticable and the trams stayed where they were"* (Spit 1976, p.49).

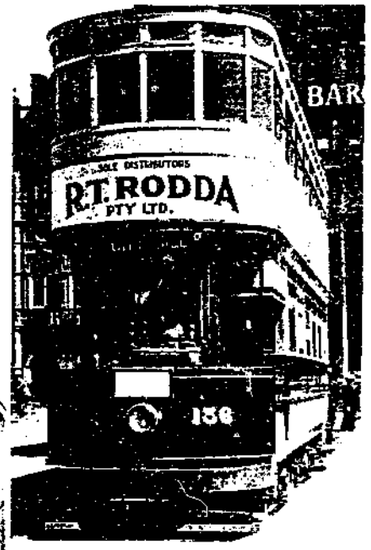
In the early 1930's a series of problems had come to the fore, including problems regarding service inefficiencies, poor perceptions in terms of public transport, and mounting annual losses. The Spencer Commission of 1934 was set up to evaluate the future of the tramway system. Several conclusions were made in this report, including that the population density was too low, at an average density of seven people per acre, as opposed to an average population density in Britain at the time of ten persons per acre. The natural topology of the ridges was viewed as problematic in forcing indirect routes to be taken, and combined with the altitude factor, made for inefficient diesel usage. The report suggested changes in both routes and methods of transport, to be determined based on a specific route. A further recommendation was made that immediate establishment of a service of native cars on all important routes, and that good rolling stock be utilised. Subject to the Spencer Commission, the tramways were rejuvenated for the next five years, supported by a seven hundred and fifty thousand pound contribution made by the City Council.

The slow death begins ...

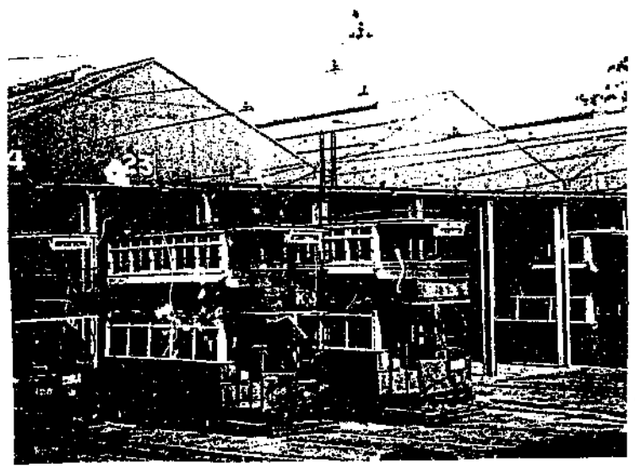
The problems facing the tramways never really abated. Up to the 1950's, the tramways faced pressure for its abandonment from the media, a series of accidents,







A RANGE OF TRAMCAR TYPES OVER THE YEARS...



← TRAM DEPOT c. 1946 (SPIT 1976).

some of which resulted in deaths and court cases, operating and maintenance difficulties during the Second World War and finally the emergence of South Africa into a period of industrial growth and expansion. Associated with this was raised standards of living, enabling more people to own a private motor car. There was an increasing move towards suburban node development, particularly in terms of shopping and office facilities.

From 1950 to the termination of tramway services, a series of problems were encountered, such as a strong anti-tram campaign from the press deteriorating service standards, severe delays, the emergence of Northern Bus Services Ltd. to serve whites in the municipal area, and further accidents.

Until the demise of the tramways.

The decline of the tramway coincided with the 1948 Traffic Plan drawn up by the City Council, which included a program to eliminate the tram. For instance, on arterial routes such as Jan Smuts Avenue, Main Road and Booysens Road, it was proposed that by removing the trucks, the carriageways could be widened without having to undergo such a costly process of land expropriation and acquisition.

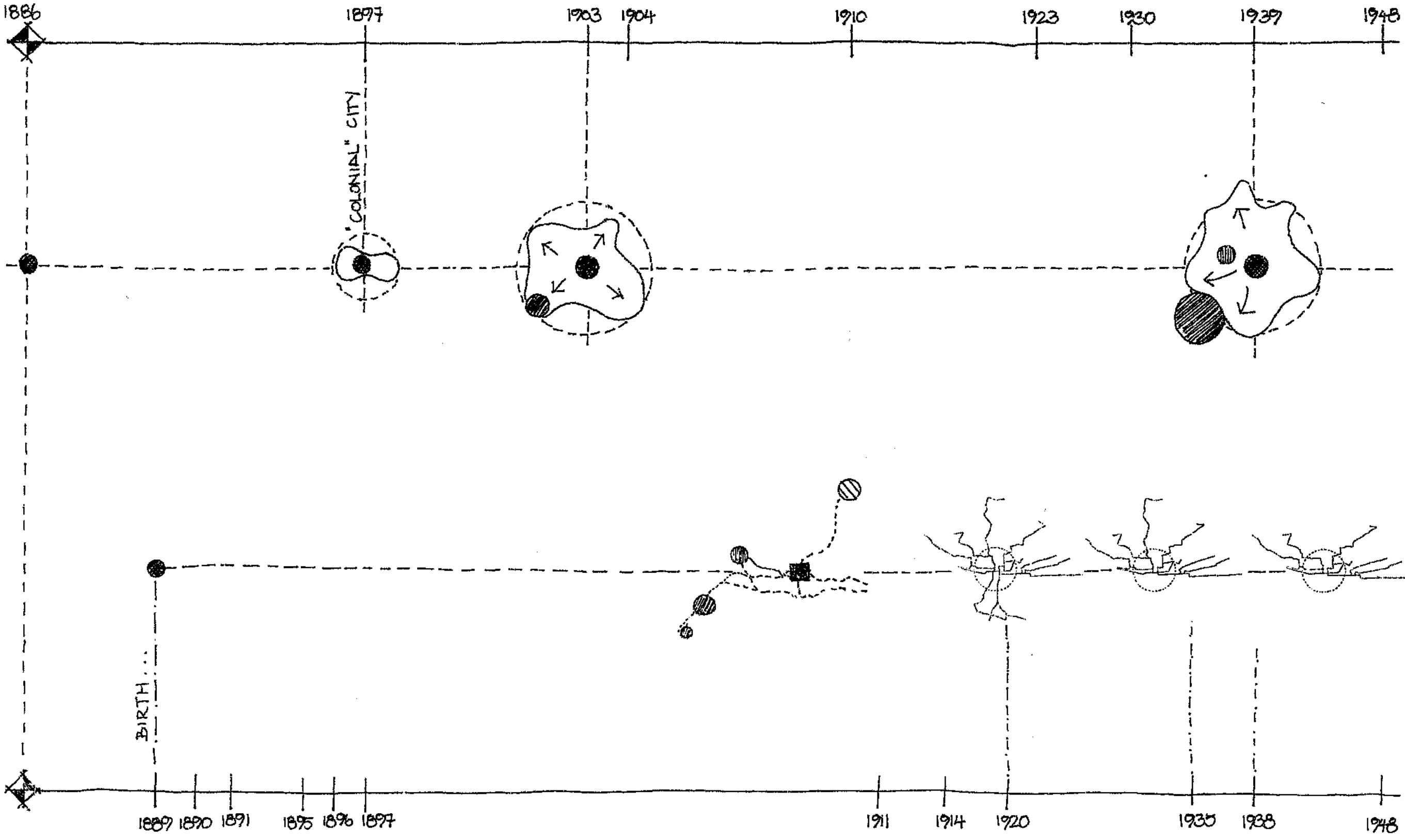
"When the end came on March 18, 1961, it came quietly" (Spit 1976,78).

By 1963, all the tracks had been covered by tarmac, and the tracks sold off.

2.3.2 Renaissance of the tramways ?

As early as 1969, the City Council identified the need for a rail rapid transit system. At the Rand Show of that year, a model of an underground station was put on display. In 1970, the Greater Johannesburg Study report indicated that an underground system be considered for the city. The report recommended that the London Underground system be studied as part of a feasibility study. This was reported in 1971, but no further action was taken. The proposal received

THE MOULDING OF THE CITY . . .



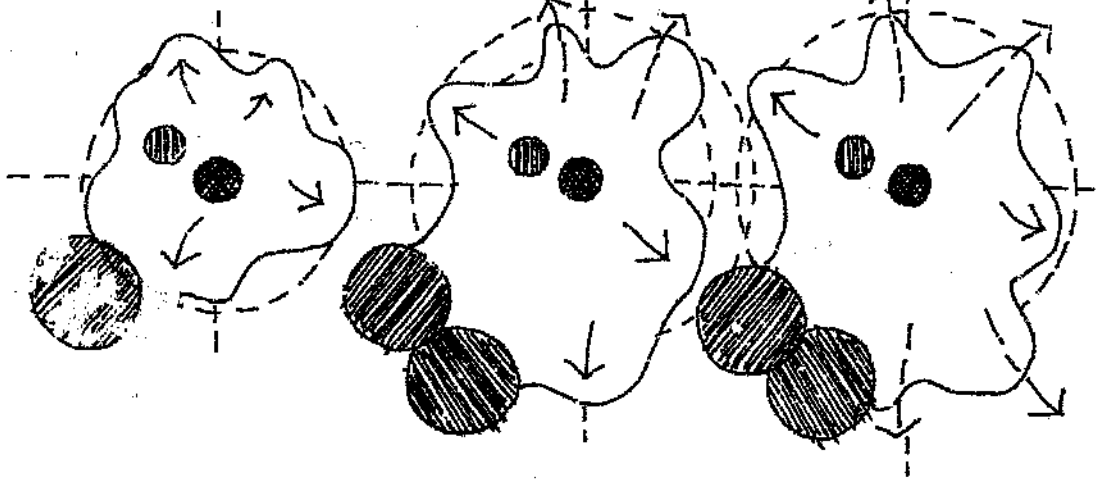
TRAMWAY EVOLUTION . . .

APARTHEID CITY 1948 - 1994

DEMOCRACY!

1948 — 1958 — 1969 1970 — 1983 — 1994 ..... NEO-APARTHEID CITY

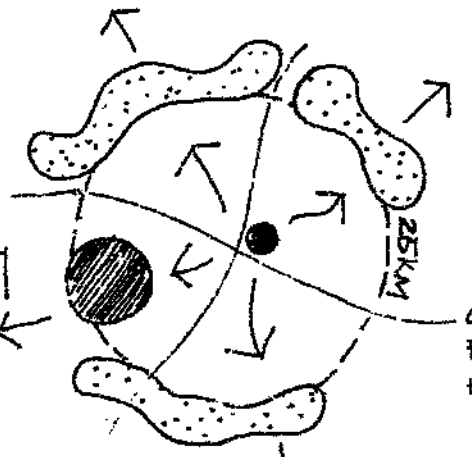
APARTHEID CITY



OPTIONS

FUTURE

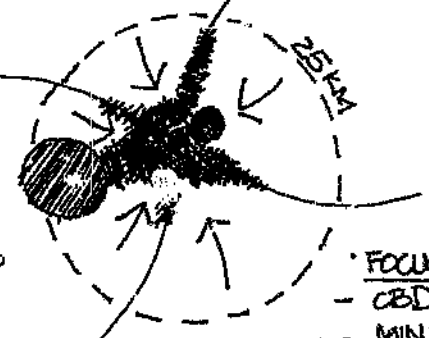
CENTRIFUGAL: UNASSEMBLED



CURRENT PROPOSALS FOR LOW COST HOUSING SITES

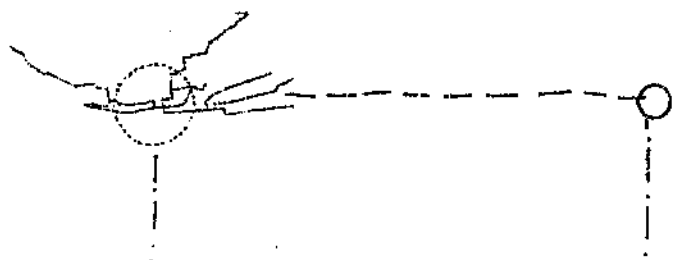
CENTRIPETAL: ASSEMBLED

KNIT INWARDS ALONG MASOR MOVEMENT LINES



· FOCUS ON:
- CBD
- MINING LAND
- VACANT / UNDERUTILISED LAND CLOSE TO CORE

... TOWARDS COMPACTING AND INTEGRATING THE CITY

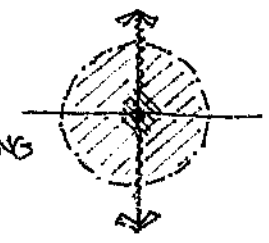


DEMISE!

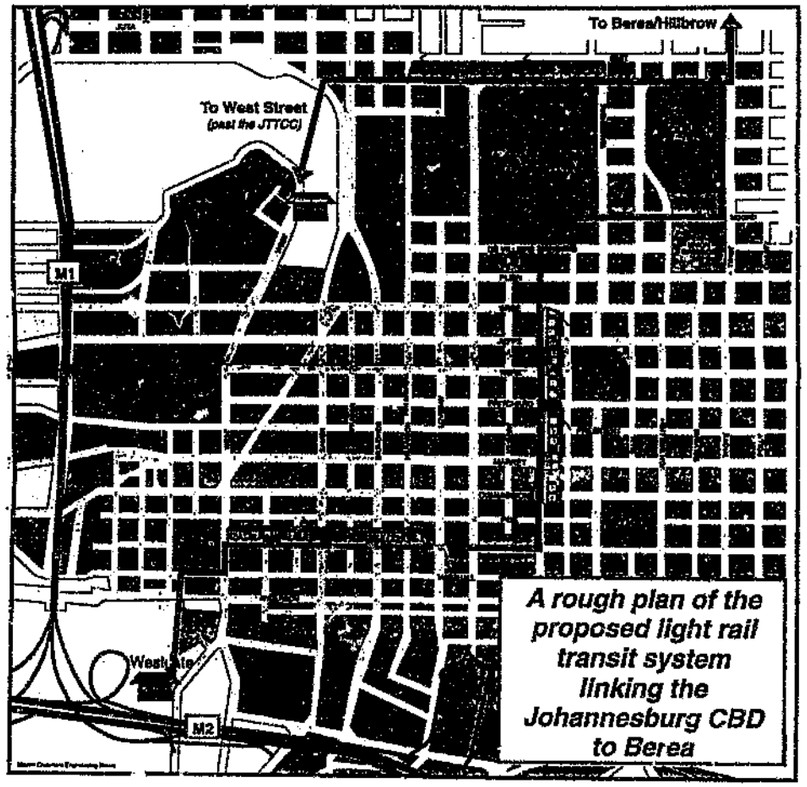
1948 — 1961 — 1969

RENAISSANCE ?

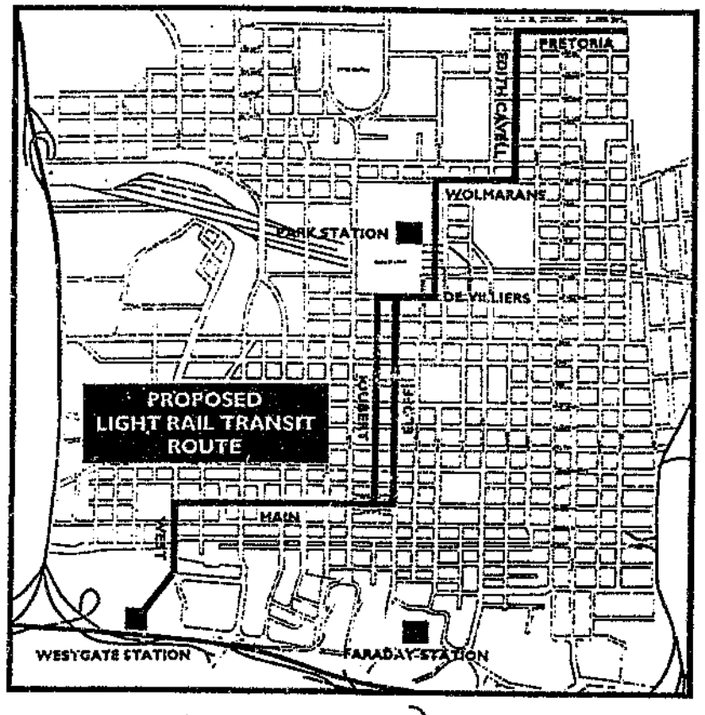
THE ROLE OF RAPID TRANSIT IN RESTRUCTURING AN RE-ASSEMBLING ...



TOWARDS RAPID TRANSIT INTERVENTION ...



(ENGINEERING NEWS 1993).



(CONTACT 1994)

wide-ranging publicity, and subject to public opinion, the Greater Johannesburg Transportation Study was never approved.

The issue of a mass transit system again surfaced in 1983, with the Minister of Transport setting up another committee to investigate the need for such a system. In the same year, a report was submitted indicating a high-capacity light rail transit system, partly on surface, partly above ground (on a structure), and partly beneath ground level, would be suitable. The estimated cost was approximately R1 608 million.

A decade later, media reports again begun covering the issue of a potential light rail system for Johannesburg. Martin Creamer's Engineering News (1993) reported that

> *"R200-million light-rail transit (LRT) system linking Berea and Hillbrow with the Johannesburg CBD could be given the go-ahead in January next year".*

This was substantiated in January 1994, when the Johannesburg City Council recommended that the principle of a light rail system be reaffirmed, and that a starter line be investigated in the inner city area (Ordinary meeting of Council, 25 January, 1994, p.82).

The critical question to be raised is whether a revived system will contribute to the perpetuation of the current neo-apartheid form and urban sprawl, as did the previous tramway system, or rather reverse this trend.

2.4 CONCLUSIONS AND INFERENCES

The time has come to move into a new mode in thinking regarding city building and rebuilding. The era of the car and freeways as the foundation for transport is at the end of the road. This viewpoint is substantiated by Newman (in Allen, 1994) who states that while the old-car dominated transport system does not have momentum left, the tide is turning and that the cities which continue to build freeways, are likely

to regret such actions. At the recent Global Forum '94 on Cities and Sustainable Development, it emerged that traffic-demand management and public transport should be considered together with community ideals, as well as promote pedestrian and bicycle access opportunities.

Increasingly, transportation is viewed as an integral component to the environmental debate, from both a problem and an opportunity aspect. According to Elkin and McLaren (1991, p.49)

> *"A transport system can be developed which would make life more enjoyable through meeting travel needs while lowering the risk and fear of road accidents, limiting damage to the environment, conserving scarce resources, giving value for money, extending opportunities for groups in the population with low personal mobility, and generally promoting healthy life-styles".*

These range of benefits attributed to urban transportation may provide the basis for sustainable urban development, enabling access to urban opportunities, while maximising resultant negative externalities.

Public transportation , in general terms, is viewed as one of the key intervention areas in redressing the density profile occurring in the Johannesburg metropolitan area (as identified by the World Bank in 1992) by means of a centripetal approach to urban restructuring. This implies `opening up' the city, encouraging people to once again re-establish themselves in the inner city.

This chapter has informed the criteria for evaluation for the selection of relevant international studies in the field of rapid transit. The process undertaken was to consider the local, national and international problems facing the city in respect of the impact of private transport usage on the city form and functioning.

It is argued that a rapid transport system may be an intervention which can play a catalytic restructuring role in an overall framework of urban reconstruction. This form

of public transport, should in taking into account the past failures of the tramway system, the need to redress spatial inequities, and attack environmental degradation resultant of a private transport philosophy.

The tramway system in Johannesburg, had played a contributing role in reinforcing spatial differentiation of the city. Segregationist policies together with technological and socio-economic, facilitated urban sprawl and a dying core area. Both colonial and apartheid policies forced the poor out of the city, thus distorting inner city residential thresholds. Increasing proportions of income thus had to be put towards long distance travelling fares. On the other hand, the minority urban bourgeois were coaxed out further towards the periphery. The urban form began resembling multi-nuclear model, with suburban centres serving their interests.

The actual design interventions are to be elaborated on in the framework for catalytic restructuring, utilising rapid transit.

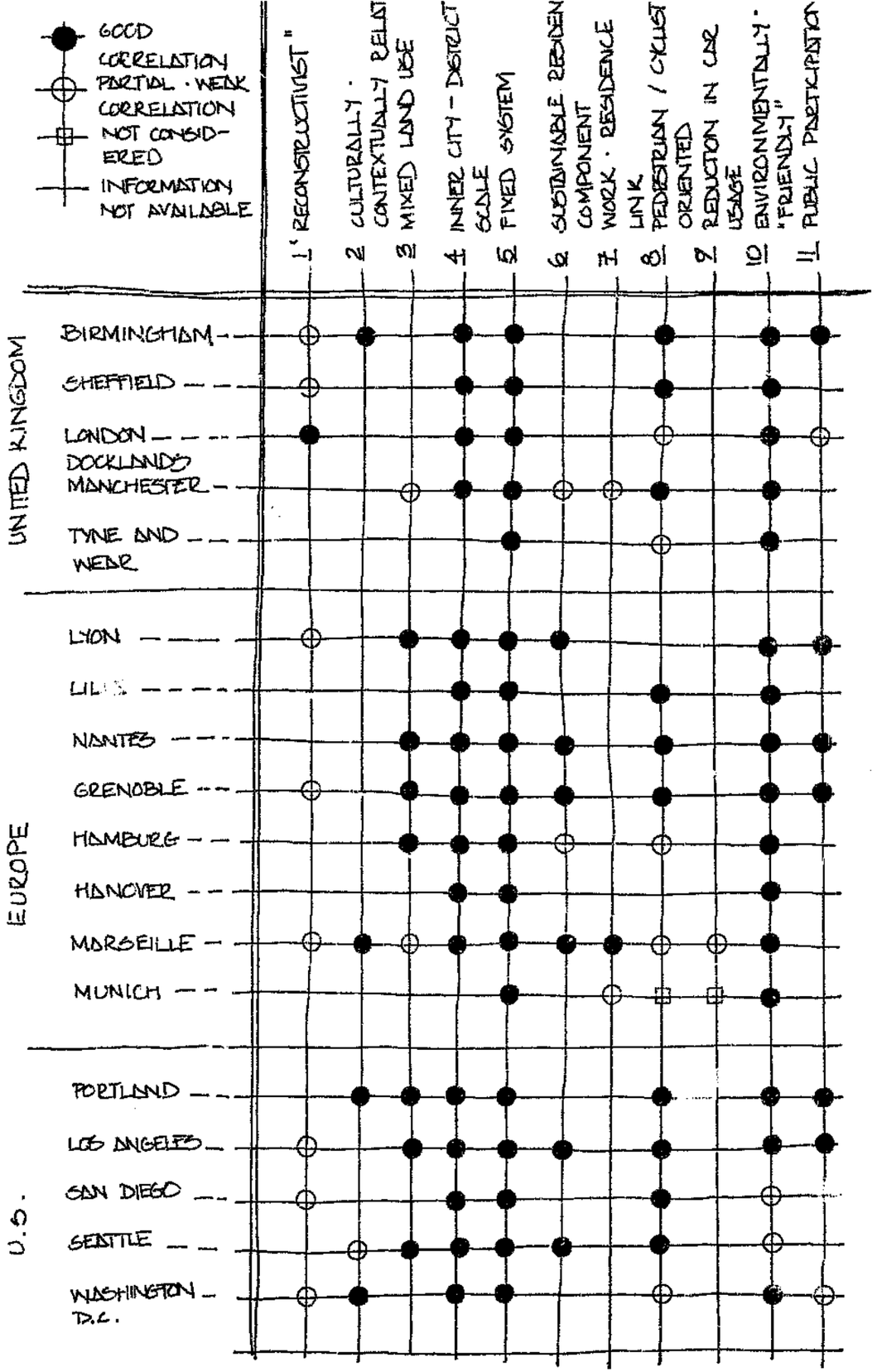
Based on the overview of the history of the tramways in Johannesburg, and the requirements to reconstruct the neo-apartheid city, several attributes of a mass public rapid transit system may be identified :

- Reconstruction or redevelopment of the urban fabric for underlying socio-political reasons.
- The intervention is culturally related and conforms to contextual parameters.
- Sustainable, mixed land use areas able to support a rapid transport system.
- Focus on inner city-district scale, in terms of catalytic impacts.
- The system is a fixed investment.
- Introduction of affordable and sustainable residential environments.

- Reducing the work : residence distance.
- Promoting the pedestrian and cyclist as key elements in a 'walkable' city.
- Subordinating the car's role in the urban transport equation.
- Utilising technology which ensures the system conforms to Agenda 21 and related environmental approaches.
- The process of a rapid transit intervention as fundamentally people-driven and accepted by both users and non-users alike.

three

international precedent



3.1 AIMS

Based on the approach by Rapoport (1990), international historical precedence is to be evaluated in this chapter. The starting premise is the selection of applicable case studies, axiomatic to the South African city context. Subsequent to the selection of relevant case studies is a brief overview of salient points relating to rapid transport intervention in particular cities. Allowance is made for general points of applicability to the reconstruction of the South African city, and in terms of the catalytic effects which a rapid transit system may have on the built form.

The case studies are furthermore discussed in terms of major geographical categories, including Europe, the United Kingdom, the United States, Asia and Australia. Africa is not considered herein due to the fact that rapid transit, particularly in the form of light rail, has not been implemented in any African city.

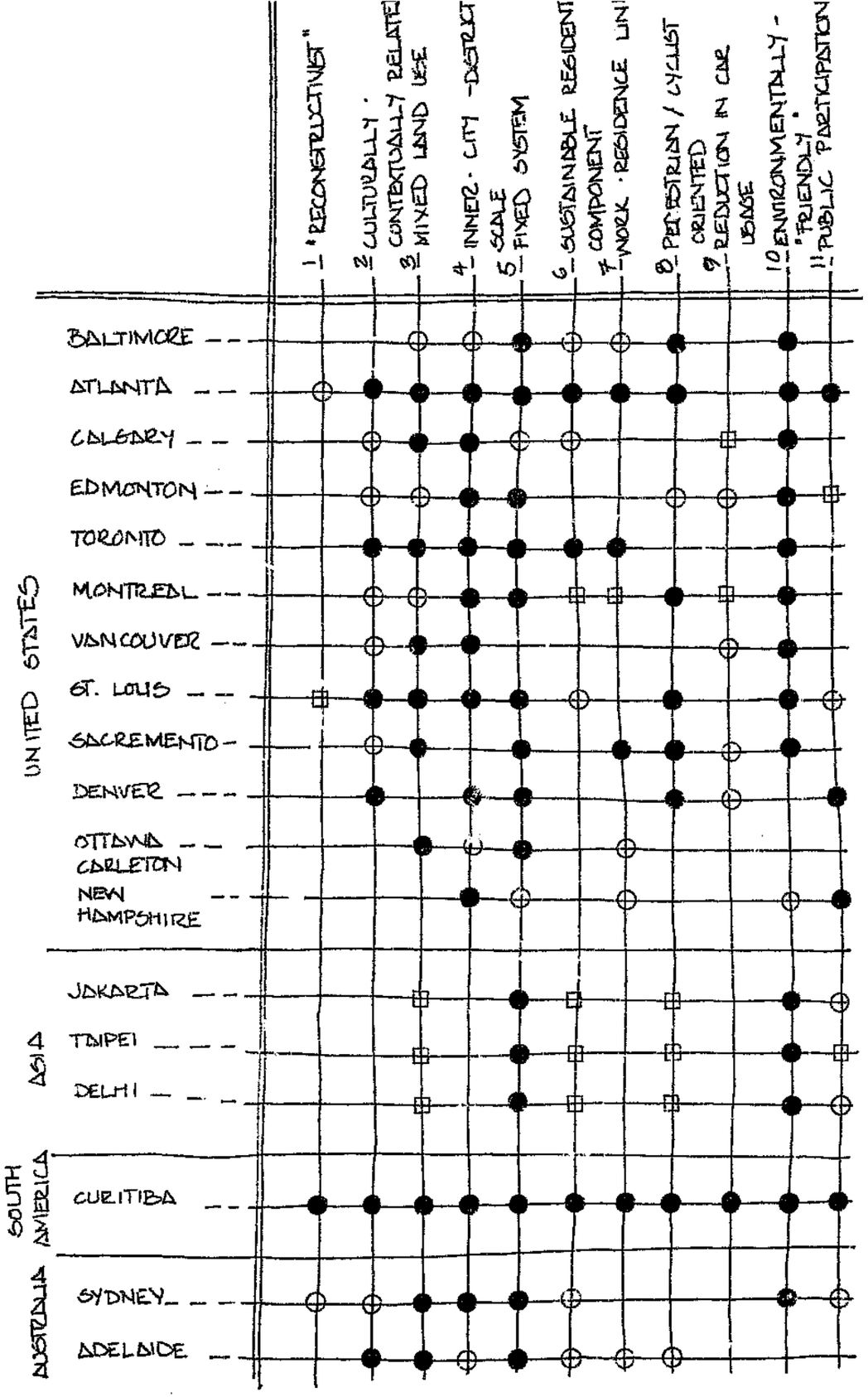
3.2 SELECTION AND EVALUATION OF CASE STUDIES

- *United Kingdom*

Based on the criteria selected in the previous chapter there is a good correlation between the attributes of a scale of inner city/district, fixed system, an emphasis on pedestrians or cyclists, environment friendly and the cities of Birmingham, Sheffield, Manchester and to a lesser degree the London Docklands system. There were weaknesses, or lack of attention with regard to socio- political motivations in the process of urban renewal/reconstruction, cultural relationships, of a sustainable nature in introducing affordable and sustainable land use in restricting the car, and in involving the public.

- *Europe*

There appears to be a stronger correlation of most of the cities evaluated in terms of criteria 3,4,5 and 6, 10 and 11 and to a lesser degree 8. There also appears to be a



stronger emphasis on publicly driven processes in the cities of Lyon, Nantes and Grenoble. As in the case of the United Kingdom there is an obvious weakness in terms of the importance of symbolism and relating the light rail system to the particular culture. Lyon, Nantes, Grenoble and Hamburg to an extent are significant to a point of view of promoting a residential component congruent to the light rail system.

- *United States and Canada*

The evaluation of cities in the United States and Canada indicates that even greater correlation with the criteria. Cities providing a higher percentage of correlation include Portland, Los Angeles, San Diego, Seattle, Atlanta, Toronto and St Louis. A significant attempt was made at establishing links between cultural symbolism and the light rail system in the cities of Washington D.C., Atlanta, Toronto and St Louis. While not directly oriented towards reconstruction for socio - political reasons there was a degree of correlation in terms of urban redevelopment in Los Angeles, San Diego, Washington DC and Atlanta. Edmonton and Vancouver indicate a weak correlation of attempts to reduce car dependency in the inner city.

- *Asia*

The cities of Jakarta, Taipei and Delhi indicate a strong bias towards transportation planning as underlying rational. Only in the areas of the system being fixed, and environmentally friendly is there correlation. Most other criteria were not considered.

- *South America*

Curitiba scores significantly in all respects. There is clearly a strong correlation with criteria 1 to 11.

- *Australia*

Sydney shows strong correlation in terms of criteria 3,4,5 and 10 with weaker correlations in terms of 1,2,6 and 11.

3.3 UNITED KINGDOM

3.3.1 Birmingham

> *"Birmingham is the transport city par excellence"* (Wenban-Smith et al 1990, p.11)

The origins of the Birmingham light rail system began in the mid -1980's when the Birmingham City Council (BCC) resumed responsibility for transport planning in the area. There was a need for reassessment of transport policies, specifically in terms of three factors :

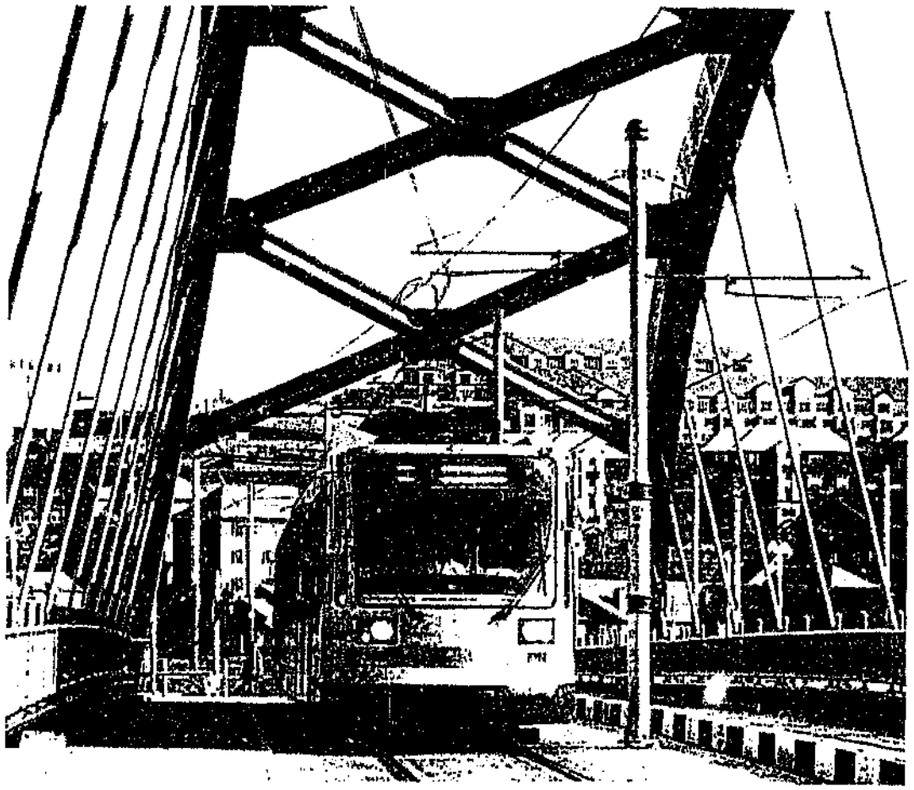
- There was political tension a LRT scheme, on the one hand, and a road scheme on the other, which

  > *"exposed the lack of a clear political position from which to strike a balance between the wider public good and the outrage of well- mobilised local groups of those adversely affected"* (ibid., p.11).

- There was a discrepancy in terms of BCC's thinking to create a European centre in Birmingham, and to deal with the poor quality of life in the city centre.

- The proposed network of LRT routes by the Passenger Transport Authority (PTA) indicated the need to establish political support for the development of the system (ibid., pp.11-12).

There are several salient points which are relevant :



SHEFFIELD SUPERTRAM (NEW CIVIL ENGINEERING 1994).

- The transport strategy is one aspect of a broader urban policy stance.

- The transport policy is viewed within a 20-30 year time span in order to consider urban form implications, as well as socio- economic organisation.

- The approach needs to have a strong political basis and community support so as to survive inevitable crises (ibid., p.12).

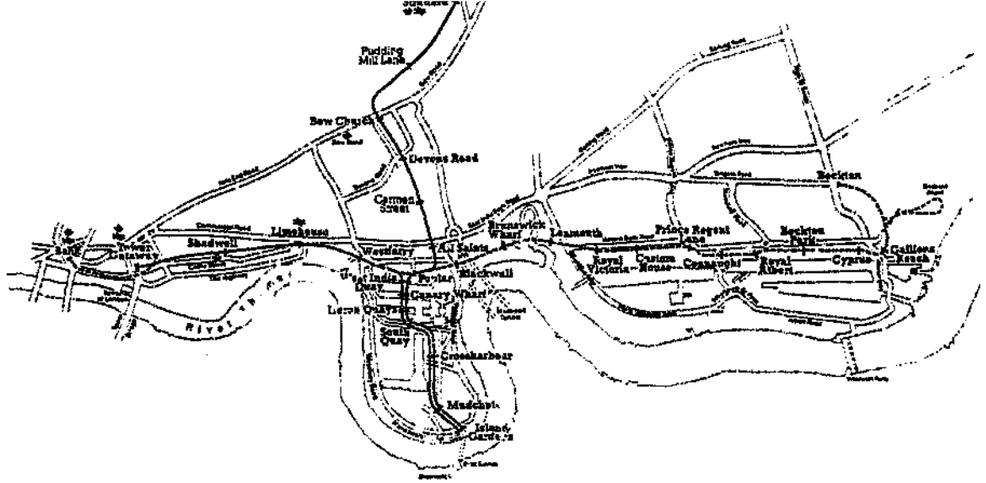
3.3.2 Sheffield Supertram

The Sheffield Supertram, proposed by the South Yorkshire PTE, opened earlier this year. It marked a watershed in the financing of modern day tram systems. The New Civil Engineer (1994, p.14) indicates that it is likely to be the last in the short lived breed of government funded schemes.

> *"The Department of Transport, sporting its new "up with private sector partnerships" hat, is fast changing the unofficial rules for light rail grant aid. And leaders of the long queue of schemes jostling for pole position for the Government green light will have little chance of success unless they can boast either cash, commitments from developers or a joint venture partnership with contractor and operator willing to fund much of the scheme's capital cost"* (ibid., p.14).

The scheme is also different from other British schemes in that existing roads as opposed to former rail lines are used. This has been a politically difficult scheme in that road oriented schemes were rejected in 1985 by local groups in Birmingham.

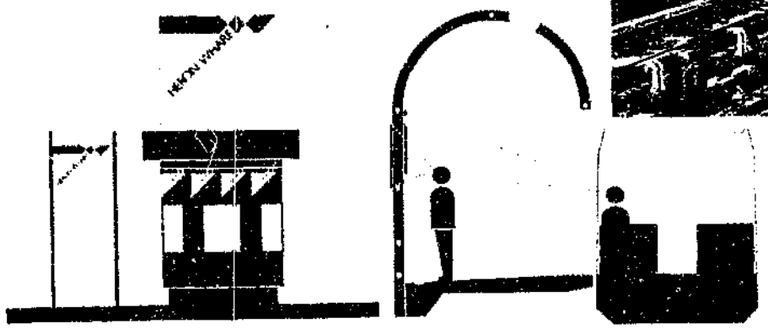
The scheme consists of two main lines, the first linking retail, commercial and leisure developments which are either in existence, under construction or still to be developed. This scheme relies on private capital investment. The second line is to follow an existing railway alignment. Warmsley and Perrett (1992, p.15) indicate



↑ LONDON DOCKLANDS

A TYPICAL STATION →

(RICHARDS 1990)



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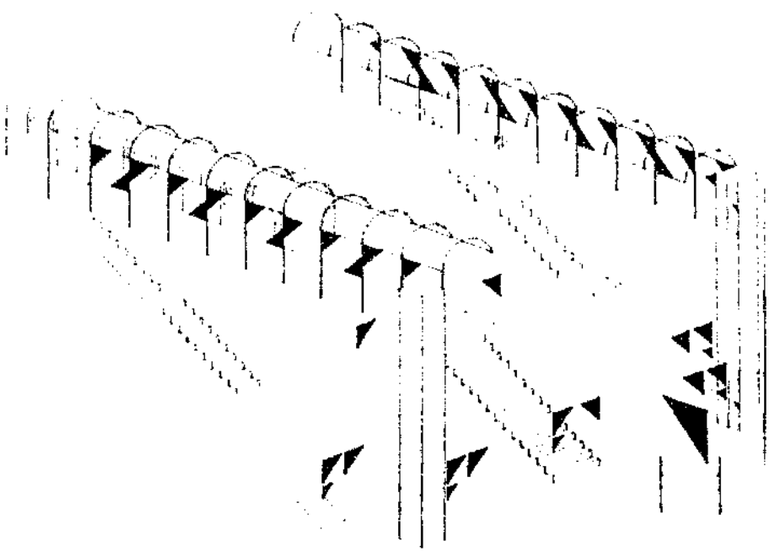
SIGNAGE AND GRAPHICS STRATEGY ADOPTED BY ARUP ASSOC. AND PENTAGRAM

(ARCHITECTURAL JOURNAL 1984).



that this route is considered by the City Council to be funded via enhanced land values.

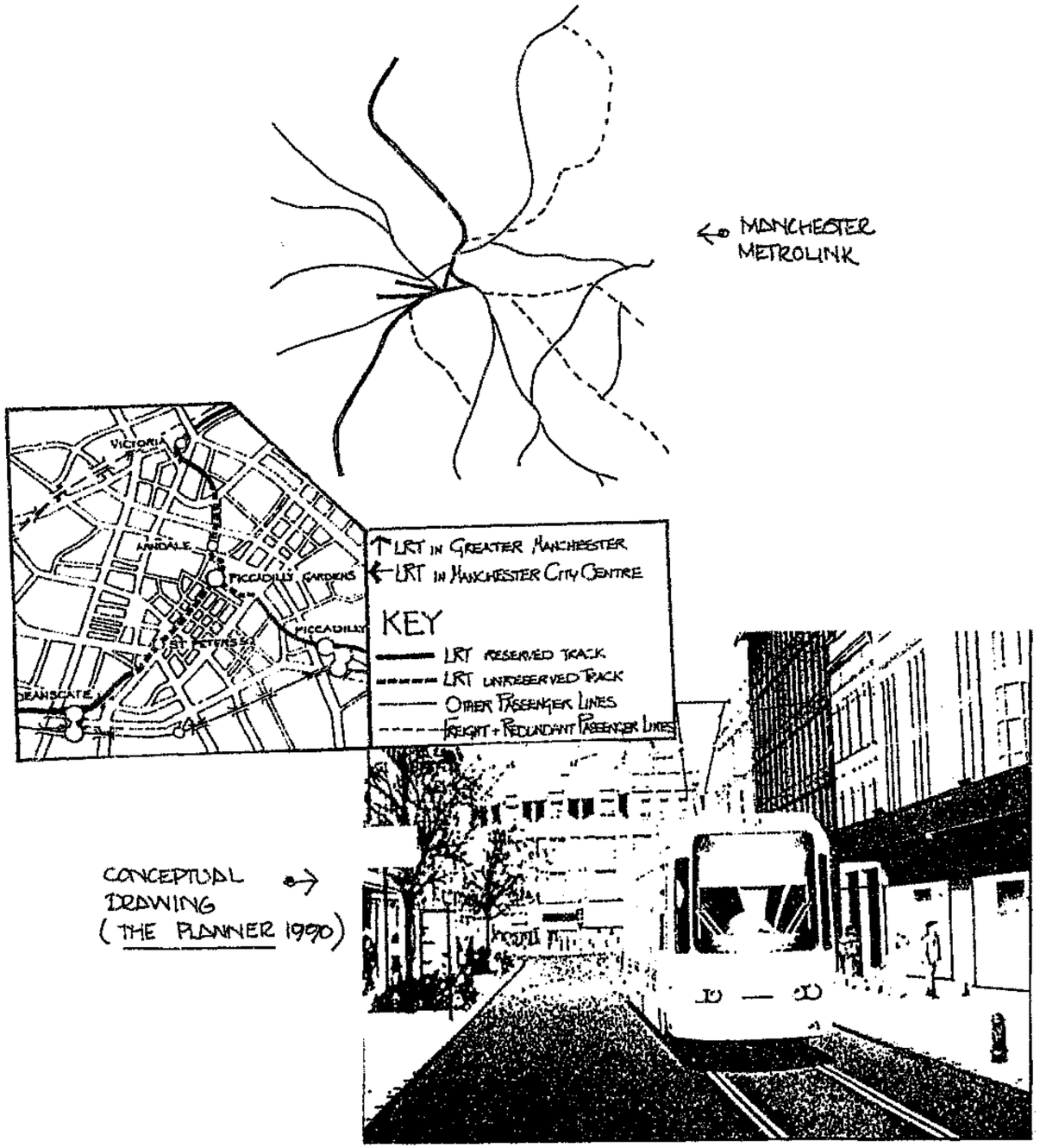
3.3.3 London Docklands

The London Docklands Light Railway (DLR), under the control of the London Regional Transport, was initiated as part of the broader London Docklands regeneration in 1981. In the same year the London Docklands Development Corporation (LDDC) commissioned the Docklands Rail Study to investigate transport solutions in the area. According to Richards (1990, p.127) initial proposals of extending the underground railway were anticipated to cost 325 million pounds, and were rejected by the Government as too costly. Other alternatives included a busway and light rail. The latter was accepted and built for 77 million pounds. Opened in 1987, the elevated system

> *"uses 8 km (5 miles) of existing railway right of way, on existing rail viaducts or at ground level, and 4 km (2-5 miles) of elevated new structure, crossing the dock basins. The trains are fully automated ... they carry 84 seated and 126 standing passengers, and operate at service speeds of 30 km/h (19 mph) at a 7 1/2 minute headway"* (ibid., p.127).

This capacity has proven to be totally inadequate. Another area of concern is that of the "design considerations". In 1984, three years prior to phase 1 being completed, it was reported that

> *"Arup Associates ... have not had any further instructions since April 1984. They hold what might well be called a 'watching brief' ... The 170 pages in three A3 reports, representing a year's intensive design development, were sent out as part of the documentation to the package dealers, but not as specifications on which to tender. It will be interesting to see how much of the Arup's - led proposals are taken on board"* (Hannay 1984, pp.23-26).



What this appears to indicate is the relegation of design to aesthetic and functional considerations, exclusive of transportation issues. Of concern is that the brief to Arup's did not include the issue of land values and uses.

3.3.4 Manchester Metrolink

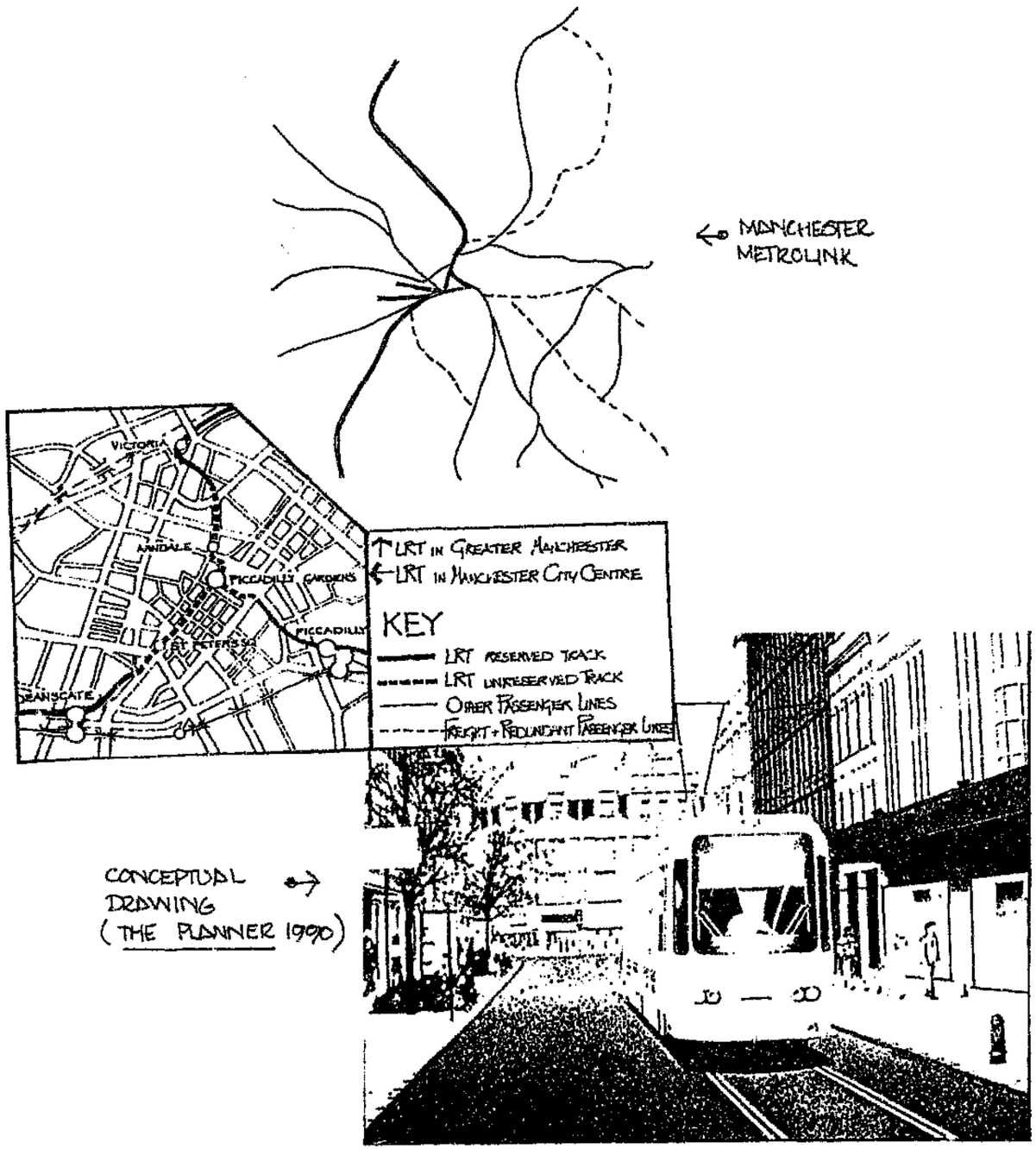
> *"Early on Monday April 27, 1992 Manchester Metrolink car No.1007, ... Deliberately bearing the number of the last tram that ran in Manchester in 1949 ... a light gray with dark gray and aquamarine-trim, Italian-made LRV ... burst through a banner heralding the revival of road-running rail transit in Britain"* (Mass Transit 1993, p.54).

One of the problems faced in Manchester has been the lack of connection between the main line railway stations of Victoria and Piccadilly. Over the past two decades a range of schemes have been proposed, but none has succeeded. Ultimately, the solution was seen to be light rail. Mass Transit (1993, pp.54-55) indicates that

> *"Metrolink is the most successful evolutionary development from a primordial soup of proposals to connect the strands of rails that terminate at the city's two main stations".*

A plus factor for Manchester is that the city is a vibrant transit-oriented core, surrounded by shopping districts. There also appears to be little competition from the motor vehicle. Furthermore, regional, commercial and recreational activities focus on the city (ibid., p.55).

As part of the bid for the 2 000 Olympics a variety of Metrolink routes were planned to service the Olympic stadium site.



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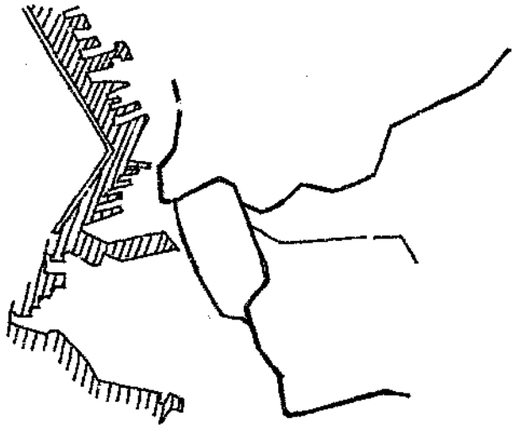
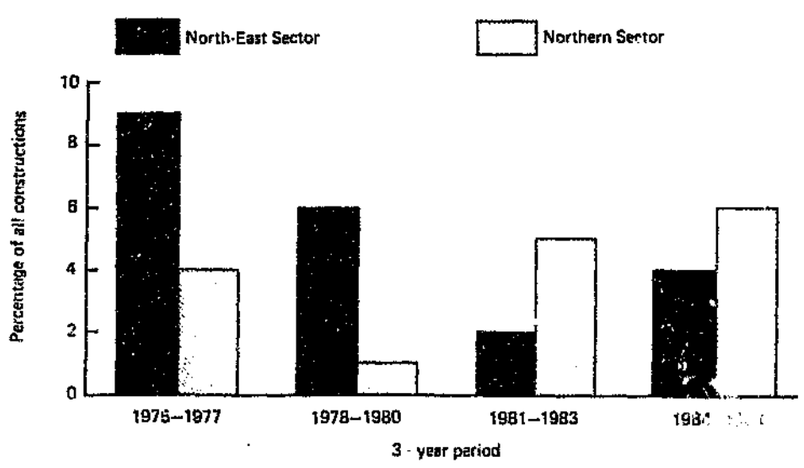


← MARSEILLE METRO



↑ CONSTRUCTION OF DWELLINGS, BY SECTOR AS PERCENTAGE OF THE WHOLE CITY (WALMSLEY AND PERRET 1992).

3.4 EUROPE

3.4.1 Marseille Metro (France)

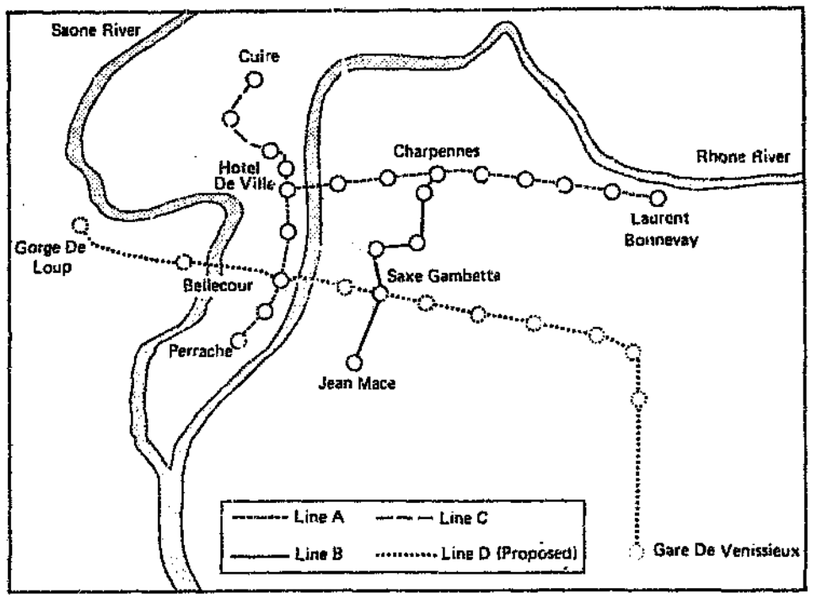
This particular system was mostly built underground due to the dense urban development on the surface. It is however significant from the viewpoint of its positive spinoffs on urban development and public transport usages. The Metro consists of two lines, with the main railway station (Gare St Charles) being a common element to both. The first line was opened in 1977, followed by line 2 between 1984 and 1987. The two lines together form a loop around the city centre, enabling good pedestrian access to any one station. Importantly,

> *"More than a quarter of the population lives within 500m of the rail network ... though the area served is only 12 per cent of the city area. Within 800m lies 20 per cent of the geographical area, but a third of the population and over half the jobs lie within this catchment"* (Walmsley and Perrett 1992, p.26).

The positive spinoffs on urban development should be noted. While no direct relationship can be found between the Metro and housing development, it is the proximity of the scheme which has indicated the location of public development, including

- A public housing development to the north.
- A new sports stadium at Prado in the south.
- The Dojo Regional Exhibition Hall at Bougainville.

The Prado Seaside Park, constructed on land reclaimed from the sea by dumping spoil from the Metro's construction (ibid., pp.28-29).



LYON METRO (WALMSLEY AND PERRET 1992).

The Metro has furthermore played a critical role in being a determining element in the urban renewal process of Marseille, including the pedestrianisation of a major commercial artery in the city centre.

3.4.2 Lyon Metro (France)

Lyon, as the second largest city in France, is a compact city due largely to its geographic limitations. The underground light Metro system was introduced in 1978 to enhance transport links between the city centre and the suburbs, and to reduce car congestion. The system is integrated with the bus network and park-and-ride facilities.

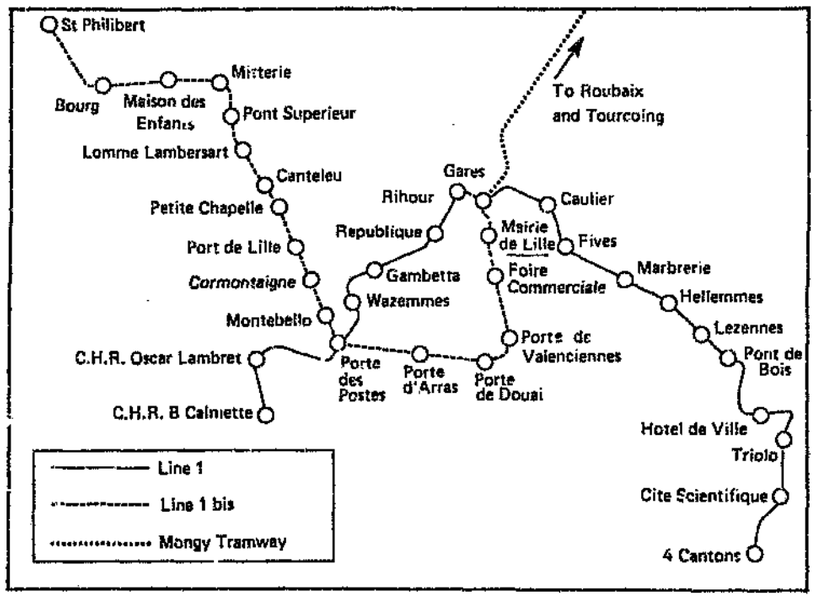
Since the opening of its first line, the Metro has recovered 120-130 per cent of it operating costs (Walmsley and Perrett 1992, p.31). Furthermore, there are several positive spinoffs of the system, including :

- An increase in business activity in the areas served by the Metro. The Chamber of Commerce (Marchand 1983, in ibid , p.32) indicates that there has been an increase in city centre shopping, at the expense of suburban shops.

- The image of the city has improved. Certain streets have been pedestrianised, with large parts of the city being traffic-free zones. It is believed that the improved image has contributed to increased economic activity.

- There have been new developments and redevelopments, which may have resulted from improved access to the city centre.

Line D (which is proposed) appears to have had a significant effect on urban development, in that certain houses in the area to be served by the line have been purchased and offices built in anticipation of the positive spinoffs to be gained from the Metro (ibid., p.32).



LILLE METRO (WALMSLEY AND PERRET 1992).

3.4.3 Lille Metro (France)

Lille varies from other French cities in that it

> *"is not constrained geographically ... there are no hills or major rivers to hinder its expansion, and even the nearby Belgian border has been no barrier ... This could account for the population density being apparently lower than in other French cities, as the city has developed outwards rather than upwards, and traffic congestion appears less of a problem"* (ibid., p.33).

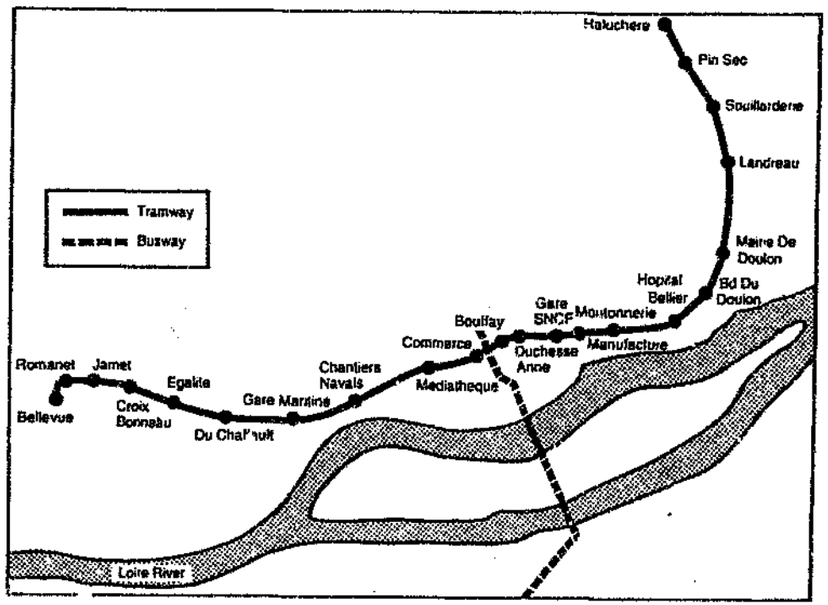
The Community Council of Lille adopted an interesting approach of involving individual architects in the appearance of each individual station. This served as an image-enhancing exercise, as well as apparently assisting against vandalism. It was believed that other public functions could be attached to the usage of the stations. For example the Republique city centre station was built in the style of a roman amphitheatre and is used for performances (ibid., p.34).

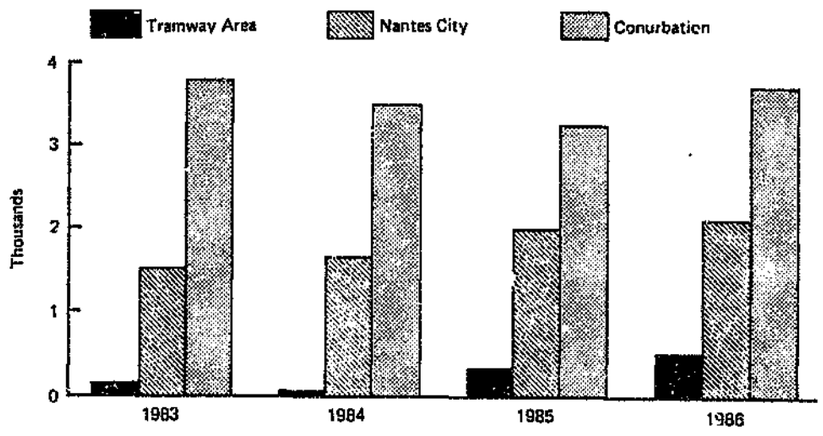
The Lille Metro has had little positive effect, and may even have accelerated decline in the inner cities areas. A contributing factor may be the declaration of Zone d'Amenagement Differe (ZAD) around stations. In doing so, the authority receives the betterment values of the land, rather than the development. Warmsley and Perrett (1992, p.35) note that

> *"in declining areas this has had a negative effect by freezing prices so that owners could not sell their property at a reasonable price. This may have actually prevented redevelopment around stations".*

3.4.4 Nantes (France)

The tramway system of Nantes was developed in the late 1970's and 1980's, as an integral part of a public transport system. Feeder bus routes were planned to connect through to the suburbs. The tramway itself was opened in 198[illegible] with later





CONSTRUCTION PERMITS FOR DWELLINGS IN NANTES (WALMSLEY AND PERRET 1992).

extensions occurring in 1992, to serve the north-south corridor. Furthermore, the bus system is malleable enough for routes to be converted into a future tramway line. The Agence d'Urbanisme (Town Planning Agency) indicates certain interesting data, with particular reference to residential developments. The adjacent graphs indicate the correlation between the tramway development and:

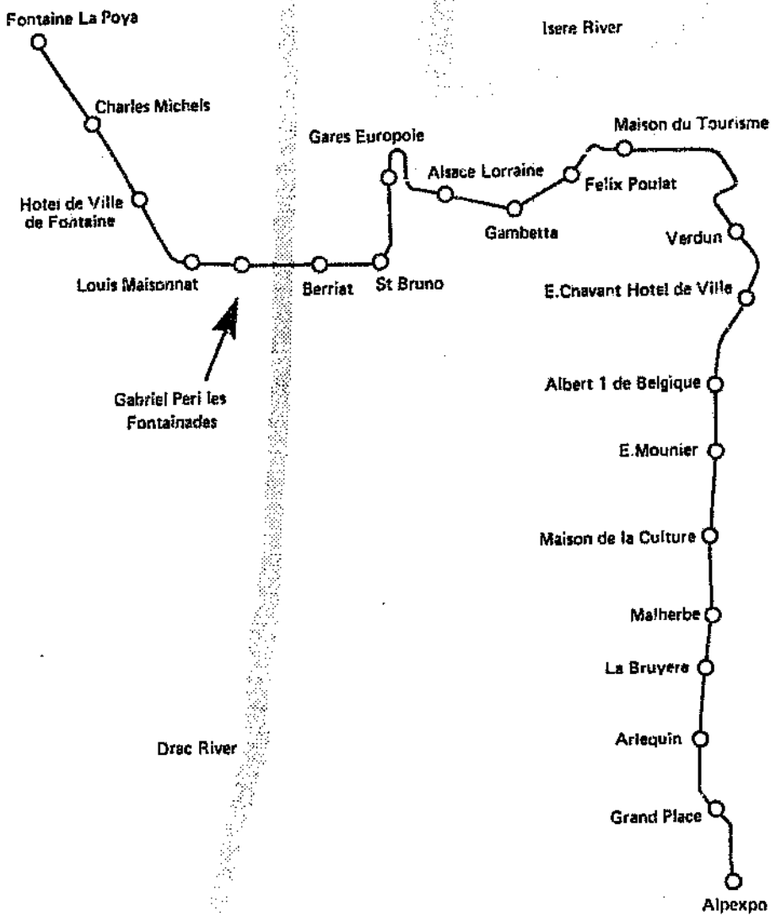
- Planning permissions.
- Large scale developments as opposed to individual applications.
- The distribution of new developments occurring along the tramway corridor.

Thus, while it cannot be conclusively stated that the tramway has been solely responsible for positive spinoffs in terms of housing developments, a trend has been established in this regard.

3.4.5 Grenoble (France)

This high-tech, university city has been well known for its technological "experiments", including the tramway system. In 1983, it was decided by a referendum that a tramway system was required in Grenoble. Several objectives were indicated from the outset for a tramway system, inter alia:

- To improve public transport and ease bus overloading.
- To improve productivity and reduce operating costs.
- To arrest operating subsidies.
- To reduce the nuisance created by busses using the southern corridor.
- To make the system accessible to the elderly and disabled.



GRENOBLE TRAMWAY
(WALMSLEY AND PERRET 1992)

↑ GRENOBLE'S PRINCIPAL SHOPPING STREET, RUE FELIX POULOT, PEDESTRIANISED WITH A TWO-WAY TRAM ROUTE

← CLEAR SIGNAGE TO INDICATE PEDESTRIANISATION.

(RICHARDS 1990).

Furthermore, a tramway was selected due to the insufficient demand and population densities to support a metro system, as well as the fact that the ground was unsuitable for tunnelling (Warmsley and Perrett 1992, p.41).

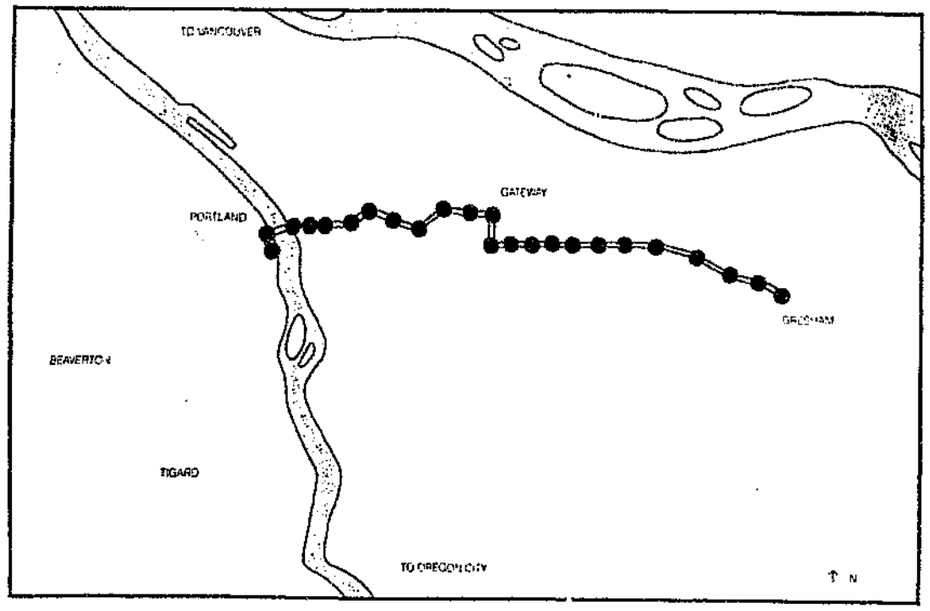
Unlike many South African cities, Grenoble operates on a 24 hour basis. The tramway system is heavily patronised in the evening serving the city centre's theatres, shops and cinemas. The Grenoble approach is furthermore significant in that it serves to reinforce the notion of a compact city. In the 1960's, an urban plan aimed at creating a Green Belt and utilising several planning mechanisms, such as concessions on height restrictions for larger developments, was implemented and played an important part in making the city more accessible in terms of public transport. The tramway of the 1980's continued this focus on the inner city.

Three main areas of positive spinoffs in the field of urban development have been noted:

- Firstly, in conjunction with the tramway installation, several streets in the city centre have been pedestrianised. As a result of an improved environment, new shops have opened in such areas. A fear had initially been that shopkeepers would loose trade due to customers not being able to park outside their doors. These fears did not materialise.

- Secondly, old railway yards near to the station, have been redeveloped, including offices, a hotel and a factory centre.

- Thirdly, the planning of the tramway in Fontaine has opened up an opportunity for the redevelopment of the nineteenth century town centre. An alternative plan for relocating the tramway route to the back streets would have caused less change, but would have made the tramway less effective. Furthermore, a housing association (HLM) is involved in the construction of housing accommodation around the tramway line. Included in this are joint commercial and housing ventures at Joliot-Curie and at Gabrel-Peri (ibid., p.44).



DOWNTOWN PORTLAND WITH STATION SHELTERS OF BLACK STEEL, GLAZED CANOPIES, BRASS TRIM AND TRADITIONAL POSTTOP LIGHTS

3.5 UNITED STATES AND CANADA

Rapid transit is being inserted into the urban and suburban fabric of numerous cities in the United States and Canada. The irony, as in South Africa, is that many of the cities currently viewing mass light rail as a solution to a range of urban problems, had complex street car systems in the 1920's and 1930's prior to their abandonment before or immediately after World War II. Ellis (1990, p.77) notes that

> *"Just as New Yorkers bitterly regretted the destruction of the original McKim, Mead & White's Penn Station in 1964 and its replacement with the tawdry Madison Square Gardens complex and its hopelessly inadequate train station below, so cities like Oakland, Los Angeles and San Jose came to regret the premature abandonment of their original streetcar transit systems".*

3.5.1 Portland MAX (Oregon)

Portland initiated the light rail transit line in 1986, met with huge public opposition. The system comprises roughly 15 miles of track and 27 stations, including both segregated and on street sections. The scheme was initially justified in striving for addressing car congestion, improved access to the central area, changing land use patterns and enhancing the overall image of the region (Warmsley and Perret 1992, p.78). Since then, public involvement and awareness has overcome this opposition. In Progressive Architecture (1988) it has been noted that

> *"From the standpoint of transit alone, it has confounded its early detractors by refusing to conform to their pessimistic estimates of 5 000 riders per day ... MAX began with an amazing 3-day weekend total of more than 200,000 free riders for its debut. Between then and its first anniversary, the system has posted an average weekday paid ridership of 19,900".*

Furthermore, there have been important economic implications for urban designers. The first month of the MAX (Metropolitan Area Express) operation, retailers had an

BEFORE ...

... AND AFTER LIGHT RAIL (PROGRESSIVE ARCHITECTURE 1988)

eighteen per cent increase over the previous year, and a fifty per cent increase over the Christmas period. Furthermore, occupancy rates for office properties increased to eighty-four per cent for the first quarter of 1988. Owners of buildings indicate that MAX is responsible for enabling buildings to be leased easier along the transit route. Similar patterns have emerged in Gresham, with new customers higher sales rates, openings over weekends, an increased commercial building activity (Progressive Architecture 1988 pp.68-70). While MAX may not have been solely responsible for these results, it has provided a focus with positive spinoffs.

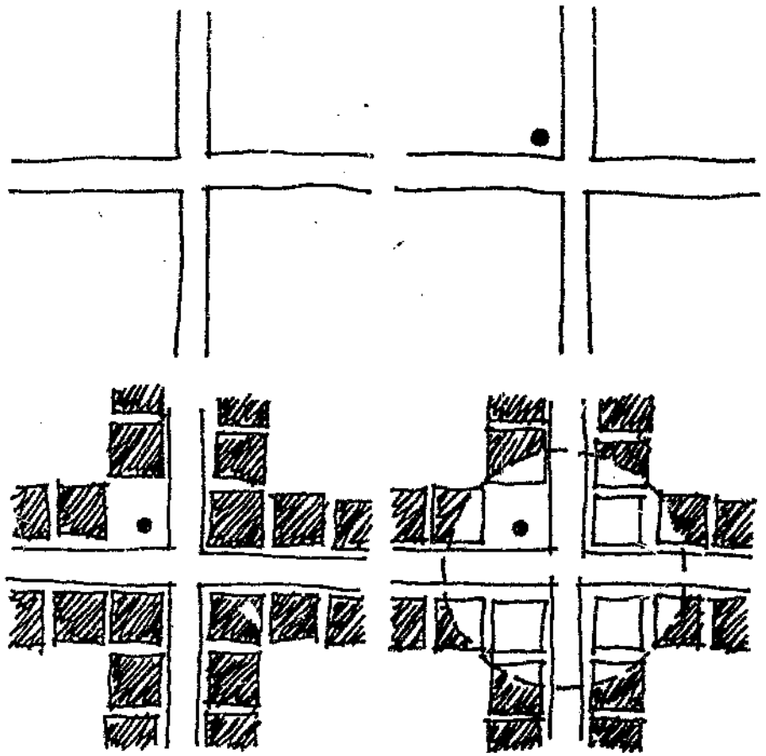
Warmsley and Perrett (1992, p.78) indicate that a Transit Investment Corporation was formed to manage mixed use joint developments around station areas and to stimulate private capital through public improvement projects, such as open space enhancements.

3.5.2 Los Angeles (California)

The significance of the light rail system in Los Angeles lies in its community development. In 1983 a thirty year, $183 billion mass transit plan was approved by the newly formed Los Angeles Country Metropolitan Transportation Authority (MTA). The new transit plan is largely funded by voter-approved sales tax and goes beyond relieving traffic congestion. Incorporated in the study are urban design and architecturally related issues, as well as

> *"implementation of new Transit Oriented Districts (TODs), which encourage higher density, mixed-use, pedestrian-and transit-related development"* (Architecture 1993, p.93).

Historically, while the early electric railway has romantic memories, it was never really a major commuter line. The new system is planned to run 400 miles and increasing ridership from 5 to 20 per cent by 2010. The transport plan incorporates an extension of the bus system, the incorporation of the Metro Rail system, and the light rail system. The Blue Line a light rail line has been operating since 1990. The Red Line of the heavy rail Metrolink commuter line has been operating since 1992



PROCESS BY WHICH A METRO RAIL STATION CAN TRANSFORM AN INTERSECTION AS THE FOCUS OF A PEDESTRIAN-ORIENTED NEIGHBOURHOOD (ARCHITECTURE 1993).

and is expanding significantly. Architecture (1993, p. 94) indicates that at the MTA's transit based housing symposium, the Vermont/Santa Monica Station is considered as

> *"A first stop for many recent immigrants, particularly from Central America ... (and) as a "context modifier" changing the neighborhood from car-focused to pedestrian-orientated ".*

There are several significant aspects to the Vermont/Santa Monica Station proposal:

- Maintenance of the small scale of existing residential blocks, by limiting the size of parcels for development to three standard lots.

- Encouraging three to four storey courtyard buildings which incorporate open space and parking. It is believed this will achieve continuity of the pedestrian-oriented scale and providing opportunities for small developers.

- Clustering of neighbourhood-specific uses and forms around the station to achieve neighbourhood identity.

There are four corners of development :

North -east corner

The addition of market stalls to the station plaza, and the development of a single room occupancy hotel above four floors of commercial use.

North-west corner

A large mercado with underground parking.

South-west corner

A large mixed-use building consisting of four storeys of residential above two storeys of retail and commercial space.

South-east corner

The retention of a historic building incorporating commercial uses (Architecture 1993, p.93-94).

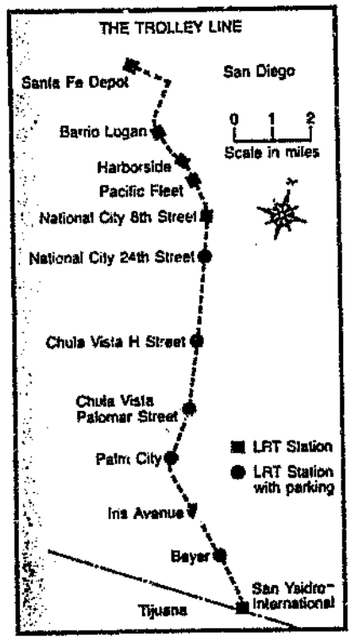
The comprehensive planning approach to light rail development incorporated the notion of a Rapid Transit District (RTD). In 1988, it was envisioned that Los Angeles could be revitalised subject to the spark of pedestrian oriented communities around transit stations. The approach incorporates the following steps :

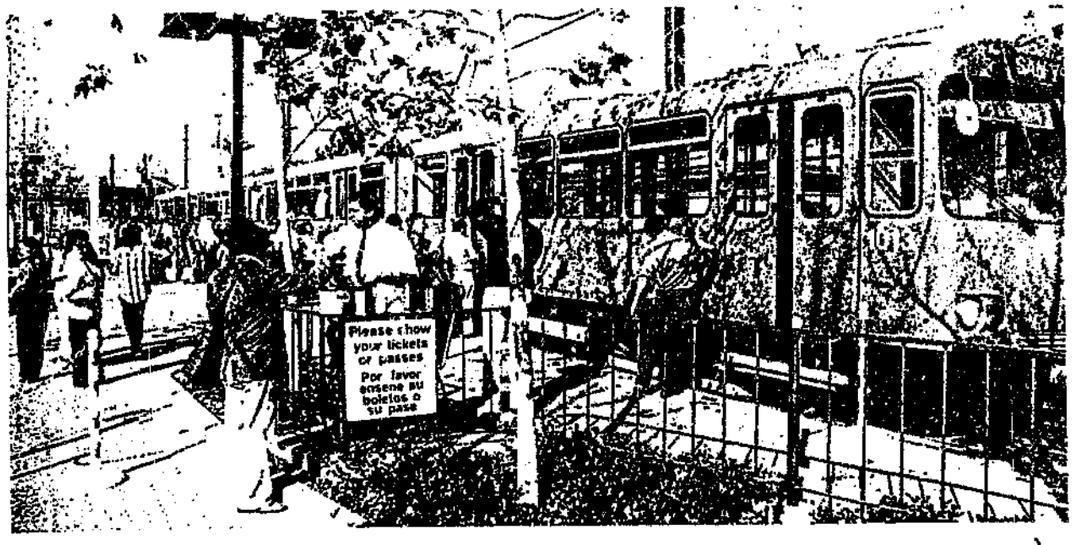
- A 500-1 000-foot radius area around the station is analysed to determine optimal location for the station portal and to provide a master plan for future development.
- A master plan indicates the primary joint public and private opportunities and roles in development :
- Feasibility studies are carried out
- A master report, incorporating environmental impacts, and site specifics, is compiled.
- Developers are then selected through requests for proposals process for either a station area or a site specific project within the area (Architecture 1993, p.95).

The approach seeks to overcome expensive housing in the Los Angeles County by allowing development on land in rights of way purchased for rapid transit, or allowing housing development over park-and-ride lots, thereby effectively offering subsidies to developers to build affordable housing (Architecture 1993).

3.5.3 San Diego Trolley

San Diego was the first US city to rediscover light rail in the 1970's. Having taken into account the problems associated with the Bay Area Rapid Transit (BART)





CIVIL ENGINEERING - ASCE 1982).

system, and difficulty in securing funding from the US Government, a less expensive European-style option was decided upon. The San Diego Metropolitan Transit Development Board (MTDB), as an umbrella agency of the Metropolitan Transit, was created in 1975 charged with planning and implementation of a mixed guideway system. The San Diego light rail transit system was initiated the following year. Due to limited capital resources, the cost of construction had to be minimised. In 1981 the South Line as the initial phase of the LRT was opened, followed by the East Line in 1986. The South Line consists of 16 miles, 12 suburban stations and 6 downtown stations. In the city centre, the trolley operates within the street space, alongside an exclusive LRT route and vehicular traffic. Four blocks of a street have, however, been converted into a LRT/pedestrian mall.

The San Diego Trolley is now used as a model of low cost, timely completion and local control (Carter and Clark 1982, p.50). From an urban design perspective, several factors contributed to the success of the trolley system. The design of stations was simplified and cost-effective.

> *"In the City Centre Area, stations are simple stops on the street and have been architecturally fitted into an existing urban fabric; along the SD & AE portion of the line, typical stations have been constructed, with and without parking, depending on real estate availability and access mode requirements. The third station type responds to the unique requirements at the international Border in San Ysidro"* (Carter and Clark 1982, p.52).

As in the case of Los Angeles the citizens of San Diego have been involved in the planning stages of the transit development. In 1987, the community endorsed a 1/2 per cent sales tax increase, which has projected to generate $2,6 billion over the next decades. Of the anticipated $700 million earmarked for massed transit, 80 per cent will be used for the trolley line extension to the North and East.

Community involvement has extended further. The community was involved in the planning, design and implementation of the project. Consultation and involvement

(CIVIL ENGINEERING - ASCE 1984)

was carried out in over 300 public meetings, as well as setting up a technical advisory committee, which represented private and public agencies. Consultation with the elderly and handicapped (E&H) committee occurred to ensure the system was fully accessible to the handicapped. Furthermore, as the system was barrier-free, and approximately 400 000 people were crossing the tracks each day, a public awareness program was initiated (Carter and Clark 1982, p.53).

A range of policies and incentives have been identified to reinforce a moderate density and mixed use around transit stops :

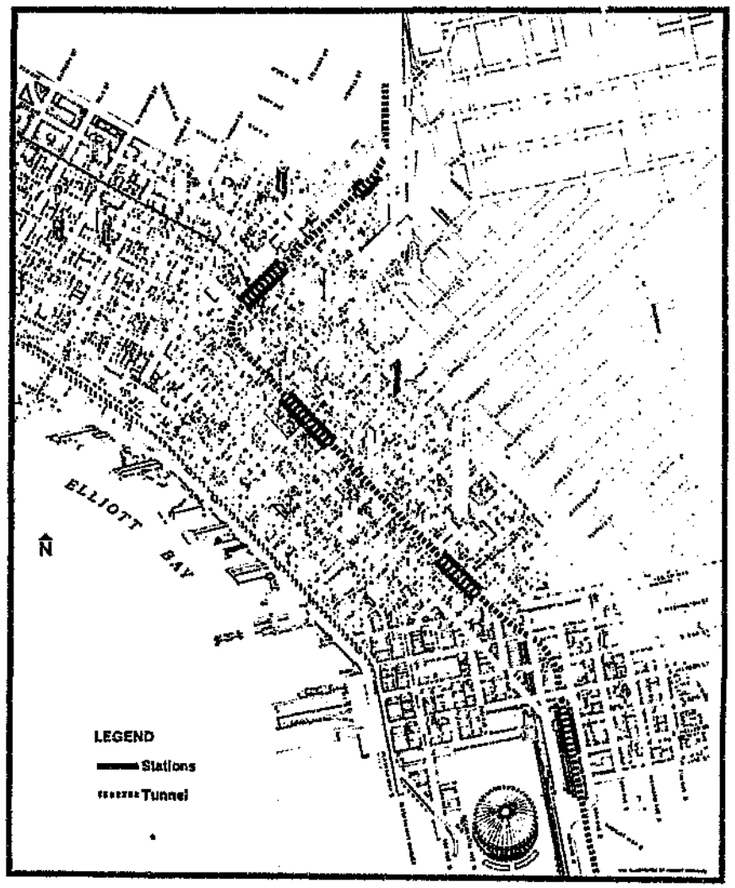
- The Mid-City Plan District indicates density gradients directly related to transit corridors, with reduced residential parking requirements. The impact of density bonuses, relaxed parking requirements and the availability of transit has been a transformation of Mid-City strip commercial into a dynamic urban community core.

- Citywide landscape requirements to ensure quality automobile-oriented development is promoted. The requirements are one tree for every four parked cars, a street tree for every 30 feet of frontage, landscaped parkways, no front-yard parking in residential areas, and buffering of parking lots and public right-of-way.

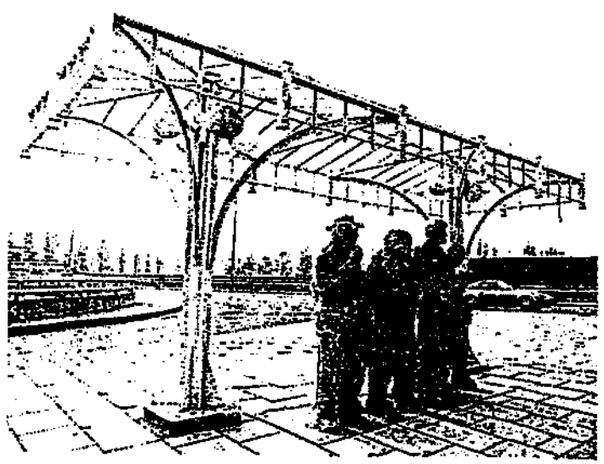
- Mandatory mixed use developments, transit stations and additional parking facilities are linked to allow development to occur only at the rate that infrastructure is provided (Curcio, in Attoe and Logan 1989, pp.92-93).

The strength of the San Diego system lies also in what Crane would term "The City of a 1 000 Designers" in that

> *"No single "urban wizard" can be credited for the many successful programs already in place; they are the product of participatory planning. This critical element in San Diego planning ... provides for the involvement of volunteer architects, planners, developers, and community interests in formulating visions and action planners"* (ibid., p.98).



SEATTLE



(UNDERGROUND SPACE 1985).

Warmsley and Perrett (1992, p.73) indicate that because the public transit system was developed economically and covers almost all operating costs, the San Diego area has experienced growth and rapid development. Negating the success of the system has been the lack of restraint of the use of motor cars.

3.5.4 Seattle (Washington)

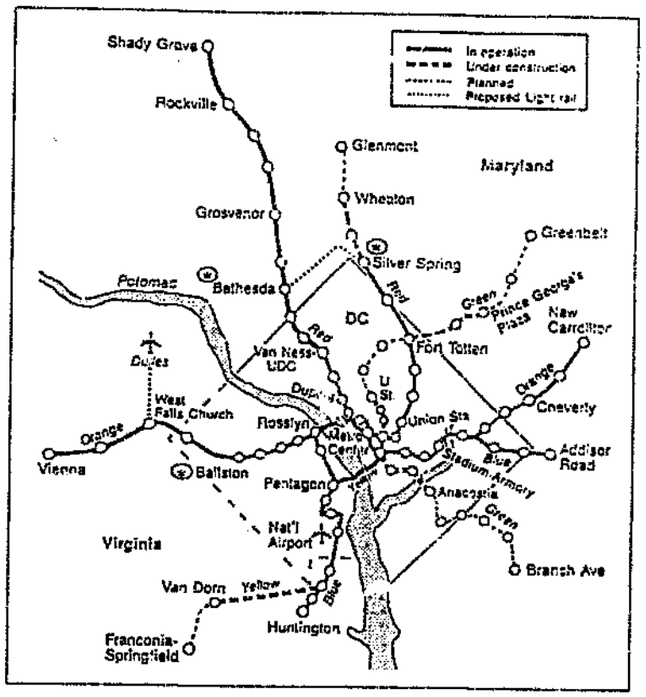
The rapid transit scheme in Seattle was opened in 1982, consisting of 1,6 km of track on two lines. The scheme was developed to serve the "World's Fair" site and linking Seattle's downtown to the "Seattle Centre". According to Warmsley and Perret (1992, p.79) the scheme was justified.

> *"on the grounds that it would serve an expanding economy, there was a public acceptance of rapid transit and a lack of public support for highway projects. Petrol and motor vehicle taxes were used to raise revenue for the scheme".*

The Seattle Underground Transit does have some relevance. This came in response to a range of suggestions and proposals since the 1960's to address the severe congestion problem in the CBD. Healy (1985, pp.138-139) indicates that

> *"The city of Seattle is the focal point of the regional transit system. The system runs smoothly until it hits the heavily-congested streets of Seattle"s central business district ... too many people are following the Yellow Brick Road, and the Emerald City's downtown is ensnarled in a seemingly perpetual traffic jam that threatens to choke the vitality of the area".*

While the system is underground, attention was paid to surface improvements along the tunnel alignment. For instance,



WASHINGTON D.C. METRORAIL
(APA JOURNAL 1991).

"Sidewalk furniture, curb cuts, and bus zones are to be organised to help separate transit activities from other sidewalk uses ... Other items, such as signs, sidewalk furniture, bus shelters, vending equipment, trees, plants, fire hydrants, and alarm boxes, would be located in conformance with a comprehensive design plan" (ibid., p.142).

3.5.5 Washington D.C. (Washington)

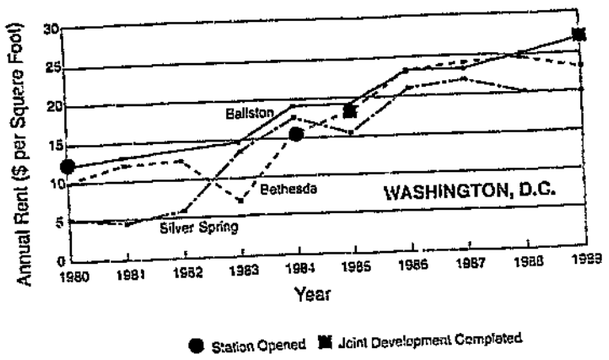
Washington D.C is significant from the point of view of its joint development approach. The Washington Metropolitan Area Transit Authority (WMATA) was established in 1967. By the late 60's work had begun on the initial 25 mile system. On completion, the system should incorporate 103 miles of track.

Warmsley and Perrett (1992, p.51) indicate that

"Metro was designed to be aesthetically compatible with the history and symbolism of the nation's capital. Most of the stations are underground. They are all of a similar design within huge spacious vaults. Platforms, mezzanines, escalators and lifts were built freestanding within the vaults, putting walls beyond the reach of vandals. Materials were selected to be durable and to give a sense of timelessness ... ".

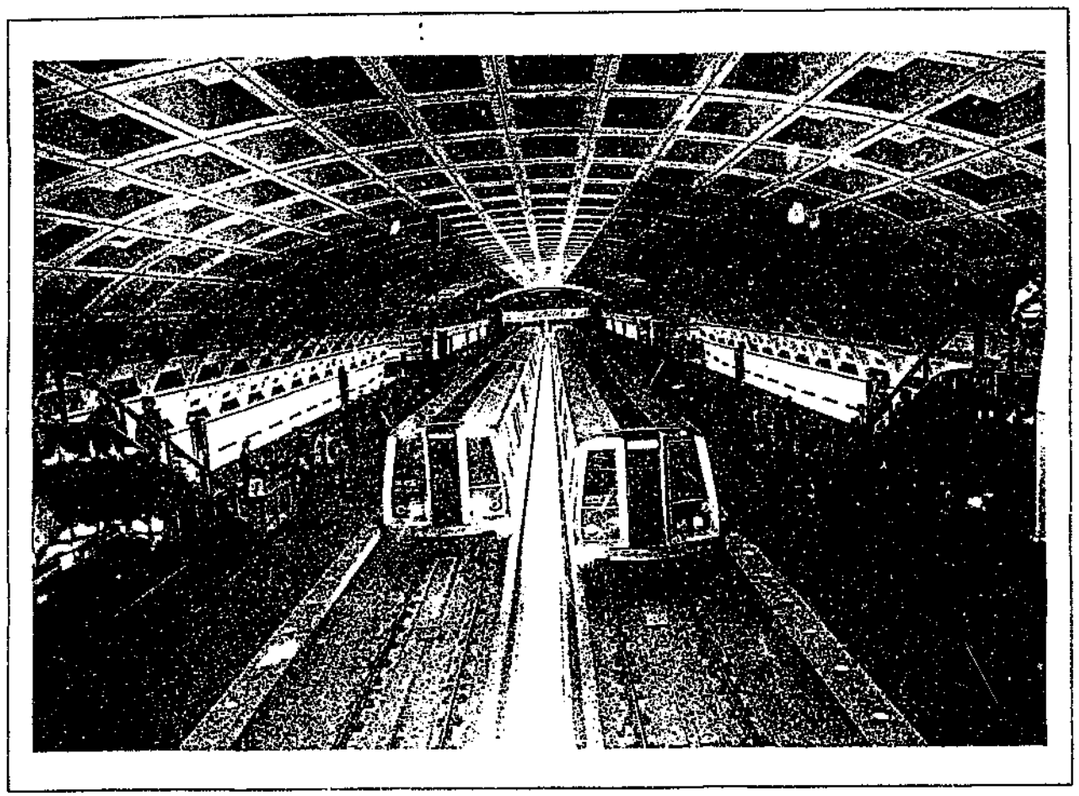
In terms of the WMATA joint development programme, there are three important issues :

- Joint development involving long term leases for air rights.
- The provision of system interfaces.
- The encouragement of symbiotic development around Metro stations without any direct financial involvement from the developer (Warmsley and Perrett 1992, p.56).



Source: Black's Guide and Smithy-Braedon

TRENDS IN STATION AREA OFFICE RENTS (1990) (APA JOURNAL 1994)



UNDERGROUND STATION ON WASHINGTON D.C. METRO RAIL TRANSIT SYSTEM (APA JOURNAL 1992).

The impacts of the joint development approach has been evaluated by Cervero (1994), pooling data of three station areas in the metropolitan area of Washington D.C.. The study approach used multiple regression analysis to isolate the effects of rail transit from other factors which may also influence property values and real estate market conditions.

The commercial and office properties considered had a minimum of 100 000 square feet of floorspace and were located within 1/4 mile of a transit station. Four main variables were measured at each station area :

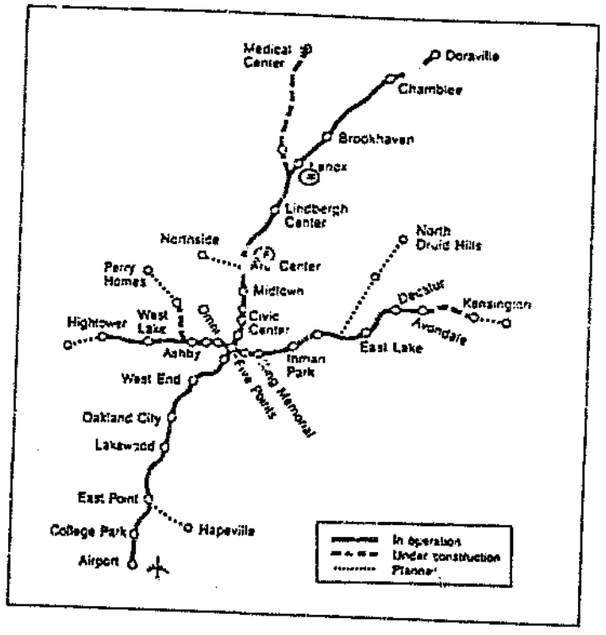
- Station area real estate market performance variables.
- Transit service variables.
- Regional economic and growth factors.
- Station area transportation, infrastructure, and development characteristics.

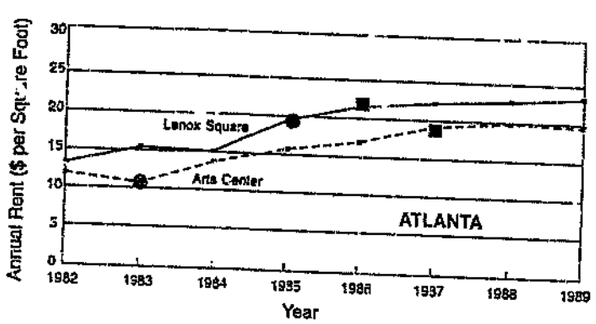
The broad conclusions reached by Cervero (1994) include :

- That the proposition that transit, and joint transit developments in particular,

  "create measurable land value and associated benefits appears for the most part to be borne out by empirical evidence, at least during the 1980s" (ibid., p.91).

- In station areas under the control of joint development, vacancy rates are low.
- There is a positive relationship between project size and a local real estate market.





Sources: Black's Guide and Frank Carter & Associates

TRENDS IN STATION AREA OFFICE RENTS (1990) (APA JOURNAL 1994)

3.5.6 Atlanta

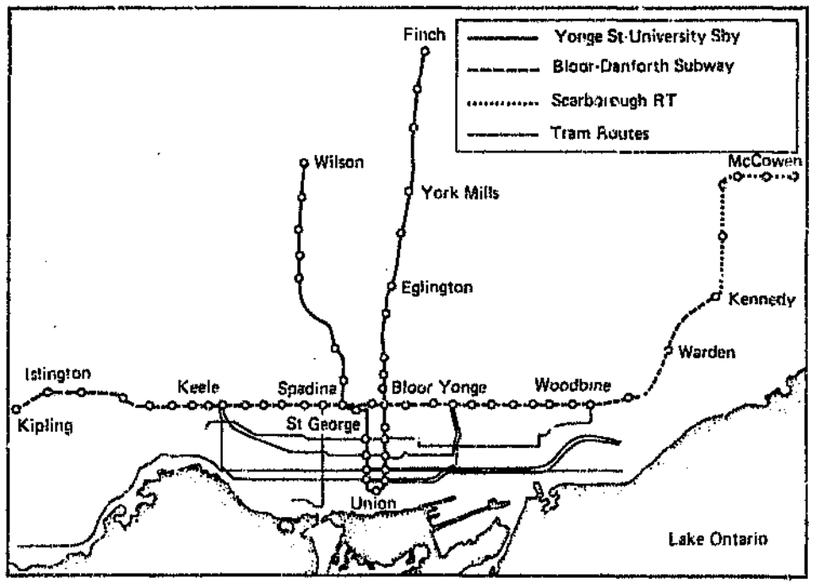
As in the case of Washington D.C., the Metropolitan Atlanta Rapid Transit Authority (MARTA) has used the approach of joint developments at station areas. The MARTA rail system which was initiated in the early 1980's currently has two-thirds of its stations in the city of Atlanta. In these areas, rezoning incentives for higher density development are promoted within special public interest zones (Cushman, in Attoe and Logan 1989, p.185).

Cushman further notes that companies desire to be located near direct transit access. In response, MARTA has obtained a significant amount of commercial office space activity around many stations. For example, IBM has built its regional headquarters (one million square feet) on MARTA air rights. Of significance, is the statement that

> *"Much of this development did not occur with the original opening of the rail lines, as development commitments seem to typically follow about 3-5 years behind the completion of construction at the stations. Not surprisingly, private investment often needs the demonstration of success before making major financial moves"* (ibid., p.185).

There is one shortcoming in the success story of the MARTA development. Development of some of the planned mixed use and residential projects have not been realised. A reason which may be attributed to this, is the general economic recession of the mid 1970's, a period during construction, and the simultaneous reduction of federal funding.

As was the case with Washington D.C., Cervero (1994, pp.83-93) indicates the positive correlation between joint development and land values and real estate markets. The Art Centre and Lenox Square which was studied by Cervero, was until recently only a major cultural centre. In the mid 1980's however, the IBM Tower



TORONTO (WALMSLEY AND PERRET 1992.).

which was built adjacent to the MARTA station sparked construction of smaller office buildings in the area. Cervero (1994, p.86) notes that

> *"By 1991, the IBM Tower had generated over $1.5 million in lease revenues to MARTA ... Lenox Square ... has acquired over three million square feet of office space which is now nearly ten percent of greater Atlanta's total office inventory Owners of Resurgens Plaza, a luxurious office building adjacent to MARTA's Lenox station, pay MARTA over $100,000 in lease revenues annually".*

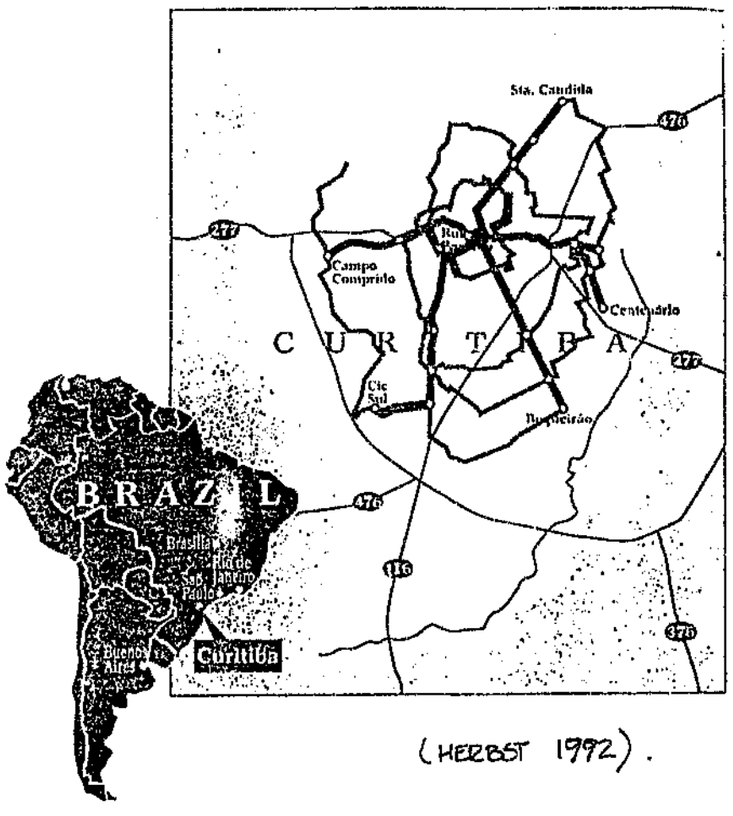
3.5.7 Toronto

The Toronto Rapid Transit System is a subway system initiated in 1954 after the establishment of Toronto Transit Commission in the same year. The public transport system integrates all modes, and is a coherent legible system which follows the rectangular street pattern of the city. Importantly, it is a cheap mode of transport, it is very stable (for instance the Yonge Street service has been operating for 140 years) and is supported by a sustainable threshold of residential communities. Warmsley and Perrett (1992, p.91) indicate that by 1974, ninety five per cent of the population lived within 600m of a service.

This has had a visual impact on the area in that,

> *"High rise development can be seen around stations towering above the surrounding area. Half of all apartment construction within the thirty year period 1954-84 occurred within a five minutes walk of rapid transit stations and ninety per cent of all office constructions in the same period occurred adjacent to downtown stations"* (ibid. p.93).

There have also been joint developments in certain areas. For instance, new bus interchange is incorporated into the development agreement between the Toronto Transit Commission and the developer.



(HERBST 1992).

There are catalytic benefits of the approach held by the municipality of paying for much of the transport development. It is believed that the city will gain from development directly and indirectly if transport can be viewed as a magnet for attracting development. The belief is that if developers were "encouraged" to contribute more to development positive spinoffs may be somewhat reduced.

3.6 SOUTH AMERICA

3.6.1 Curitiba (Brazil)

The avant garde city of the 1970's is significant in terms of its turnaround from a relatively unknown city to one which is now becoming a model for sustainable development, incorporated in which is a transportation approach. In the mid 1960's, a new plan for the city was developed which favoured a restriction of high density growth to several corridors radiating from the city centre. Herbst (1992, p.24) notes that

> *"The result is an unusual skyline. Instead of the traditional core, defined by a cluster of highrisers and scattered outlying development, virtually all of Curitiba's tall buildings are arrayed along five transportation "axes" ... that converged on the city centre from the north, south, southeast, east, and west".*

These fingers of development were achieved due to the city purchasing and condemning large parcels of land alongside or in nearby proximity to the transportation axes. Furthermore the city enacted zoning regulations that restricted development to a two-to four-block corridor on either side of the road (Herbst 1992, p.24). These major eixos estrutrurais (structural axes) that define linear vectors for development also provide clues for an architectural typology of high-density residential tower blocks, commercial and service-related uses (del Rio 1992, p.275).

"LIGEIRINHOS" - TUBES TO SPEED UP BOARDING TIMES (NEW GROUND 1994).

The driving figure behind Curitiba's urban model has been Lerner, an architect and planning consultant in Latin America and New York. In 1971 he was appointed as mayor, and reappointed in 1979 and 1988. He made significant changes during his first term of of..., including to the planning department in making it a multi-disciplinary department. Lerner had a strong vision which included public involvement. In an interview, he stated that

> *"Only when the whole population understands and desires the dream will they work together to realise it"* (Barrett 1994, p.32).

In 1974 ideas for the city bus system were refined. A three tiered system was developed to allow for transfer from different bus types without being charged. For instance, riders could transfer from the red express busses operating on the axes, to yellow feeder busses that operate in outlying districts, to green inter-district busses that circulate in concentric circles connecting outlying areas (Herbst 1992, p.26).

The transport network consists of a web of five radial axes which together comprise over 500km, 270km of feeder lines, and 185km of inter district lines, carrying in excess of half a million passengers daily. The system is operated by the municipal transport authority (URBS) with no subsidy scheme. The express articulated busses, able to carry a capacity of 270 people, operate on exclusive traffic lanes. They lock into ligeirinhos ('speedy'), which are specially designed perspex-tube shelters (Barrett 1994, p.33).

The system is considered cost effective in that it is three hundred cheaper than a subway and it can be built in six months. Furthermore its capacity is four times greater than Rio's subway. (Herbst 1992, p.26) indicates that roughly ten per cent of users income is spent on transportation in the form of a flat "social" fare.

The lesson to be learnt from the Curitiba example is that the urban design approach is simple, effective and feasible, and not simplistic. In quoting Lerner,

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The lesson to be learnt from the Curitiba example is that the urban design approach is simple, effective and feasible, and not simplistic. In quoting Lerner,

"the city of the future will not be a scene from Flash Gordon ... it probably will look like cities of today. We have to get grandiose solutions out of our heads" (del Rio 1992, p.278).

3.7 EVALUATION OF SELECTED CASE STUDIES IN TERMS OF URBAN DESIGN PERFORMANCE DIMENSIONS.

A second level of evaluation to provide clarity on lessons gained from international precedence, is carried out in terms of a range of urban design related performance dimensions. The first level has been carried out to select the applicable international case studies, which have relevance to the South African city. The performance dimensions are derived from Lynch (1989) and Bentley et al (1985), and detailed in terms of more specific sub-criteria. This evaluation is carried out on a city wide-district scale.

The performance dimensions include :

Efficiency

Efficiency is a balancing criterion which

> *"deals with how costs and benefits for any one group are distributed among the several types of value"* (Lynch 1989, pp.221-225).

Efficiency is considered in terms of the cost related efficiency of the light rail system itself, and in terms of any positive spinoffs on the nearby urban area.

Justice/democracy

> *"Justice is the way in which benefits and costs of any one kind are distributed between persons"* (Lynch 1989, p.225).

To make democratic cities, processes for the introduction of rapid transit systems should also be democratic. Therefore, the first sub-criteria is the level of public involvement, and secondly, whether or not the system serves a majority.

Permeability

> *"Only places which are accessible to people can offer them choice. The extent to which an environment allows people a choice of access through it from place to place is therefore a key measure of its responsiveness"* (Bentley et al 1985, p.12).

In terms of rapid transit, there are two sub-criteria of relevance, firstly system connectivity to other movement systems and built environment, and secondly in providing access to urban opportunities.

Personalisation

Personalisation, is the extent to which people put their stamp on a particular place (Bentley et al 1985, p.9), corresponds with Lynch's performance dimension of control. Personalisation is considered at the level of the pedestrian or user, on the immediate neighbourhood or precinct, and in terms of the built urban form.

Variety and vitality

A choice of activities and uses is a key quality of urban variety. This parallels the basic dimension of vitality proposed by Lynch (1989) as the degree to which the urban environment supports the sustenance of urban dwellers. The international studies are further evaluated in terms of a mixed land use component and of a strong retail and commercial component.

Legibility and sense

	EFFICIENCY		JUSTICE · DEMOCRACY		PERMEABILITY · ACCESS		PERSONALISATION · CONTROL		VARIETY · VITALITY		SENSE · LEGIBILITY	FIT · ROBUSTNESS	
● GOOD CORRELATION ⊕ PARTIAL · WEAK CORRELATION — INFORMATION NOT AVAILABLE	SYSTEM EFFICIENCY IN TERMS OF COSTS	CATALYTIC SPINOFFS	PUBLIC PARTICIPATION	FAVOURS MAJORITY	SYSTEM CONNECTIVITY	ACCESS TO URBAN OPPORTUNITIES	PEDESTRIAN CYCLIST RELATED	NEIGHBOURHOOD LEVEL DESIGN	MIXED LAND USE	RETAIL · COMMERCIAL CORE		STATION CONSISTENCY	FIT IN TERMS OF CITY
BIRMINGHAM	⊕	⊕	●	●	●	●	●	●				⊕	⊕
SHEFFIELD	⊕	⊕		●	●	●	●	●		⊕		⊕	⊕
LONDON DOCKLANDS	⊕	⊕	⊕	⊕	●	⊕	⊕			●	●	⊕	⊕
MANCHESTER	●	⊕	⊕		●	●	●	●	⊕	●	●	●	⊕
MARSEILLE	●				⊕	⊕	⊕	⊕	⊕	⊕			⊕
LYON	●	●	●	⊕	●	●				●	●		⊕
LILLE	●	●			●	●	●	●		●	●	⊕	⊕
NANTES	●	●	●		●	●	●	⊕	●	●	●	●	
GRENOBLE	●	●	●	⊕	●	●	●		●	●	●	⊕	
PORTLAND	●	●	●		⊕	●	⊕	⊕	⊕	●	●	●	●
LOS ANGELES			●	●	●	●	●		●	●	●	⊕	⊕
SAN DIEGO			●	●	⊕	●	●		●	●	⊕	●	⊕
SEATTLE	⊕				●	⊕	●	⊕	●	●		●	⊕
WASHINGTON D.C.	●			⊕	●	●	⊕	⊕		●	●	●	●
ATLANTA	●	●	⊕	⊕	●	●	●		●	●	●	●	●
TORONTO	●	●	⊕	⊕	●	●	⊕	⊕		⊕	⊕	●	⊕
CURITIBA	●	●	●	●	●	●	●	⊕	●	●	●	●	●

Sense is defined as

> *"the degree to which the settlement* (and rapid transit) *can be clearly perceived and mentally differentially and structured in time and space by its residents and the degree to which that mental structure connects with their values and concepts"* (Lynch 1989, p.118).

Integral to how well rapid transit in its context is perceived is partly dependent on its legibility, in other words, how easily people can understand its position in space.

Robustness

Robustness is the choice offered by places to its users for many uses. This flexibility of space parallels fit, defined as the degree to which the form/capacity of spaces, channels, and equipment in a settlement can match peoples requirements (Lynch 1989). This performance dimension is further considered in terms of the degree to which stations, signage, street furniture etc., is consistent, and in terms of the system's fit into the image of the city.

3.8 CONCLUSIONS AND INFERENCES

This chapter aimed at selecting and evaluating on different levels international case studies which may have bearing for the South African city, and Johannesburg specifically. Three broad conclusions may be reached from the studies conducted :

1 Few cities have relied upon a specific design procedure in accordance with the broader framework of rapid transit intervention.

2 Some cities, particularly in the East, are still oriented towards a traffic engineering approach. This raises concerns at a similar approach may be adopted in Johannesburg currently.

3 The trend in the United States appears towards the restriction of the motor vehicle and the promotion of a pedestrian oriented urban environment. A reason maybe proffered as to why European cities are not as strong on this stance as their American counterparts. Traditionally European cities are characterised by compact urban areas developed around the needs of the pedestrian and not the motor vehicle and have therefore not been shaped around the needs of the latter. The lesson to be learnt from the American situation are the similar sprawled nature of the urban form which have largely been served by individual motor vehicles. Approaches for the restriction of the motor vehicle and how to promote pedestrian oriented environments could be adapted for local application.

There are more specific lessons to be gained from the evaluation of individual cities, particularly in terms of :

- Joint developments, and more specifically, the formation of TODs in urban and suburban areas where rapid transit is occurring.

- Street specific regulations, such as the provision of landscaping as applied certain French and American cities.

- The catalytic impact of rapid transit tend to occur within a three block radius of the fixed system.

- Increasingly the pedestrian is emphasised, paralleled with a reduction in car usage.

- There is a need for public involvement in all phases of the rapid transit intervention.

- The system needs to be financially viable. Creative ways of achieving this have been applied in various cities. In Johannesburg's case, the option may exist to cut expenditure on expensive road building programmes, utilising this to finance the rapid transit, at least in part.

- Rapid transit intervention should be viewed as only one, but integral element of a broader framework for city re-assembling and restructuring.

- The system should be fixed to provide incentive for long-term assurance to private sector interests. For example, the study of Lyon indicated that because the system to be implemented was fixed it provided incentive to the private sector to purchase land in nearby proximity in advance.

- Not explored here in detail, is the issue of implementing a rapid transit in times of economic decline. Generally, this may be problematic as indicated in cities such as the London Docklands which has become the "white elephant" of the Docklands area due in part to being economically unfeasible.

- Climate plays a lesser role in determining the location of the rapid transit system above or below ground level. In South Africa, a moderate climate permits a system above or on ground level in that protection from severe weather conditions is not required, unlike in cities such as Toronto.

- The underutilisation of urban land in South African cities necessitates the need to intensify development, as opposed to developing systems below ground level. Furthermore, research indicates that pedestrians tend to relate poorly to subways and underground systems.

- There is a need to link rapid transit to sustainable development programmes, as is well illustrated in Curitiba.

- Intense concentration of activities and commercial/retail land uses tend to occur around stations.

- Successful rapid transit systems tend to link existing retail, commercial, and to a lesser degree residential activity areas.

- Particularly in France, a large percentage of people reside in close proximity to a rapid transit line.

four

towards a paradigm of
city re-assembling oriented
towards rapid transit

4.1 AIMS

Research and a brief overview of international case studies has indicated that there is a lack of a comprehensive theoretical premise regarding the restructuring and catalytic opportunities offered by rapid transit systems, particularly as a rejuvenated form of the nineteenth century tramway. The seeds of thought are, however, ready for germination. Particularly in the past few years, thinking has focused towards Transit-Oriented Districts (TODS) in the United States, and the implications thereof. This chapter sets out to provide an overview of TODS, and as an extension, assess the impacts/ripple effect of rapid transit on the encompassing districts.

In accordance with the approach adapted from Rapoport (1990), both local and international history and precedents is incorporated, substantiated and added to with urban design theories. There is an identifiable need to look back to the past to inform and guide our thinking to address the contemporary non-place realm, in a manner which extracts lessons. To substantiate and correlate these lessons (gained in the preceding chapter), several urban design related theories/ideas are evaluated in terms of application to rapid transit and its implications on urban development.

The approach for this section is adapted from a layering concept derived from architecture, developed out of structural theory. This approach differs significantly from deconstructivist thinking (in that it does not want to express ambiguity or contradiction. Three interrelated systems which are overlaid are identified :

1 Line.

2 Point.

3 Ripple

4.2 TOWARDS A NEW PARADIGM OF CITY RE-ASSEMBLING USING RAPID TRANSIT AS CATALYST

A series of conferences in the past year concerning design, urbanism and sustainability, have highlighted that

> *"There has been a quiet revaluation going on in town planning and architectural circles of the last decade. Urban design ideals are being stood on their heads. The new movement has taken various forms and names, but in general seeks to reform design and planning"* (Ke...augh 1994-1 p.73).

There are seven principles underlying a reformed urban design approach:

1 A spatially coherent and cohesive sense of place, neighbourhood and community. There must be a move away from the anonymity of suburban sprawl, to that which builds on local uniqueness.

2 Communities should be more compact, dense and be clearly bounded by natural systems.

3 Single use zoning should be replaced by a richer and finer-grained mix.

4 Walking, bicycling and public transit as part of an interconnected network, to replace the motor vehicle on most trips.

5 Focus on revitalising, infilling and conserving existing urban centres, as opposed to new community development.

6 Rekindle the public realm with face-to-face interaction.

7 Replace commodification and consumption of natural resources by sustainable environmental, cultural and economic approaches (Kelbaugh 1994, p.73).

These constructs underlie the rationale/philosophy behind TODS and their implications on the urban form and interlocking spaces.

It is contended that while all urban development should incorporate these constructs, urban re-assemblage, should in particular, encompass such thinking.

4.2.1 Bentley et al : towards permeability

One of the fundamental steps in ensuring the success of the rapid transit system is the degree of accessibility and permeability offered by the physical urban layout, so as to enable more open and democratic city. Permeability is defined by Bentley et al (1985, p.12) as

> *"The extent to which an environment allows people a choice of access through it, from place to place".*

This is a key element in making responsive environments. The grid is viewed as one of the best ways to enable maximum permeability and therefore potential choice and change.

4.2.2 Hillier : movement lines and grids

Hillier (1992, in Murrain 1993, p.88) indicates that

> *"In a grid people start and finish everywhere. Origins and destinations are everywhere, with different levels of intensity. This by-product of movement is to generate as many happenings and interactions as possible ... Enclaves are almost, by definition destinations which are not available for 'natural*

movement'. They are discontinuities in the urban grid and disruptive of the movement economy. Any tendency in an urban structure towards 'precinctisation' must also be a tendency to a lessening of the useful by-product of movement".

4.2.3 Bacon : simultaneous movement systems

Bacon (1967) explores the movement in cities through time and space, from a historic point of view, as well as movement in more contemporary time, particularly with the impact of mechanical power. The term used is that of simultaneous movement system, which refers to paths along which people move or are transported. Three concepts assist in understanding simultaneous movement systems :

1 The relationship of mass and space.

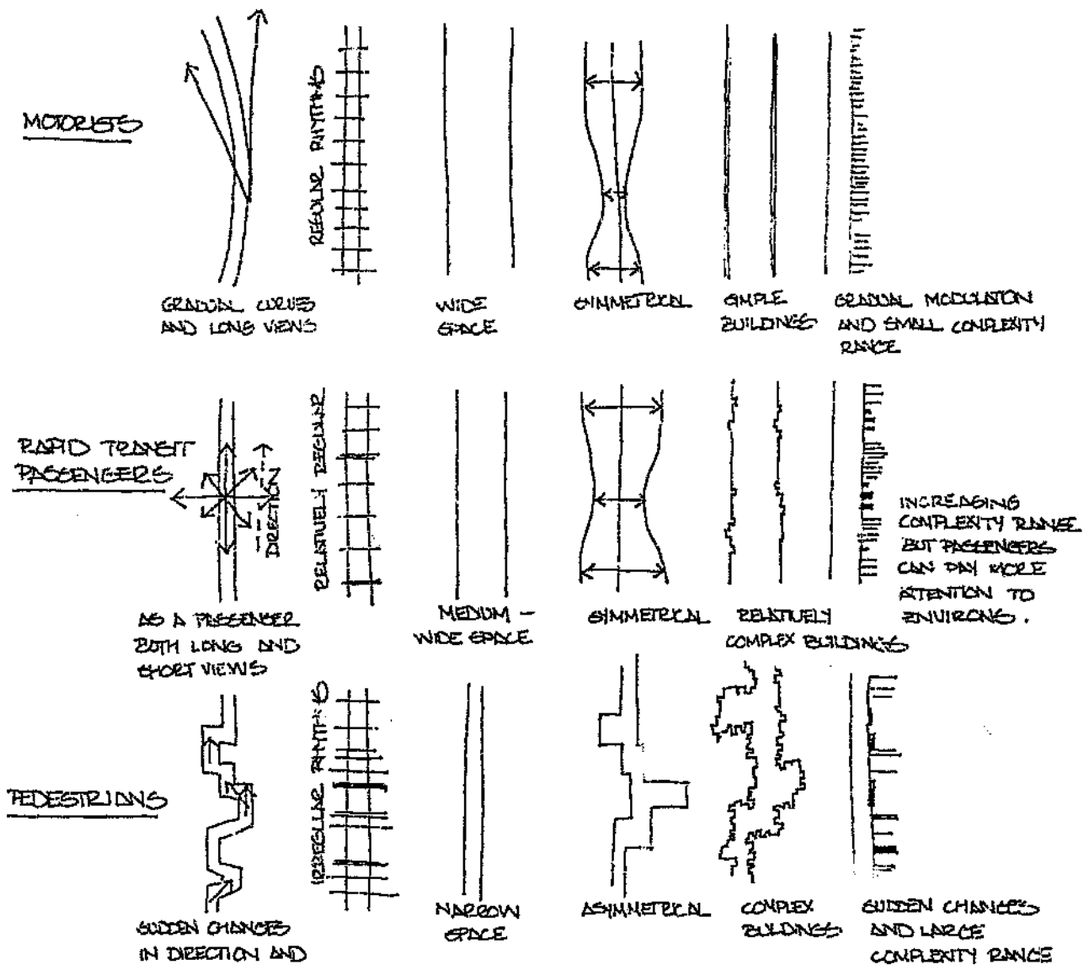
2 Continuity of experience.

3 Simultaneous continuities.

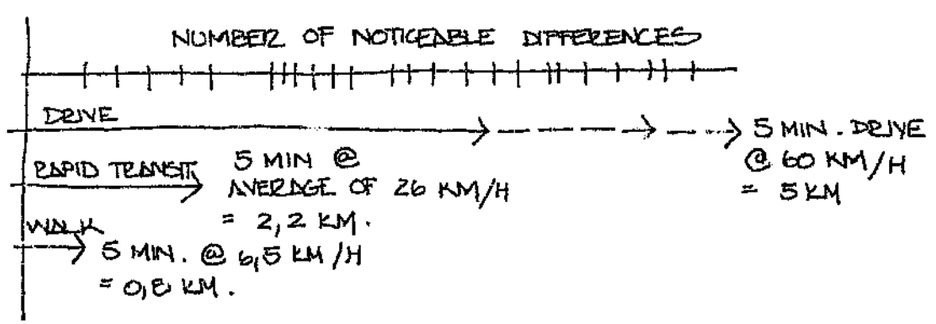
Bacon (1967, p.34) stresses that the purpose of a city plan

"should lie not in authority but in the ability to influence growth just as the seed has within it a force which causes the cells to group themselves according to an order necessary for the organism to develop".

This thinking to enable growth, and in particular catalytic growth, is critical to rapid transit. The core of a transit-related district as the focal point of optimum growth, relates to Klee's analogy of the point of convergence of the veins of a leaf as the convergence of the movement of people and goods within a city.



CHARACTERISTICS OF PEDESTRIAN, PASSENGER AND MOTORIST SPEED-SETTINGS (ADAPTED FROM RAPOPORT 1990).



PERCEIVED COMPLEXITY AND SPEED OF MOVEMENT (ADAPTED FROM RAPOPORT 1990).

The linkage between movement systems and natural or man made topography is also raised by Bacon (1967). The nature of terrain and natural features can

> *"serve to emphasize, dignify, or give new meaning to churches and spires, to public buildings, and to historic movements that have special significance in the community"* (ibid., p.35).

4.2.4 Rapoport : speed of movement and perception

A related aspect is that of the speed of movement. Specifically, with regard to rapid transit interventions, there is a need to consider simultaneously the different ranges of speed and rates of perception, to provide variety and fixes along a route for passengers on a light rail car to the cyclist to the pedestrian. Rapoport (in Boden, 1979) argues the need for complexity arranged to encourage

> *"gradual unfolding of the ordering principles, rather than familiarity breeding boredom and contempt".*

Therefore, what becomes critical is the relative speed of the various transport modes. Simply, there is an inverse relationship between speed and the ability to absorb and process inflaming stimuli. The adjacent diagram indicates that rapid transit provides a relatively good opportunity to perceive complexity in the built environment and general environs. The speeds used in this example are illustrative of an urban conte

4.2.5 Crane : five faces of movement and Dynamic City

In terms of "line" of the route of rapid transit, there are two concepts explored by Crane which are of relevance. In 1969, Crane proposed that there were Five Faces of movement::

1 The route/"line" as a carrier of goods and people.

2 As city expander (relates to catalytic impacts).

3 As a space-shelter.

4 As a channel for information.

5 As a connector between various activities.

Secondly, the notion of a dynamic city was explored by Crane (1960), structured in terms of

1 *Electability.*
Choice is the critical key. The grid and associated block structure is seen as the primary tool to maximising permeability and connectivity.

2 *Malleability*
The "line" should be flexible to the extent that it may be upgraded to greater capacities. It is argued that the built form and public spaces should be flexible for later conversion and adaptation over time, subject to changing demands and pressures. To keep land in reserve for future use may be viewed as problematic in the context of land invasions

3 *Predictability*
The "line" needs to be fixed to ensure predictability, necessary for attracting business confidence, as well as providing legibility for pedestrians and system users.

4 *Symbolic place*
This relates to achieving a sense of permanence and meaning to both "lines" and "points". The manner in which this is achieved is largely dependent on context and precedent.

4.2.6 Dewar and Uytenbogaardt : towards compacting the South African city

In considering "the way forward" for the South African city, Dewar and Uytenbogaardt (1991), indicate that change should be directed

> *"towards creating a compact, intensive and convenient city which operates as an integrated system, which works well at the level of the lowest common denominator (people on foot), which makes maximum use of limited resources, and which is respectful of its beautiful natural setting"* (ibid., p.79).

The structuring elements are identified as:

1 Regional open spaces.

2 Site-making actions.

3 Activity systems.

4 Public facilities.

5 Urban spaces.

Important to note herein are the last 3 elements.

Activity systems, as a network of interlocked linear activity systems, of mixed intensive uses, are seen to be dependant on six actions:

compact and densify the city

create a grid of continuous, direct public transportation channels

Ensure a rhythmical system of urban public spaces along these channels, reinforcing their spatial logic.

Furthermore,

> *"The public spaces should coincide with points of greatest accessibility and there should be a hierarchical correlation between the degree of accessibility and the site of the space (for example, the largest spaces should occur at the intersection of two major transportation channels containing paralleling modes of transportation ... stopping points for different modes should coincide with these spaces. Allow informal urban activities to occur within these spaces"* (Dewar and Uytenbogaardt 1991, p.82).

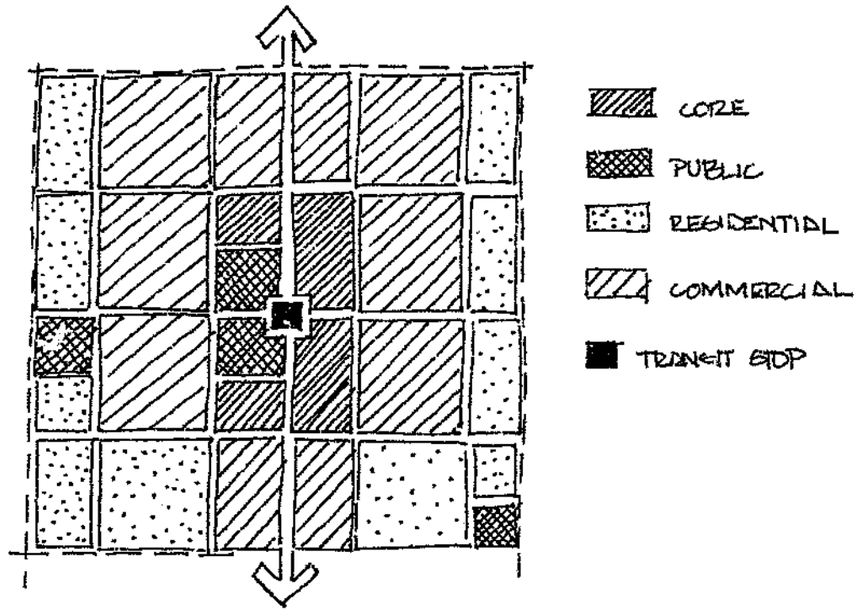
Public facilities and social services should be located around public spaces. A sense of hierarchy, scale, definitions and enclosure of spaces is to be aimed for :

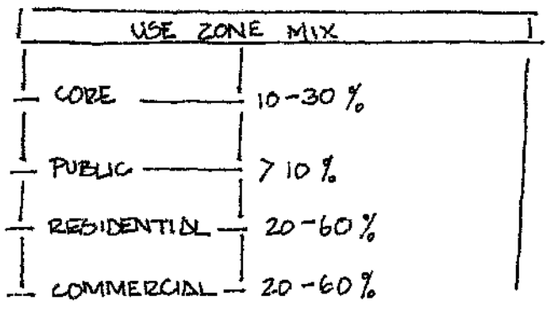
- More intense private sector activities dependent on public support should be encouraged to respond to the flows of people carried in the transportation channels. Proactive steps towards a higher degree of activity mix, as well as informal trade opportunities to occur at places of greatest economic opportunity.

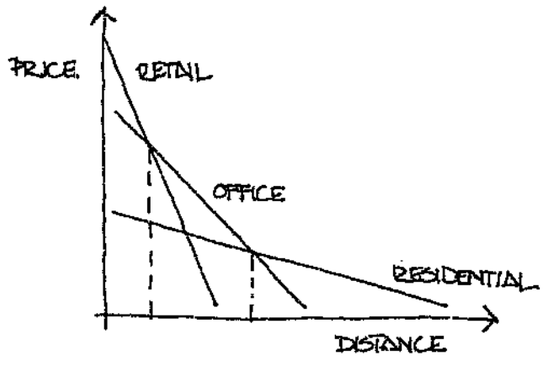
- Emphasize and maximise the potential of well located land parcels through a process of intensification.

- Public facilities are concerned with maximising scarce resources available for the creation of social infrastructure.

  "Thus, encourage the atomization of public facilities such as schools. Place their more public functions (such as halls, libraries, cafeterias and workshops) in highly accessible locations and encourage sharing between different institutions and between institution and the community its serves. Encourage







OFFER PRICES OF RETAIL, OFFICE AND RESIDENTIAL USES WITH DISTANCE FROM CITY CENTRE (IN GOODALL 1972).

CORE

A mixed use core area should consist of ground floor retail and commercial space of a minimum 10% site space. A *minimum* of 10 000 sq. feet (110 000 sq. m.) of retail space should be provided within this 10% minimum. The core area is located adjacent to the transit stop and is pedestrian-related. Included are :

- Convenience shops (110 000 - 165 000 sq. m.)
- Neighbourhood centres (660 000 - 1 100 000 sq. m.)
- Community centres
- Speciality retail centres (660 000 - 1 100 000 sq. m.)
- Formal markets

PUBLIC USES

To include parks, squares and community-related buildings, for example, recreation facility, library, or town hall. Public buildings should be located in convenient areas, with good access opportunities, and in highly visible focal points.

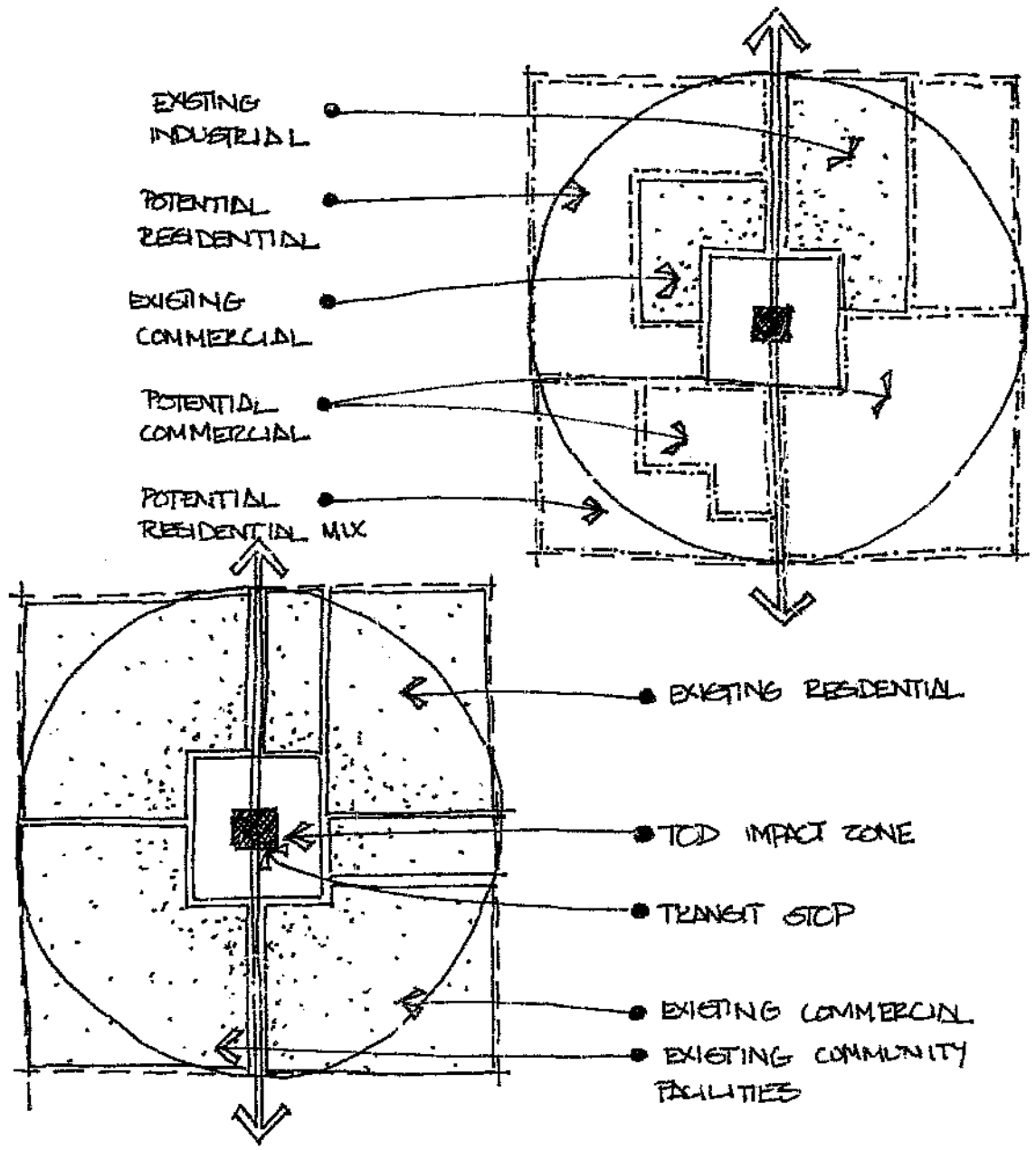
RESIDENTIAL

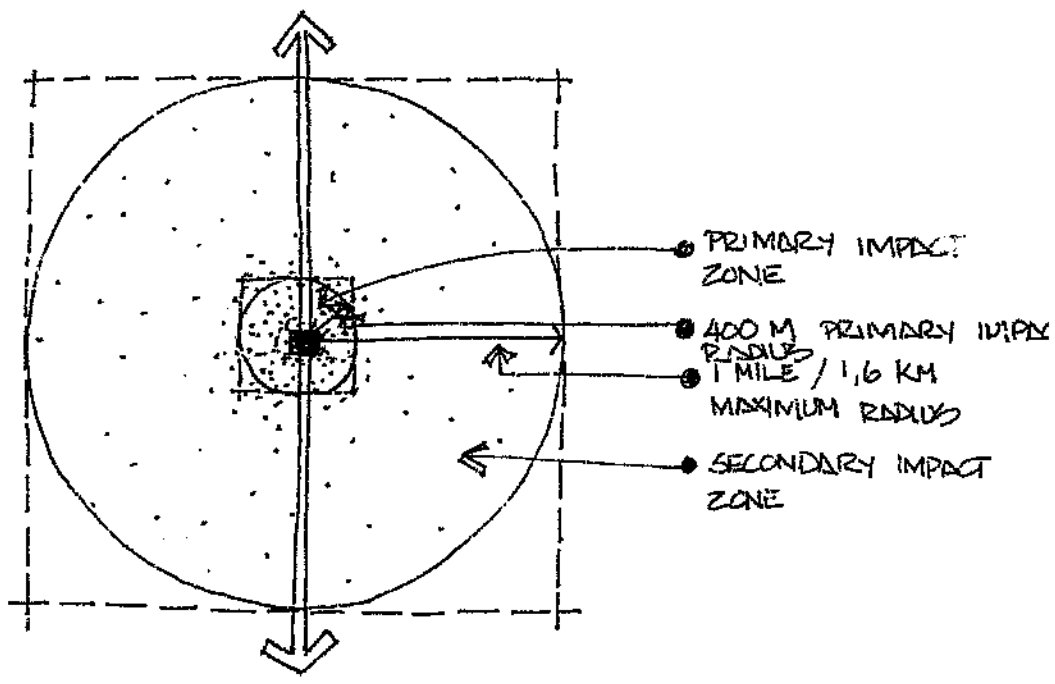
A mix of type, ownership and density is promoted in a TOD. In urban areas, a combination of duplexes, and 3-4 storey walkups is recommended. These can also be developed to a sub-R65 000 range if appropriate planning processes and agreements are entered into between the community and relevant stakeholders.

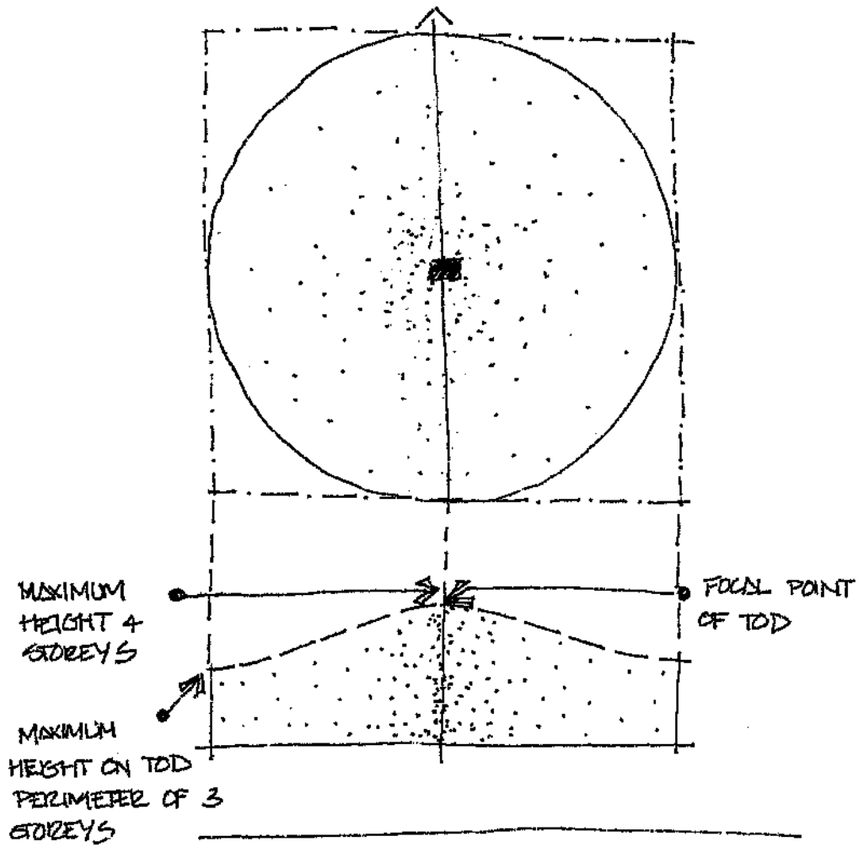
COMMERCIAL

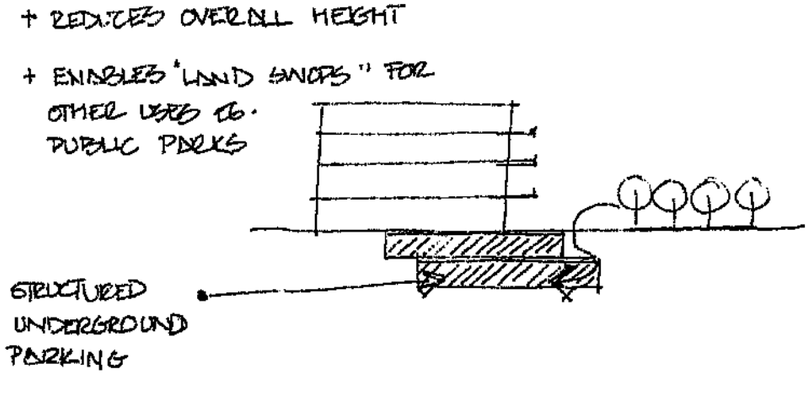
Office intensities (without formalised parking) have a minimum FAR of 0,6. With structured parking urban TOD offices should not exceed 1,7 FAR. These FARs encourage multi-storey development and structured parking in urban TODs. Joint use parking facilities should be promoted. Interior or "introverted" and shopping centres surrounded by parking lots are not permitted.

(extracts from Calthorpe and Associates, 1990).


EXISTING INDUSTRIAL
POTENTIAL RESIDENTIAL
EXISTING COMMERCIAL
POTENTIAL COMMERCIAL
POTENTIAL RESIDENTIAL MIX
EXISTING RESIDENTIAL
TOD IMPACT ZONE
TRANSIT STOP
EXISTING COMMERCIAL
EXISTING COMMUNITY FACILITIES


PRIMARY IMPACT ZONE
400 M PRIMARY IMPACT RADIUS
1 MILE / 1,6 KM MAXIMUM RADIUS
SECONDARY IMPACT ZONE





a generality of architectural layout so that functional changes can be easily accommodated over time" (ibid., p.84).

A rapid transit line becomes a critical element in a system of interconnected activity flows. It contributes to

> *"different intensities or thickness ... (making) city places which would capture the investment imagination of all sectors of the city's population"* (ibid., p.102).

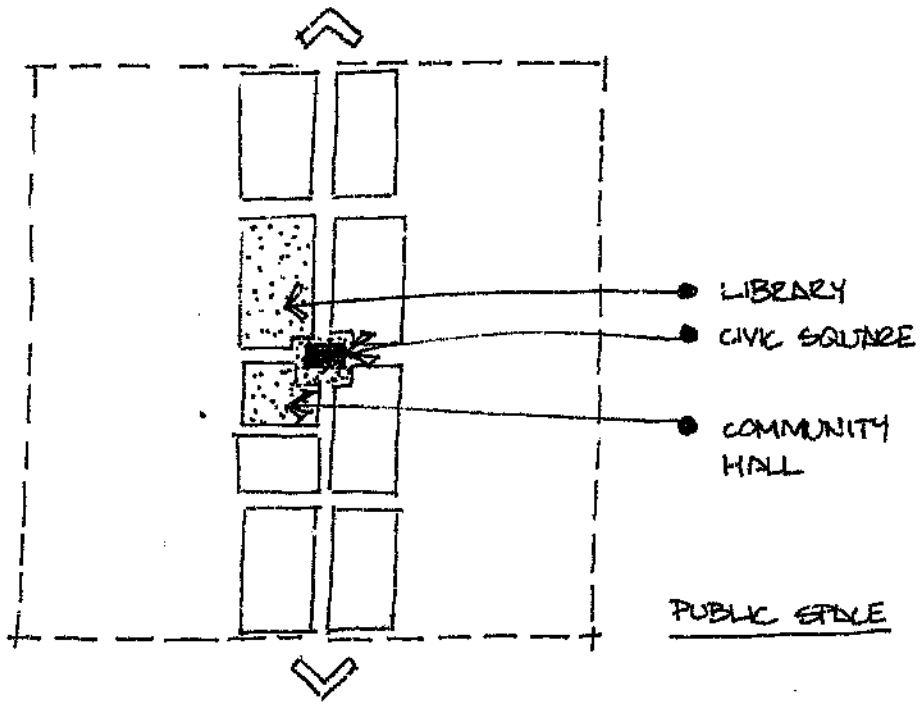
Furthermore, the different rhythms and stops of transport modes is noted, and the effect this has in terms of creating a complex pattern of accessibility and, thereby, maximising opportunities

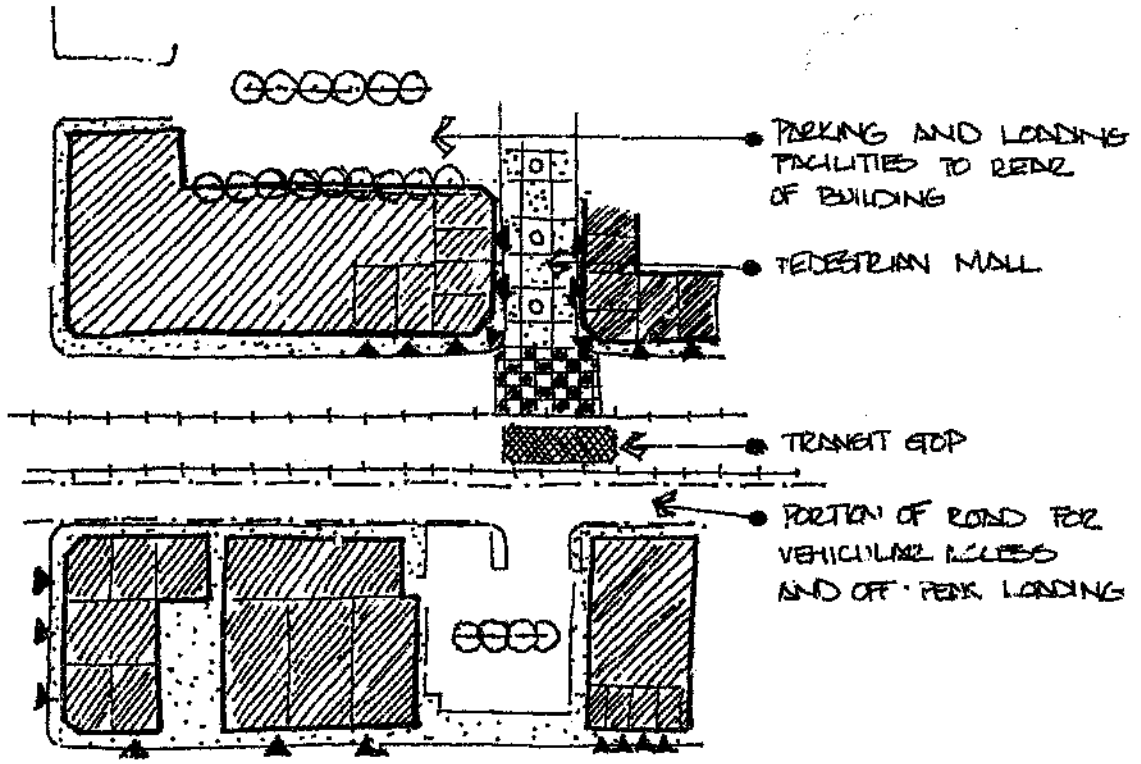
Urban spaces should be introduced at a variety of scales including public social squares and "urban rooms" (ibid., pp.80-84).

4.2.7 Understanding the TOD concept

A response to the problems associated with suburban sprawl and the car-culture of the past decade, has been Transit Oriented Districts (TODs). The underlying thinking is that of Neo-Traditional design, scaled according to the pedestrian. One of the main protagonists of the TODs concept is Calthorpe. A TOD is defined as

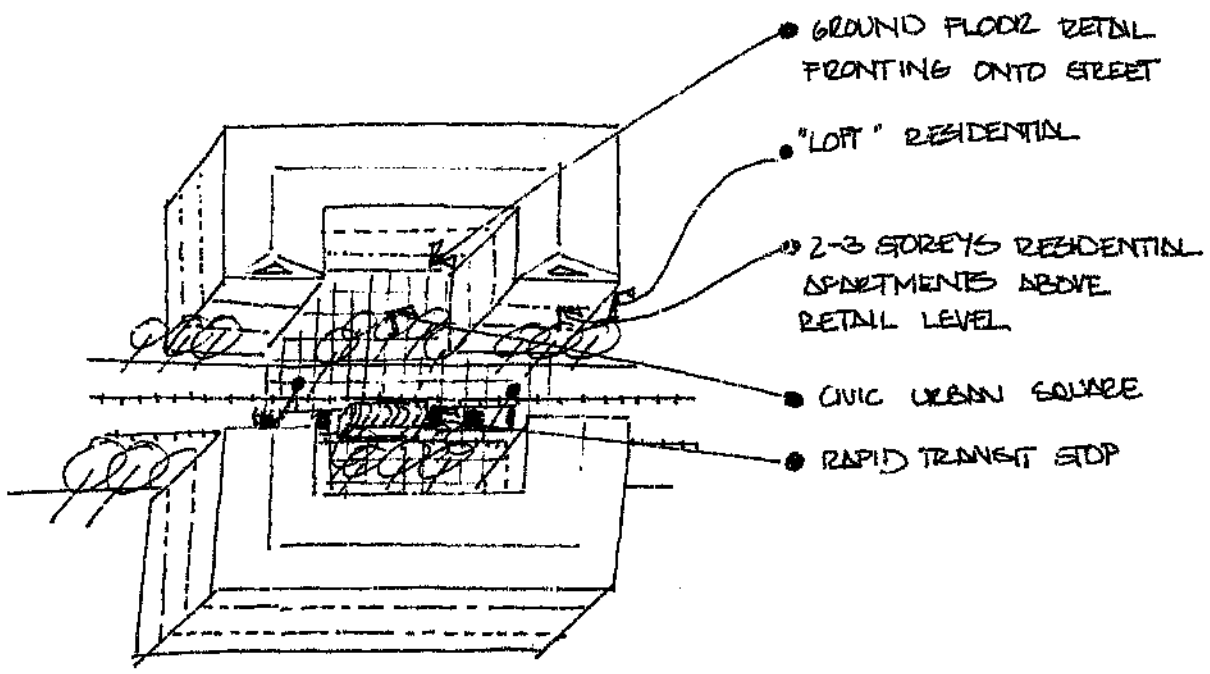
> *"a mixed-use community within an average one-fourth mile walking distance of a transit stop and core commercial area. The design, configuration, and mix of uses emphasize a pedestrian-oriented environment and reinforce the use of public transportation. TODs mix residential, retail, office, open space, and public uses within comfortable walking distance, making it convenient for residents and employees to travel by transit, bicycle or foot, as well as by car"* (Calthorpe Associates 1990, p.5).

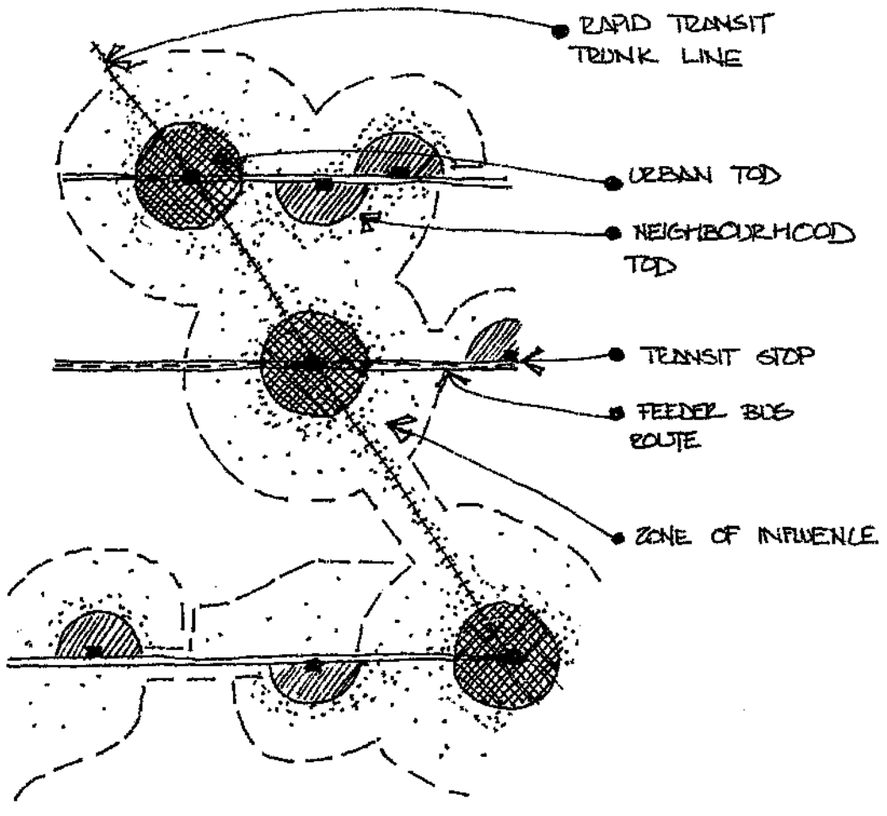


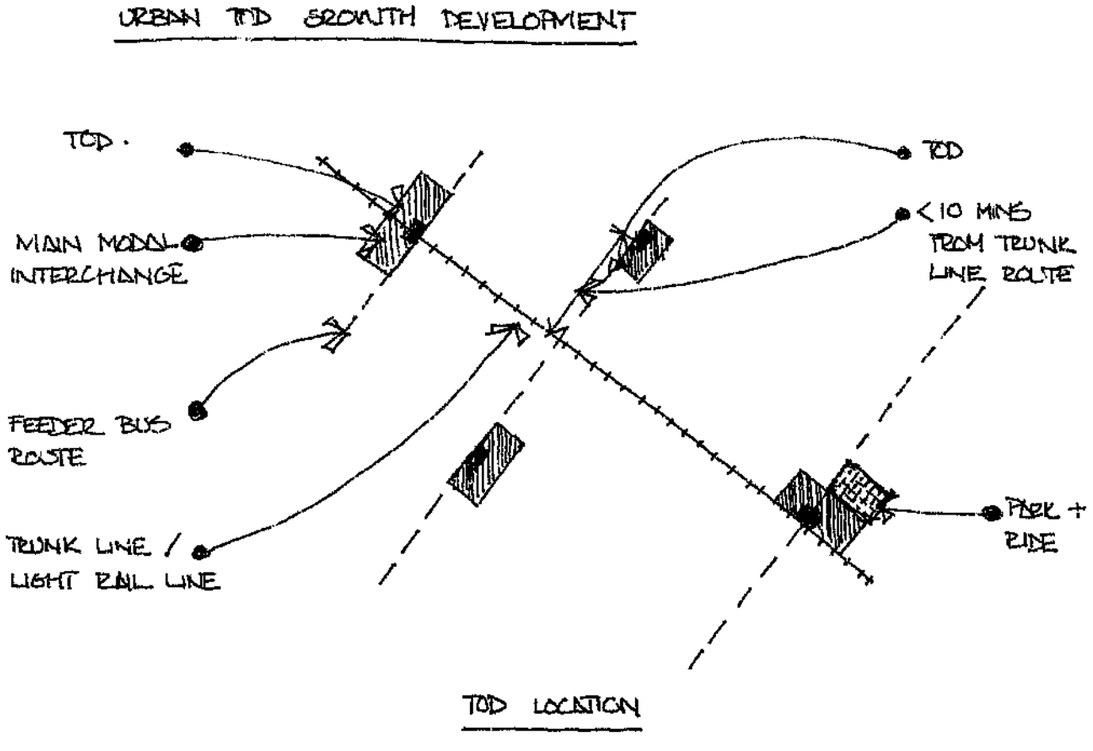


ACCESSING COMMERCIAL AND RETAIL BUILDINGS.

MIXED USE FOCUSSED AROUND THE CIVIC URBAN SQUARE...







The size of TODs vary from 20 to 160 acres, with two types of TODs being "urban" TODs and "neighbourhood" TODs. The distinction between the two is that the former

> *"are located on the Trunk Line Network at light rail stops or at bus transfer stations ... (having) a higher percentage of job-generating uses and may be developed at higher commercial intensities and residential densities",*

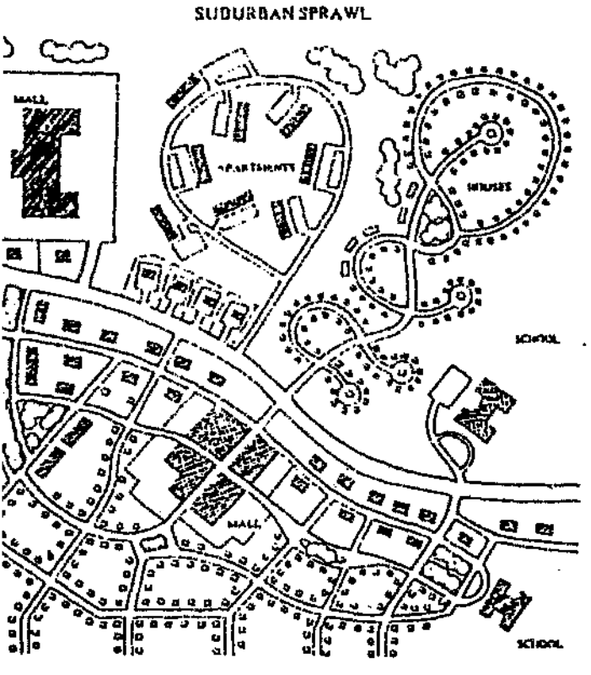
whereas the latter

> *"are located on feeder bus lines within 10 minutes travel time from light rail stops or bus transfer stations. These TODs should place a greater emphasis on residential uses and local-serving shopping"* (Calthorpe Associates 1990, p.2).

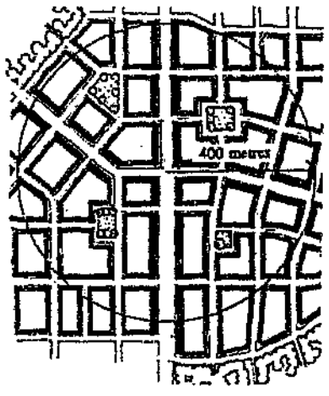
According to Rosencrantz (1992, in Murrain 1993, p.91) the density and proximity necessary to make rapid transit work is 20 to 30 dwellings per acre within 200m of fixed track transit. Calthorpe (1989, in Murrain 1993, p.91)

> *"empl.asis concentration and mixed-use and supports the 5 minute/400 metre rule of thumb. Within this approximately 125 acre/50 hectare is housing, offices, retail, day care, recreation and parks ... some 2,000 units of housing and one million square feet of office space can be located within three blocks of the transit station without high-rise apartments or offices any higher than four storeys".*

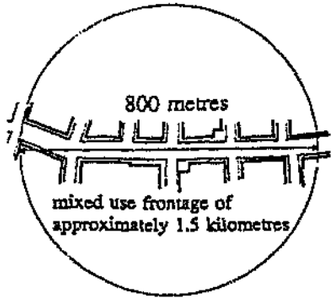
Studies by Pusharev and Zupan (1977, p.30) indicate that densities of the order 7 to 30 dwelling unites per acre were necessary to sustain rapid transit. Furthermore, an increase in density towards 30 dwellings per acre brought about an increase in transit use, and a sharp reduction in auto travel.

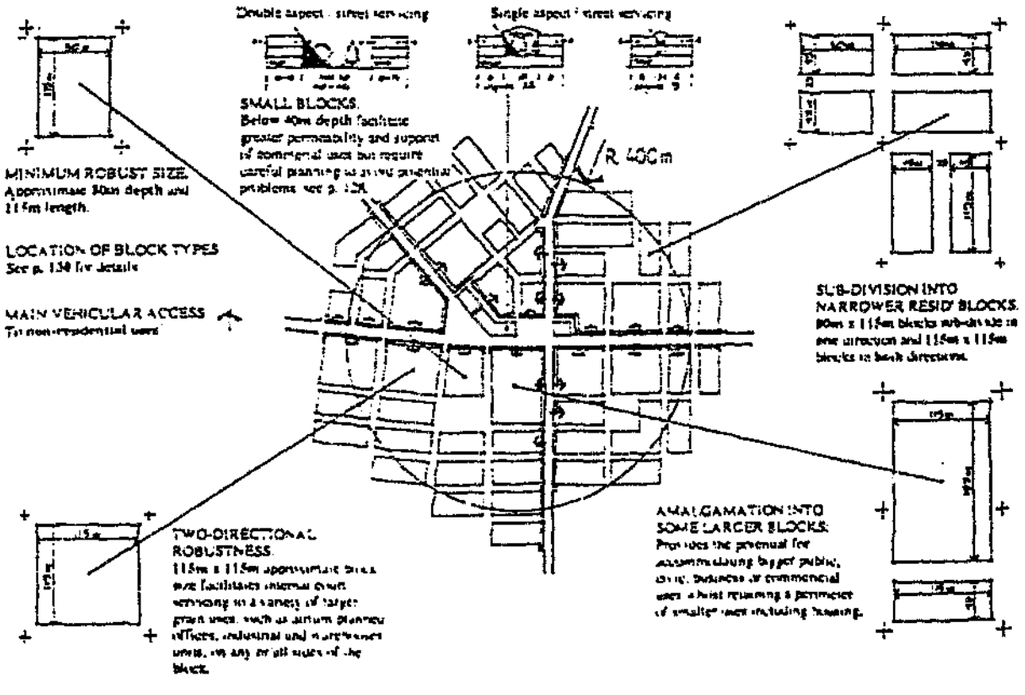


TRADITIONAL NEIGHBOURHOOD



THE NEIGHBOUR-HOOD UNIT MODEL (MURRAIN 1993).





A RANGE OF MIXED USE BLOCKS (MURRAIN 1993).

The concept of a TOD is substantiated by research carried out by the American Society of Civil Engineers, in terms of the application of Traditional Neighbourhood Development (TND). TNDs are defined as new urban communities reminiscent of urban neighbourhoods at the turn of the century. Several attributes are associated with TNDs (correlating with TODs):

- Maximise pedestrian travel for routine neighbourhood trips.
- Integrated land use, located in close proximity, and often with no buffer areas.
- Higher intensity of land use.
- Closely spaced commercial buildings located on the street, narrow streets, small blocks, and small residential stands (American Society of Civil Engineers 1990, p.1).

Murrain (1993) expresses further thoughts regarding the structure of the urban district. In terms of public open spaces, major open spaces should be located towards the periphery of the 400m radius of the central core, with more community and neighbourhood oriented open spaces located no more than 200m away from the community it serves. These spaces should also be located at the junction of well-integrated local connector routes (ibid., p.93).

In promoting mixed land use, the appropriate building typology is considered to be

> *"A robust building typology of four storeys maximum, 9 to 15 metre depth with frequent entrances along its frontage will best ensure a mix of uses at any one time and over time ... "* (ibid., p.93).

In terms of block dimensions, a range of options have been offered, including 90m (Bentley et al), 165 x 83m based on the American subdivision system of a 4.8m frontage (Duany and Plater-Zyberk), 60 x 140m based on a 9m plot frontage (Thorne), 115 x 80m as optimum for fine grain mixed use (Baulch) (Murrain 1993,

pp. 93-94). Clearly these dimensions vary somewhat, and are dependent on local conditions and subdivision systems. However, it may be generalised that blocks should not exceed 140m in length and 60m in depth.

4.3 SEARCHING FOR "LOST SPACES" IN THE URBAN FABRIC

In order to apply the TOD concept and facilitate processes to catalysis further positive reactions in the urban realm, opportunity sites need to be sought out. The focus of this thesis is towards underutilised and unused areas in the inner city. However, this does not discount other possibilities, such as the total redevelopment of land, or a single intervention in a well-established transit area. The focus is thus towards discovering "lost space" in the city.

Trancik (1986) proposed three theories of urban spatial design in addressing this "lost space" in the urban fabric :

1 *Figure-ground theory.*

This layer is concerned with the study of the comparison of solid mass (figure) to void (ground). The aim of the urban designer is to manipulate these relationships so as to enhance the structure and hierarchy of urban spaces. Five types of urban voids are identified, which are to be carved out of and intrude into solids enabling functional and visual continuity :

- Entry foyer space.
- Inner block void.
- Primary network of streets and squares.
- Public parks and gardens.

- Linear open space system.

These urban voids each displays varying degrees of openness and enclosure. For example, the second above-mentioned aspect portrays both limited enclosure to the street and a sense of enclosure provided by the surrounding buildings located on the block.

Three categories of urban solids are identified :

- Object buildings and monuments.
- Predominant field of urban blocks.
- Directional or edge-defining buildings.

2 *Linkage theory.*

The primary concern here is the linkage between urban elements. An attempt is made at establishing a system of connections, emphasising circulation. Trancik (1986) utilises Maki's (1964) ideas regarding collective form in viewing linkage as the glue of the city. Urban design is concerned with making comprehensible links between discrete elements, as well as articulating the parts of a large entity.

3 *Place theory.*

This stage involves the superimposition of the above two theories in that it adds human needs, cultural, historical, and natural contexts. It also attempts to include a temporal aspect.

There are several relevant considerations underlying the approach proposed :

- The integrated approach is oriented toward change and innovation.
- Integration can be achieved via incrementalism, as opposed to total redevelopment.

- Mixed land uses offer greater richness and vitality than single land uses.
- New ways of integrating the motor vehicle into the urban landscape can be found.

Subsequent to this, five design principles are suggested :

Principle 1 - Linking sequential movement.

Principle 2 - Lateral enclosure and edge continuity.

Principle 3 - Integrated bridging.

Principle 4 - Axis and perspective.

Principle 5 - Indoor/outdoor fusion.

The southern belt of Johannesburg's inner city is characterised by "lost spaces" or gaps in the urban fabric. The opportunity, therefore, presents itself to exploit these gaps in an optimal manner .. to be explored is the Westgate area in the subsequent chapter.

4.4 CONCLUSIONS

Relevant extracts of urban design related theories and ideas from a range of theorists were evaluated in terms of pertinence to the "line", "point" and "ripple". These three elements are seen to encompass the catalytic and restructuring effect which rapid transit may have on urban form and development.

Certain important conclusions in relation to available theories which may relate to rapid transit and its impacts, include :

- There is a degree of overlap in relation to design related approaches to rapid transit in certain American cities, for example Sacramento where the TOD concept has been

applied. However, developments in this field are still relatively unexplored and require careful analysis for application in different contexts.

- The need for community involvement in all phases of the planning and design process of rapid transit is viewed as increasingly integral to the success of the scheme. Furthermore, the need for multi-disciplinary interaction, indicated by theorists such as Crane, is viewed as important to design process.

- The TOD concept indicates the trend being increasingly promoted in the United States, promoting the mixed land use, a pedestrian related environment, sustainable urban developments, and takes into account the significant effects which fixed track transit may have on its surrounding urban environment. The approach of TODS increasingly encompasses principals recently promoted in urban design circles.

- Of concern, are indications that urban design is not viewed as integral to rapid transit planning, design and implementation. Rather, it is an add on component. Furthermore, ideas proposed in the United States with regard to concepts such as TODs which take into account the impacts of such systems on the environment, are not taken up in any visible manner in South Africa.

five

designing for a transit-friendly city :

johannesburg inner city

as a case study

5.1 AIMS

This chapter sets out to provide an alternative vision for rapid transit in the inner city of Johannesburg. The application of principles and strategies explored in the previous chapter in relation to rapid transit catalysis is carried out on one district in the city - the Westgate Station District. This exploration is considered in light of the total route context.

Therefore, this chapter focuses on :

- An evaluation of the proposed pilot study route put forward by the Johannesburg City Council.

- To put forward an alternative route in light of the findings in this dissertation as to exciting opportunities offered by rapid transit applications worldwide and based on the historical background of the Johannesburg tramway system.

- To provide a vision for the Westgate Station District, identified as one of several pockets of unidentified land in the city ripe for intervention and restructuring.

5.2 MOTIVATION

The Westgate Station District is identified as "lost space" in the fabric of the inner city of Johannesburg. This district is an integral part of the proposed light rail transit route, as the starter point of the route which runs through the core area, and terminates in Rockey-Raleigh Street, Yeoville. The location of the site on the "periphery" of the CBD offers opportunities for its redevelopment and modification to be integrated into the structure of the city, with light rapid transit as a catalyst.

Furthermore, this district incorporates three important elements of the rapid transit system :

- The route itself (a part thereof).

- Transit stops.

- The main station (main nodal interchange) at Westgate.

Certain critical assumptions for the implementation of a light rapid transit system are made :

- The city and metropolitan area of Johannesburg will undergo significant economic growth.

- Processes will be initiated and stakeholders involved to jumpstart housing projects in the inner city, including the Westgate District. Critical to the success of rapid transit is a sustainable residential threshold within nearby proximity of the route stops and modal interchanges.

- Transportation cannot be separated from other initiatives or programmes, such as housing development.

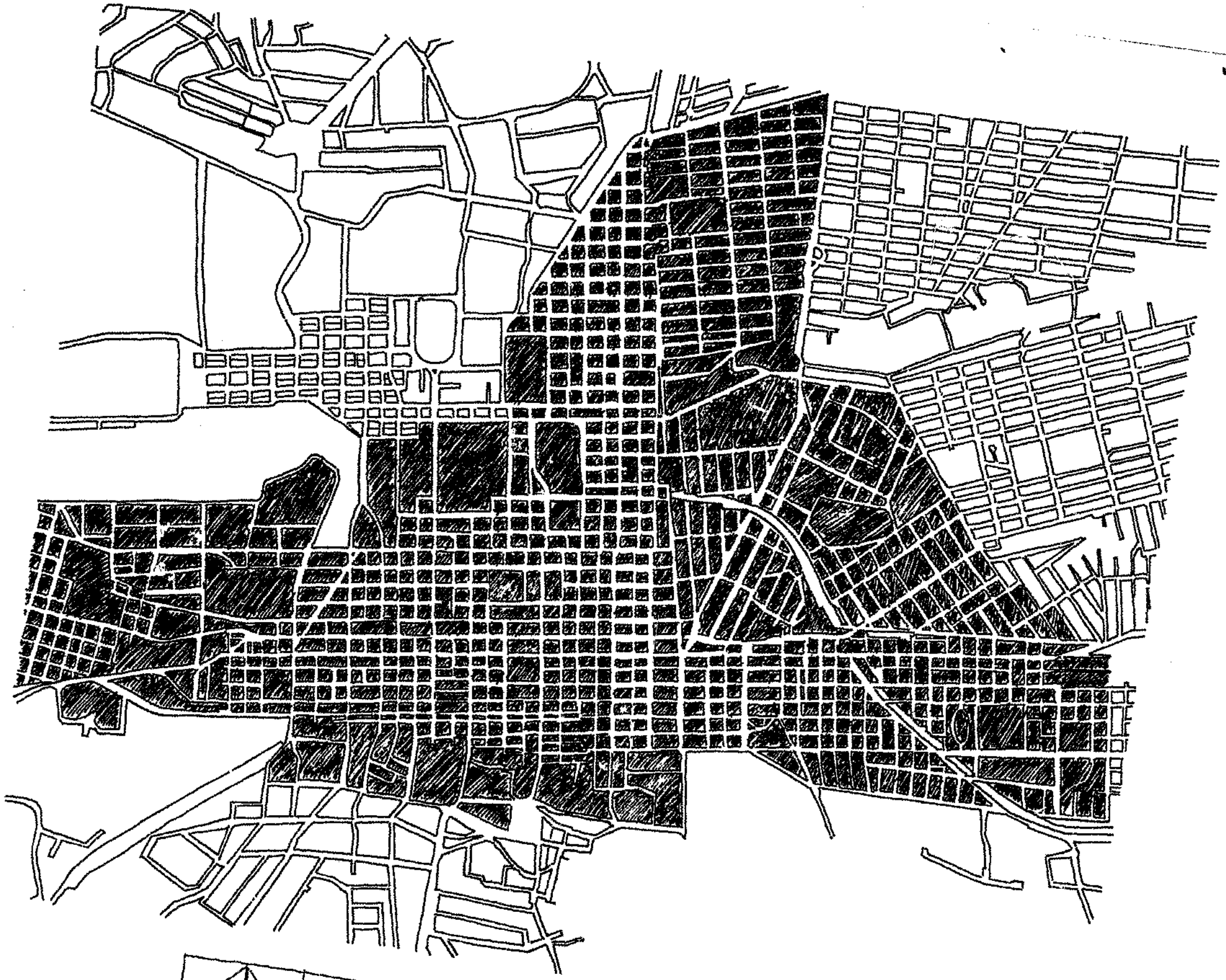
- Capital funding from road-based programmes for the investigation, planning and construction of major roads and freeways be shifted in part, or total, the programmes such as light rail, which would fulfil criteria identified earlier for urban compaction and reconstruction.

- Furthermore, the shift from a car-dominated society needs to be strongly enforced via car tax and other mechanisms or policies, from metropolitan, provincial or national level.

- There is support from taxi organisation to negotiate on how mass public transportation can be co-ordinated and efficient to the benefit of the parties and users.

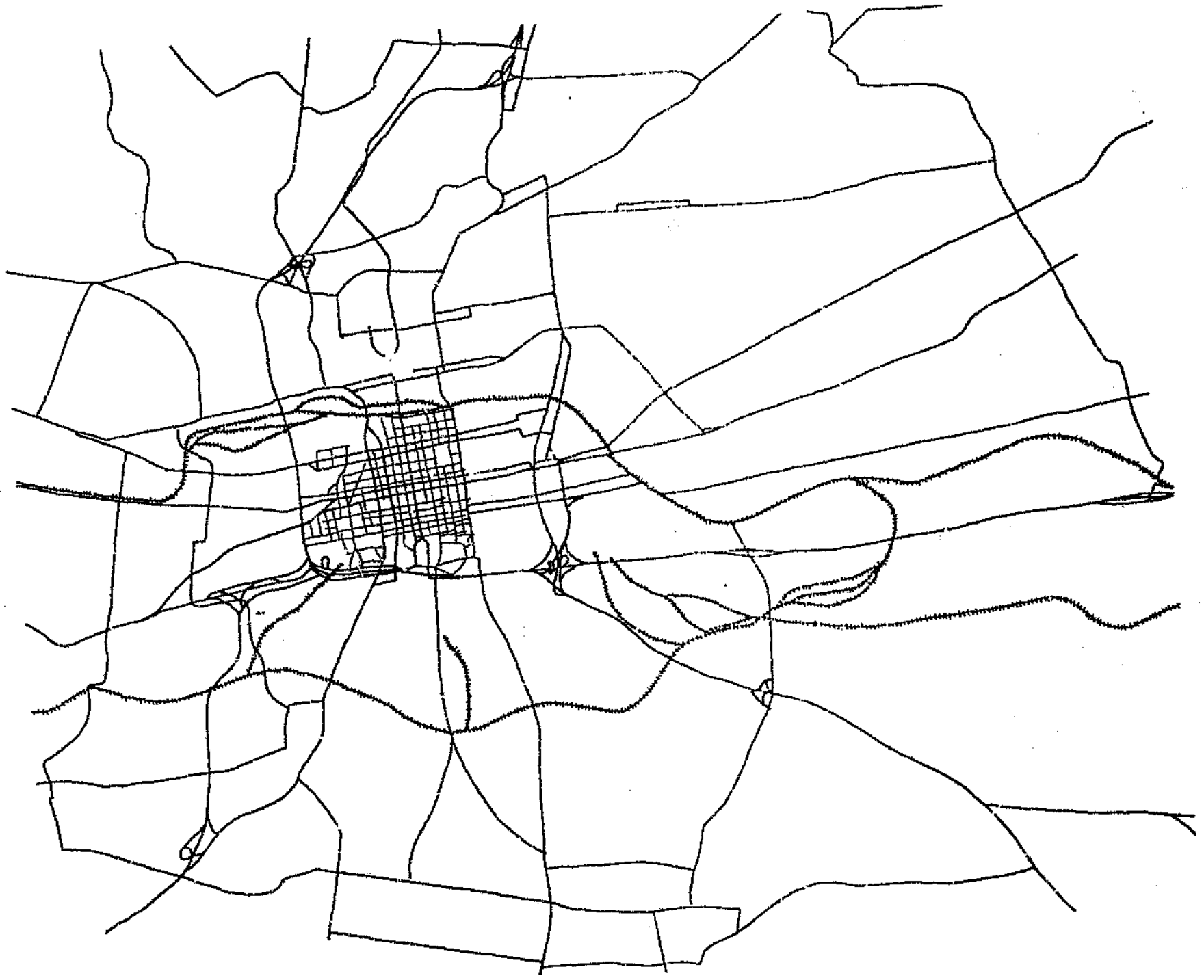
westgate tod
johannesburg inner city

setting the scene
urban context



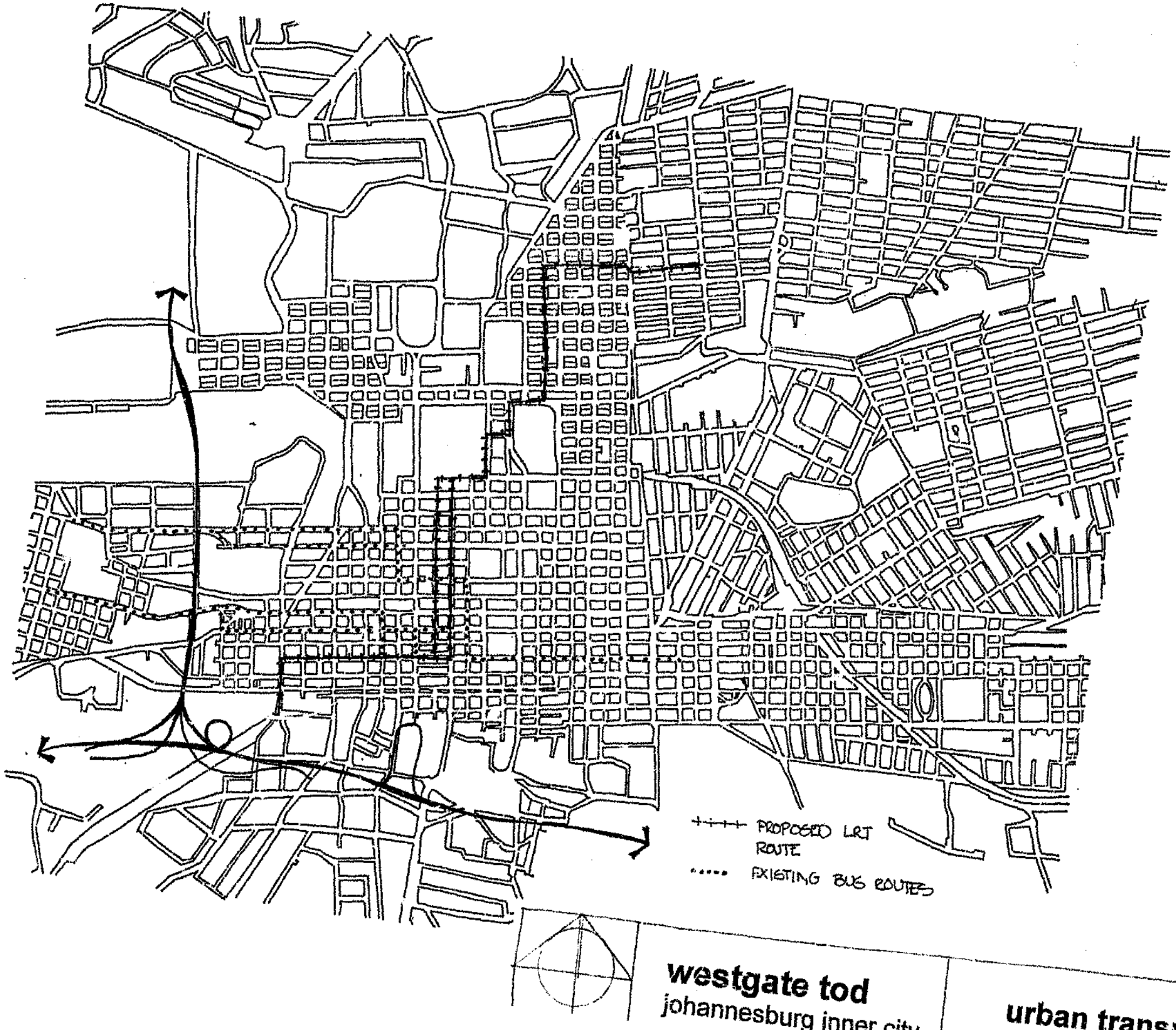
westgate tod
johannesburg inner city

setting the scene
urban context



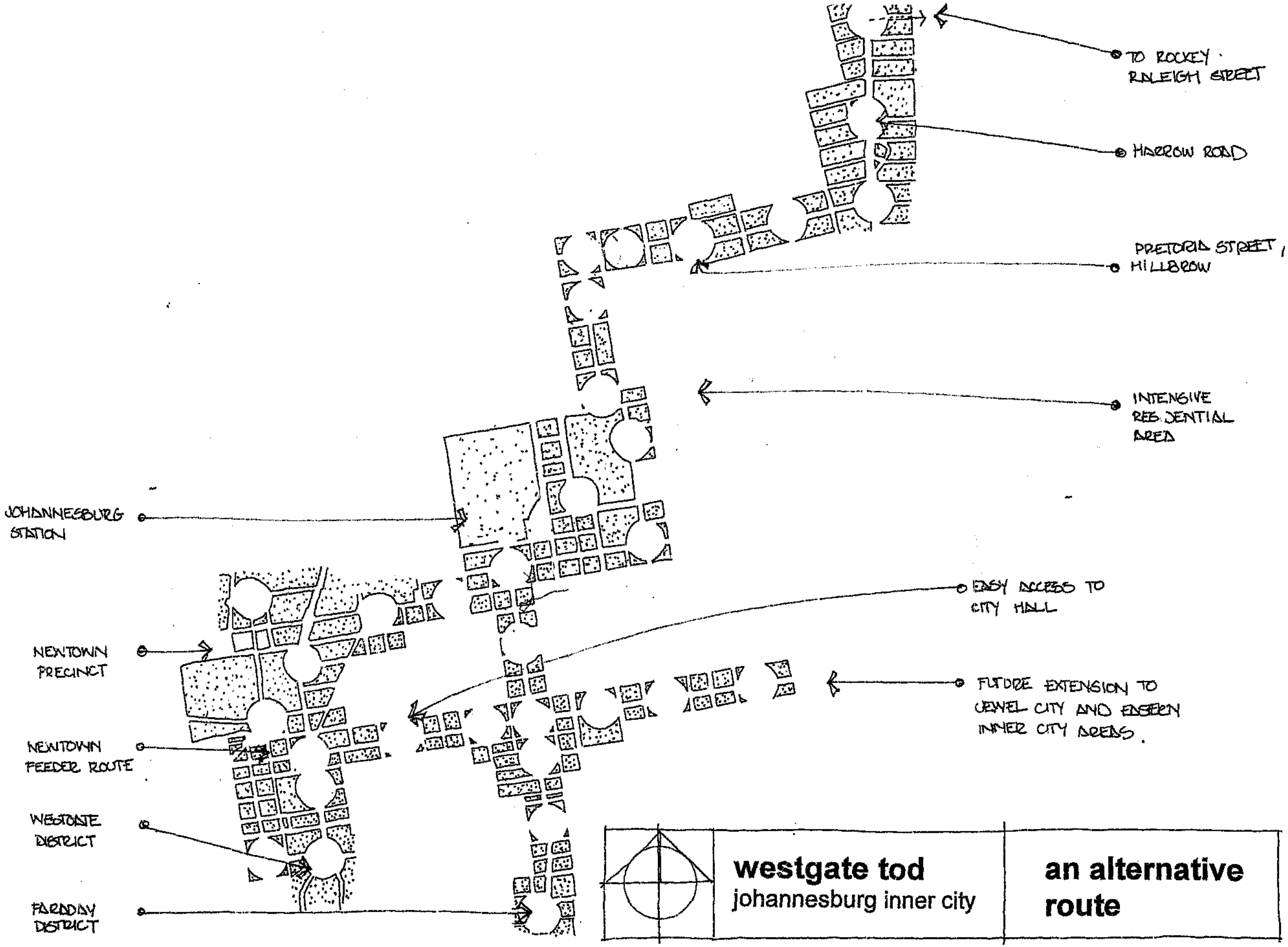
westgate tod
johannesburg inner city

regional transport



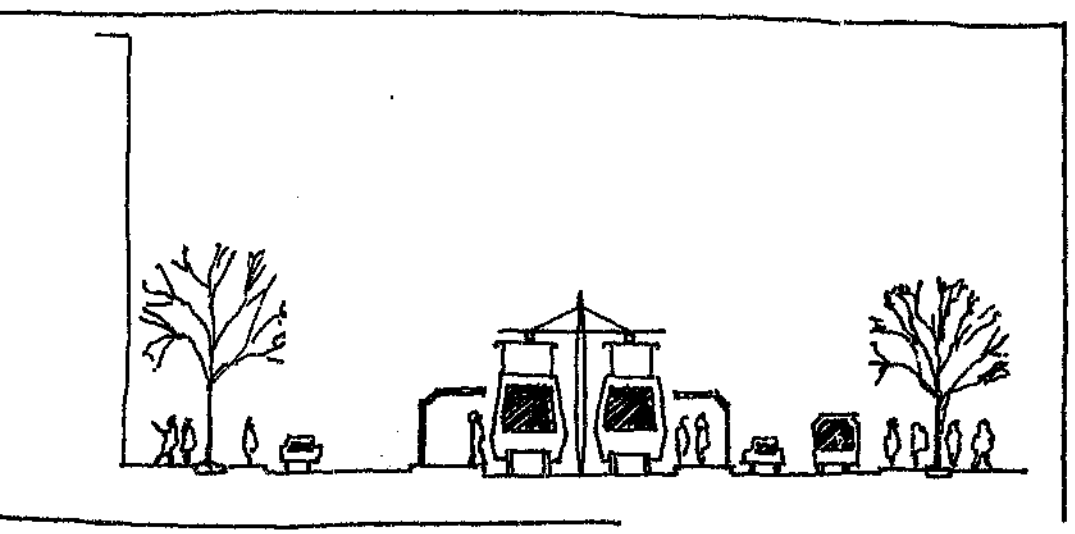
westgate tod
johannesburg inner city

urban transport

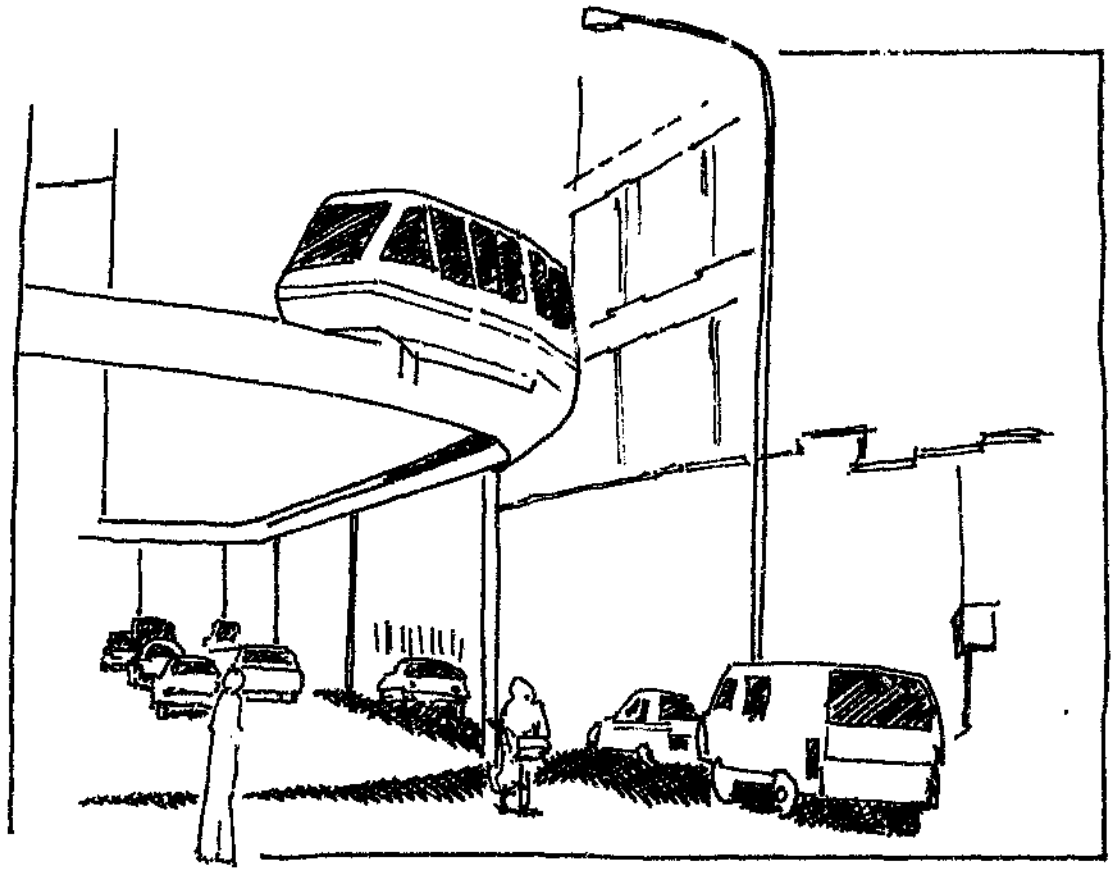


westgate tod
johannesburg inner city

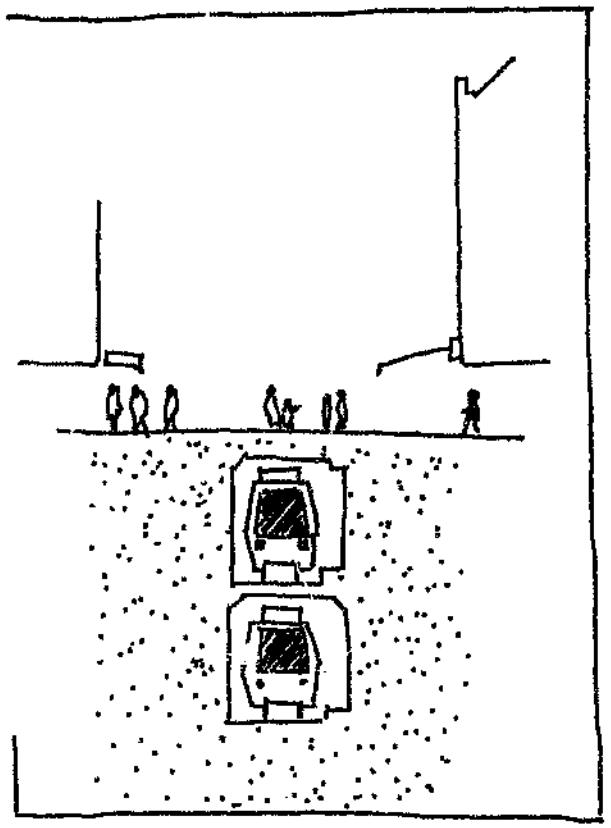
an alternative route



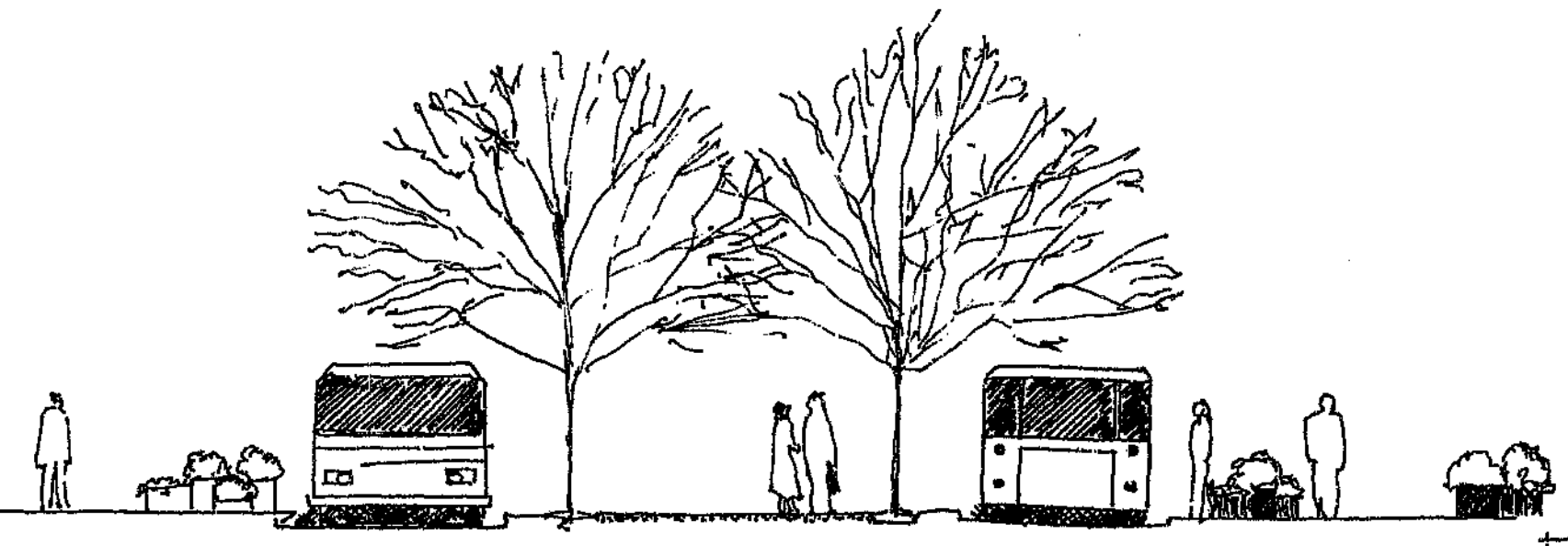
HANOVER : EXCLUSIVE BUS AND TRAM ROUTES OVER ONE BLOCK



SYDNEY : SINGLE LOOP MONORAIL SYSTEM, CONSISTING OF A STEEL BOX-SECTION TRACK LOCATED ABOVE PAVEMENTS



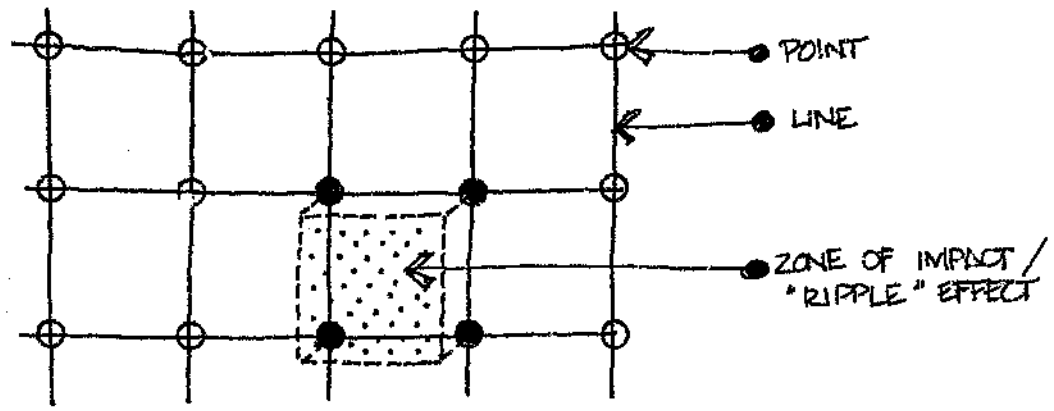
HANOVER : TWIN TRAM TUNNELS BUILT ONE ABOVE ANOTHER TO AVOID FOUNDATIONS AND SERVICES TO BUILDINGS ABOVE



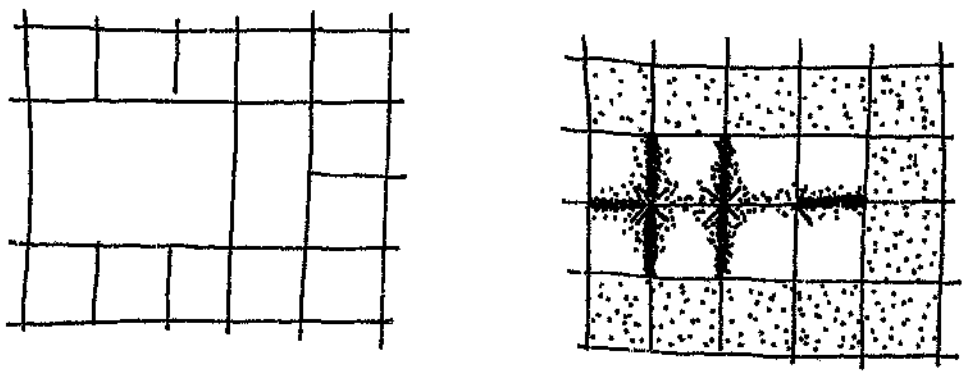
DENVER MALL : LIMITED PEDESTRIAN ZONE ALONG CENTRAL AXIS

westgate tod
johannesburg inner city

some rapid transit options

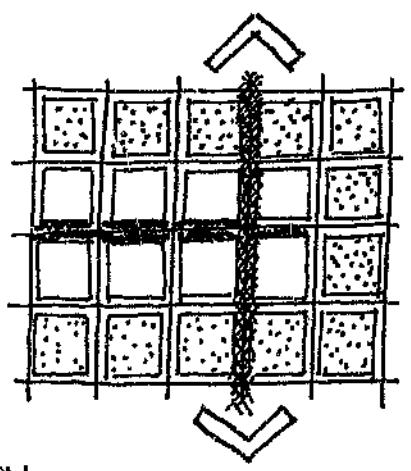


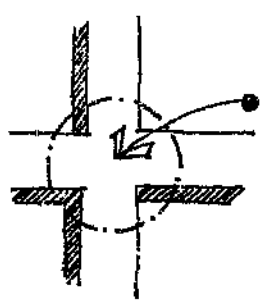
TOWARDS COMPACTING THE URBAN FORM ....



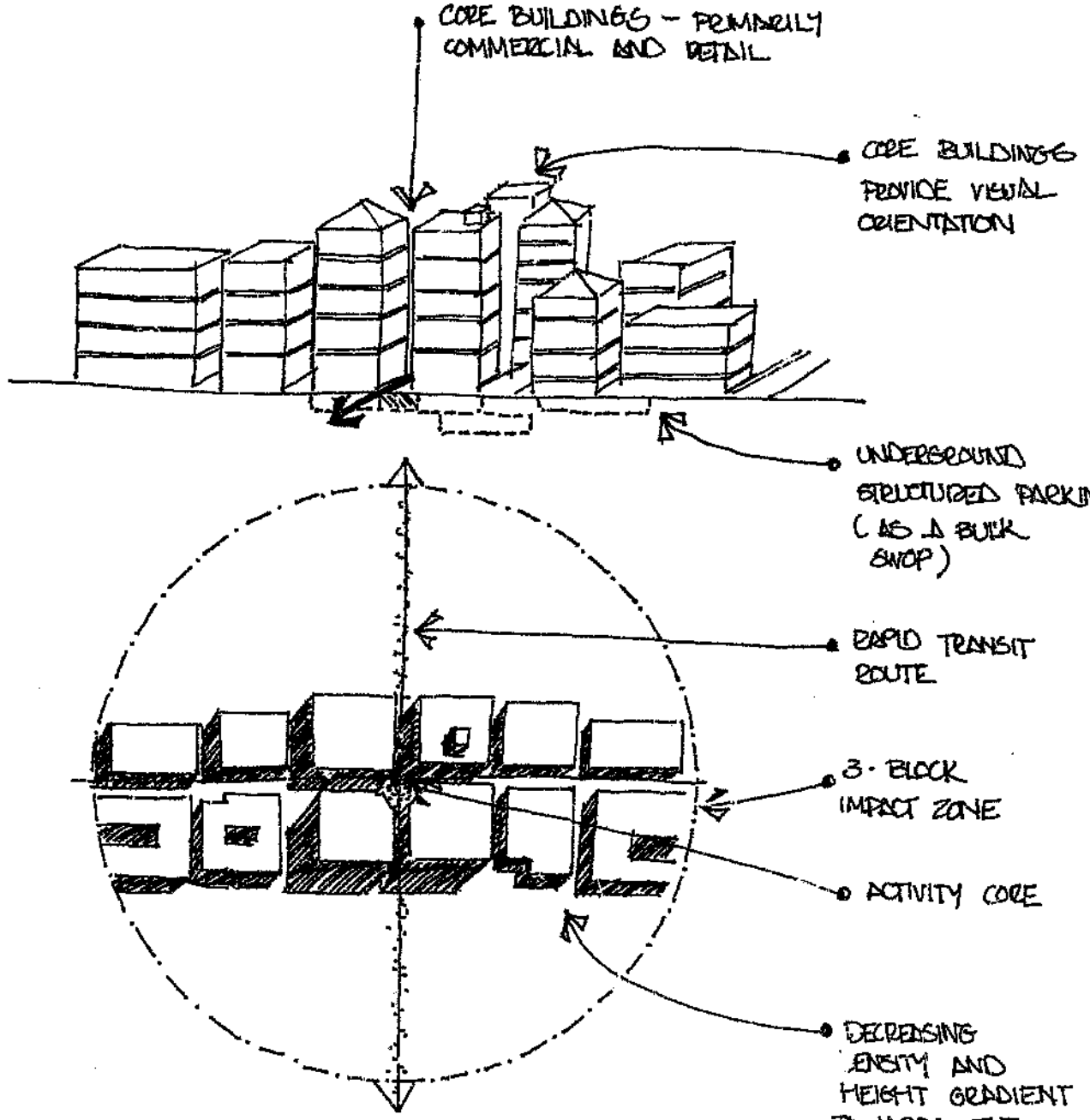
1 RE-ESTABLISH THE GRID

2 POSITION THE RAPID TRANSIT ROUTE AND STATION IN A STRATEGIC LOCATION, WITH GOOD GLOBAL AND LOCAL CONNECTIONS.

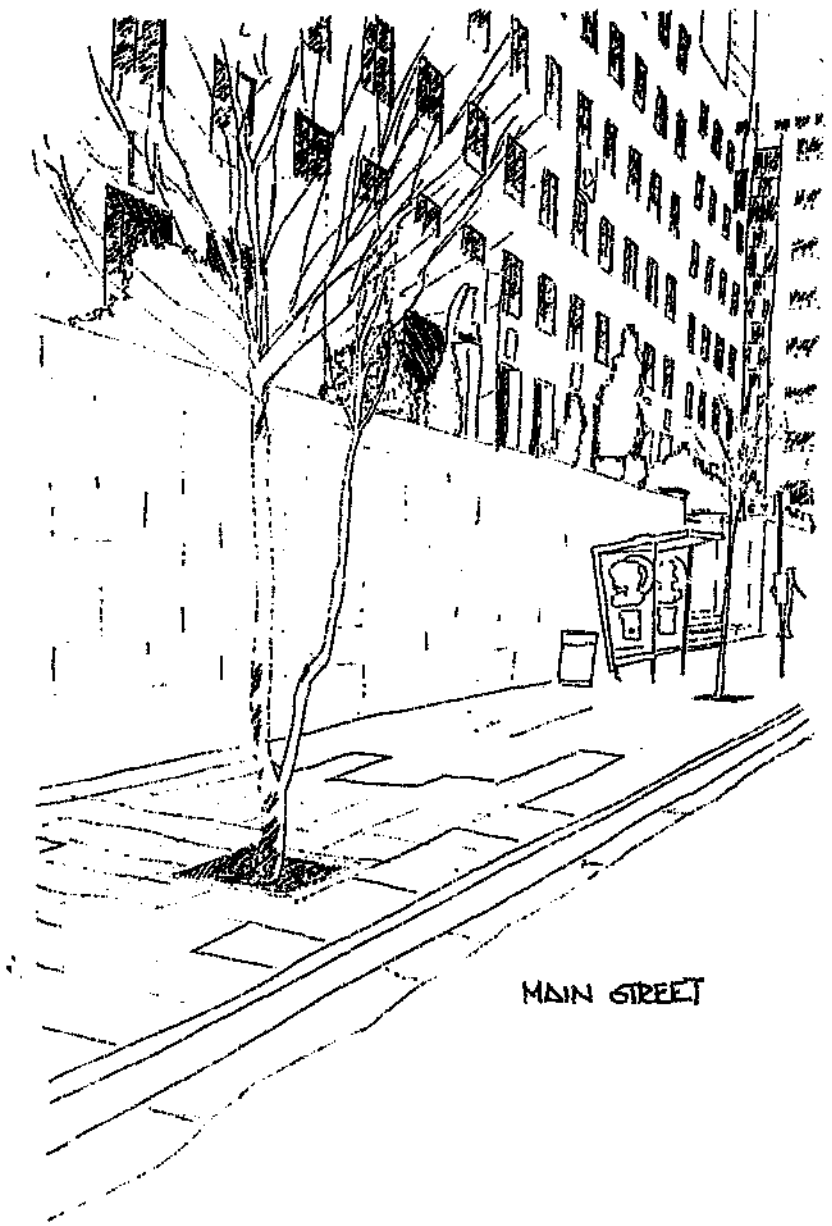




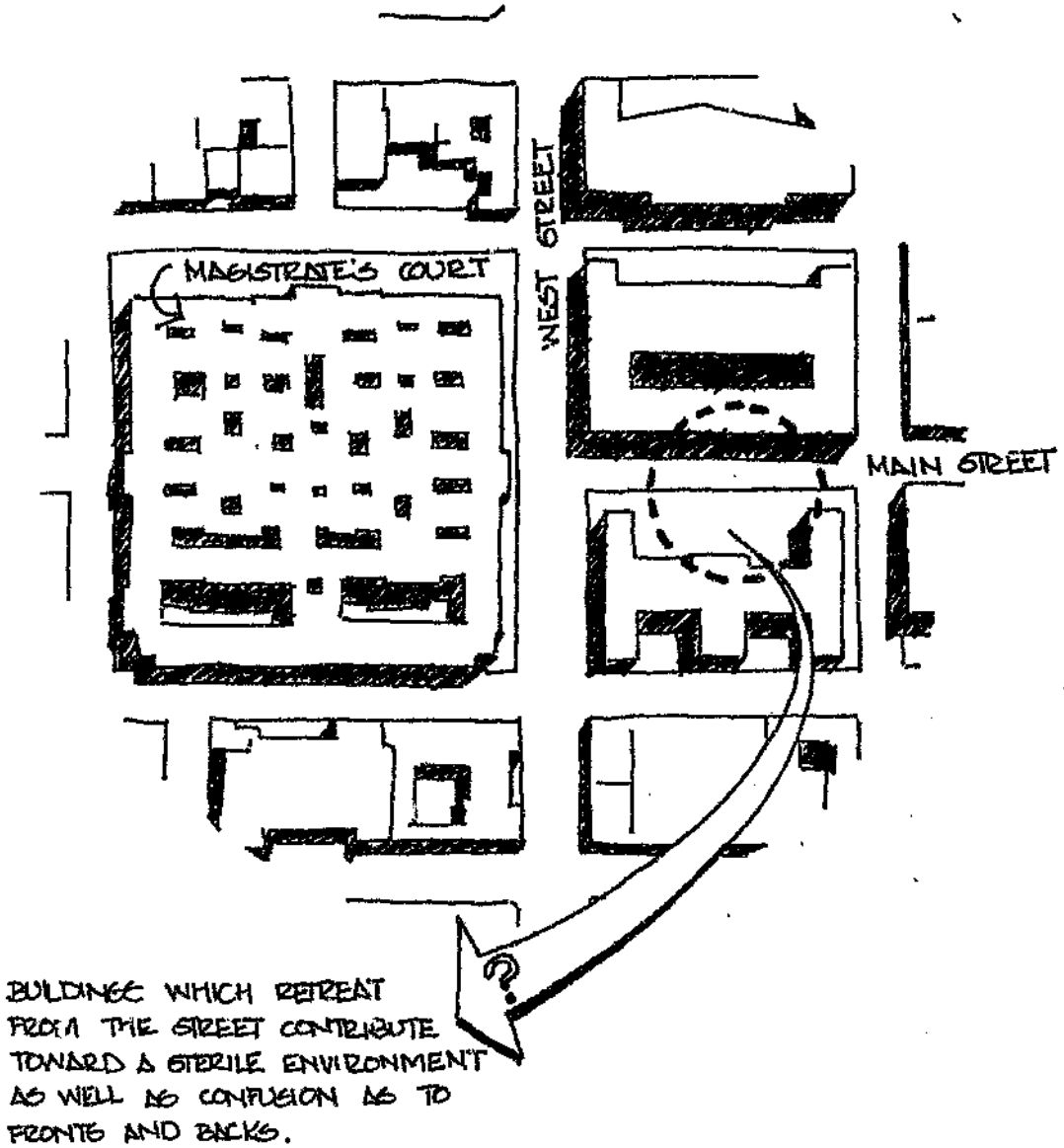
A FIXED POSITION OF RAPID TRANSIT NODE REINFORCES LEGIBILITY AND ACTS AS A MARKER WITHIN A PATH SYSTEM



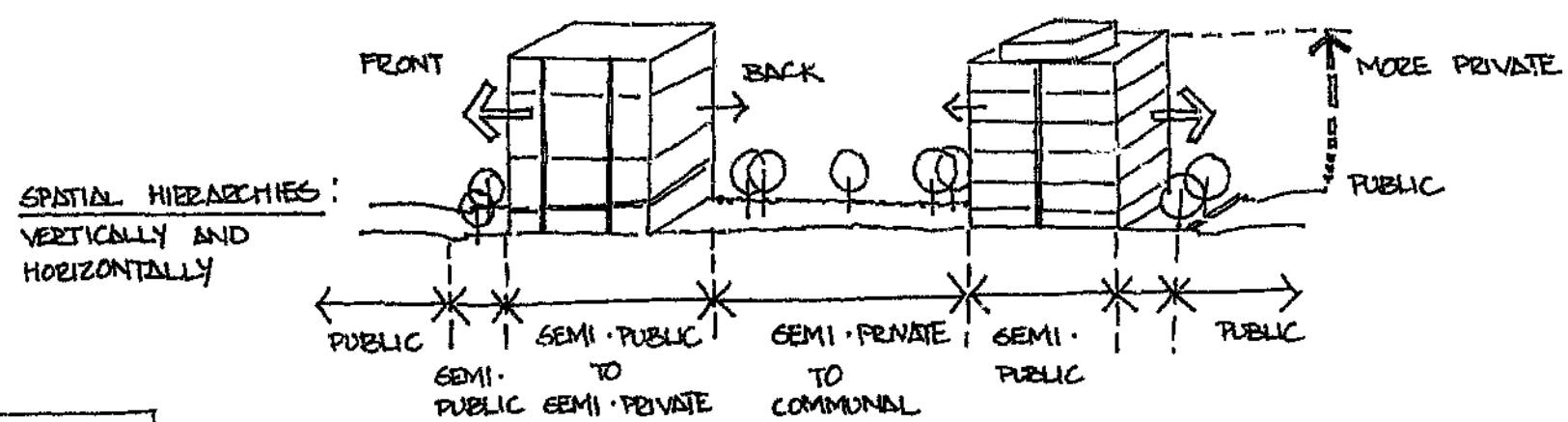
westgate tod johannesburg inner city	**line - point - ripple**



MAIN STREET



BUILDINGS WHICH RETREAT FROM THE STREET CONTRIBUTE TOWARD A STERILE ENVIRONMENT AS WELL AS CONFUSION AS TO FRONTS AND BACKS.



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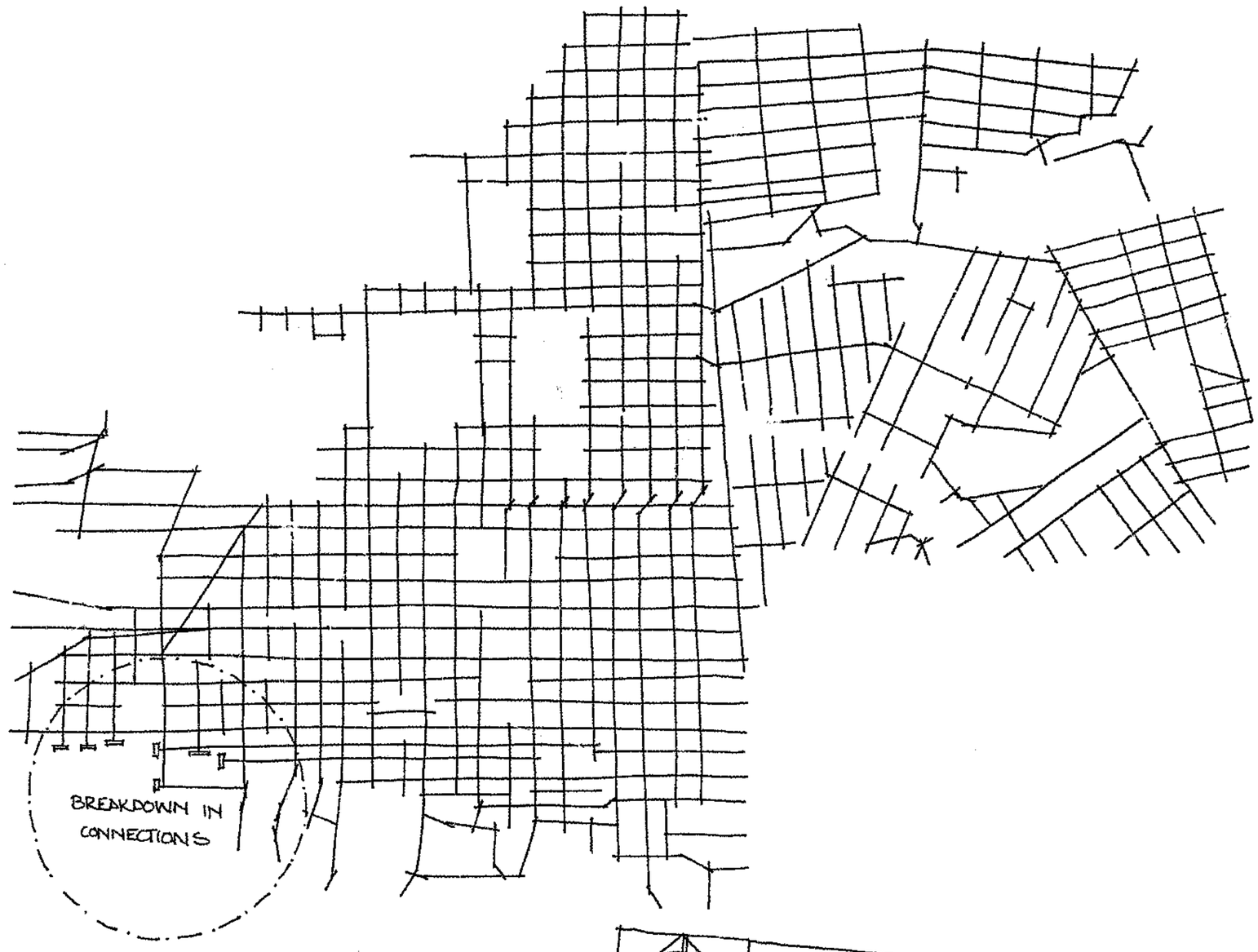
johannesburg inner city

towards democratic streets



westgate tod
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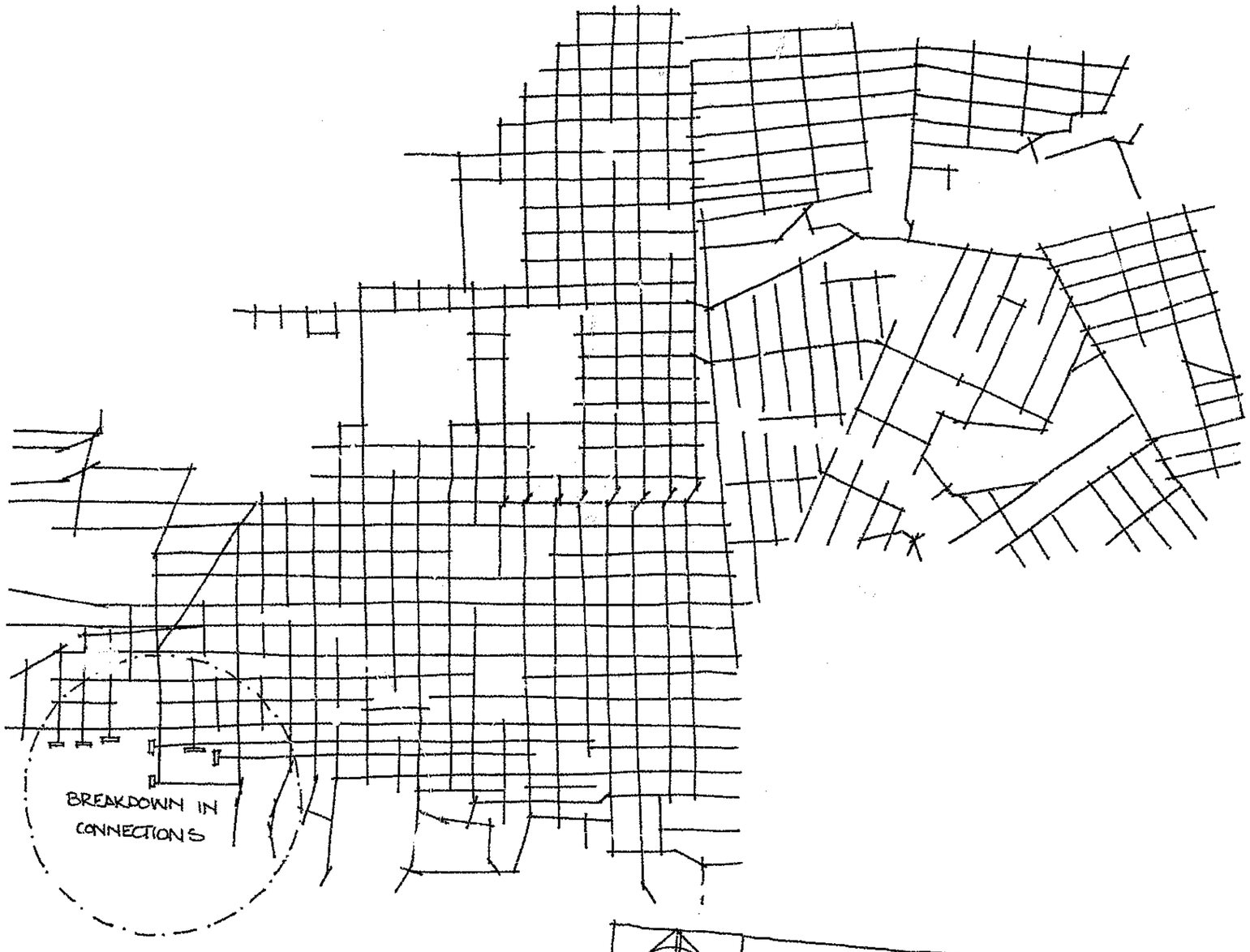
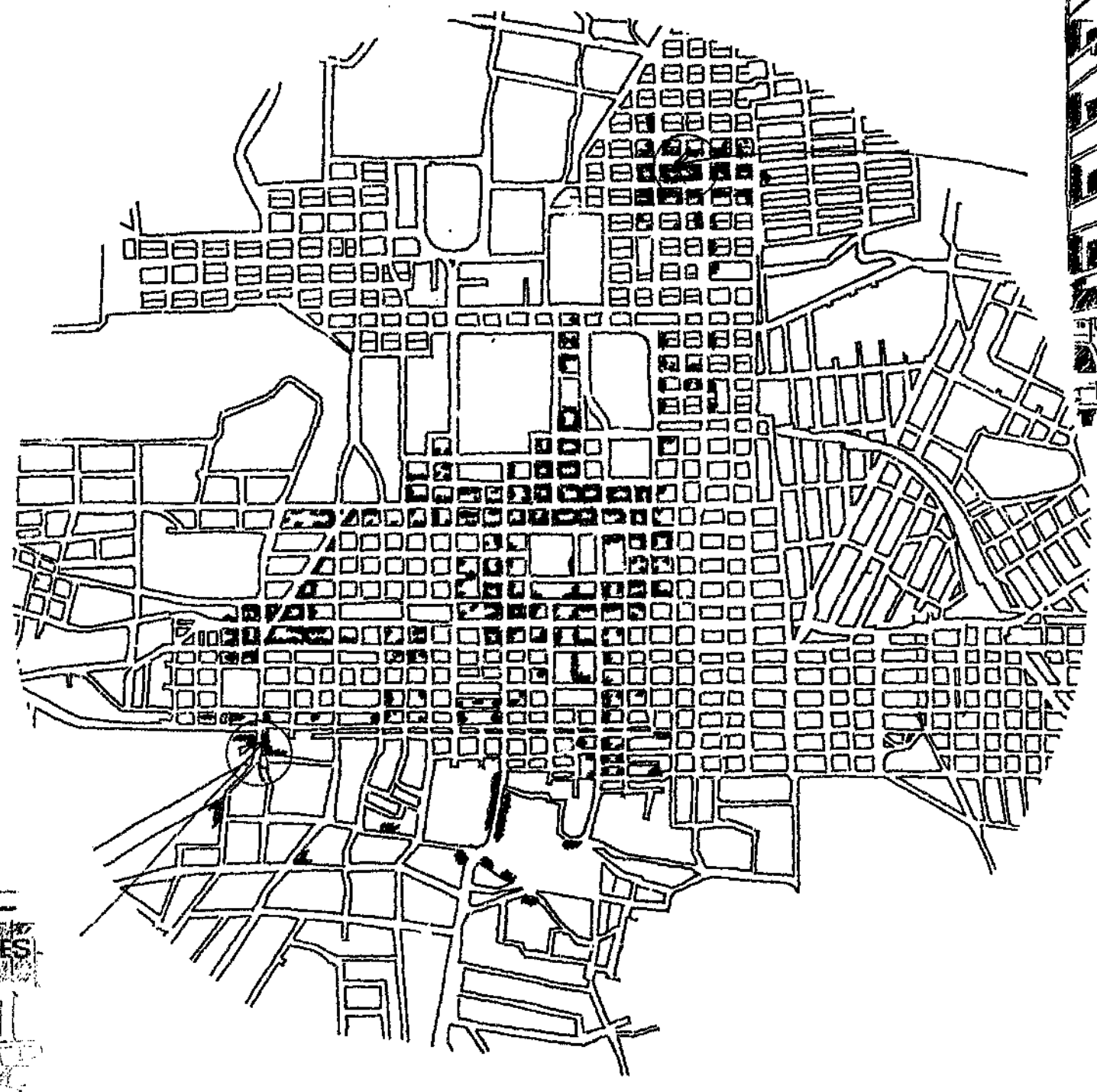
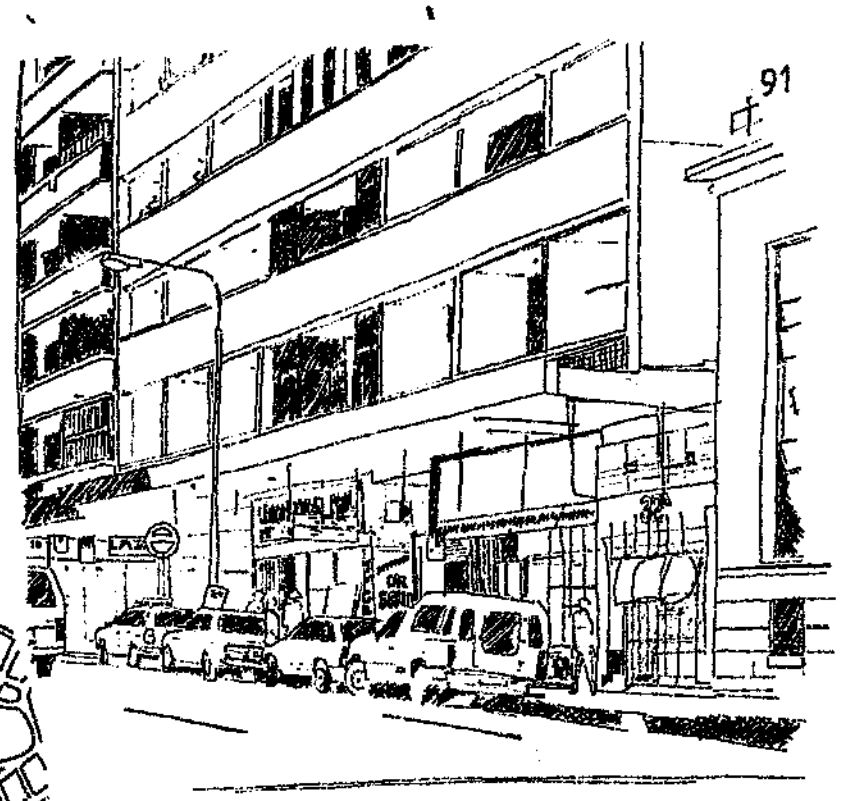
connectivity
urban movement lines

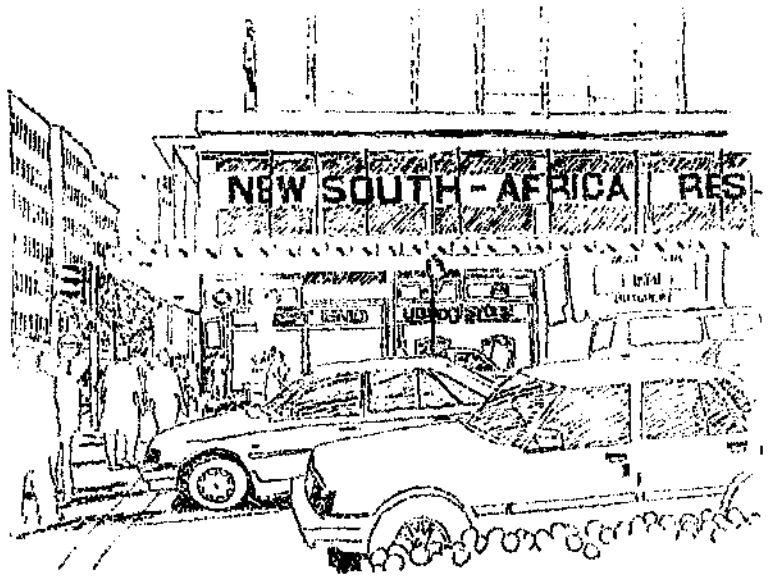


westgate tod
johannesburg inner city

connectivity
urban movement lines







westgate tod
johannesburg inner city

urban activity
retail & commercial

1 MAGISTRATES COURT

2 NEWTOWN CULTURAL PRECINCT

3 MARY FITZGERALD SQUARE

4 MUSEUM AFRIKA

5 GALLERY

6 TAXI RANK

7 ROTUNDA

8 JOHANNESBURG STATION

9 ATTWELL GARDENS

10 UNION GROUNDS

11 JOUBERT PARK

12 HOSPITAL

13 OLD FORT

14 GREENCOTS SPORTS FACILITY

15 JHB GIRLS HIGH SCHOOL

16 DONALD MACKAY PARK

17 END STREET PARK

18 SUPREME COURT

19 CARLTON CENTRE

20 VAN DER BIJL

21 CITY HALL

22 POST OFFICE

23 CIVIC SPINE

24 LIBRARY

25 BANK CITY

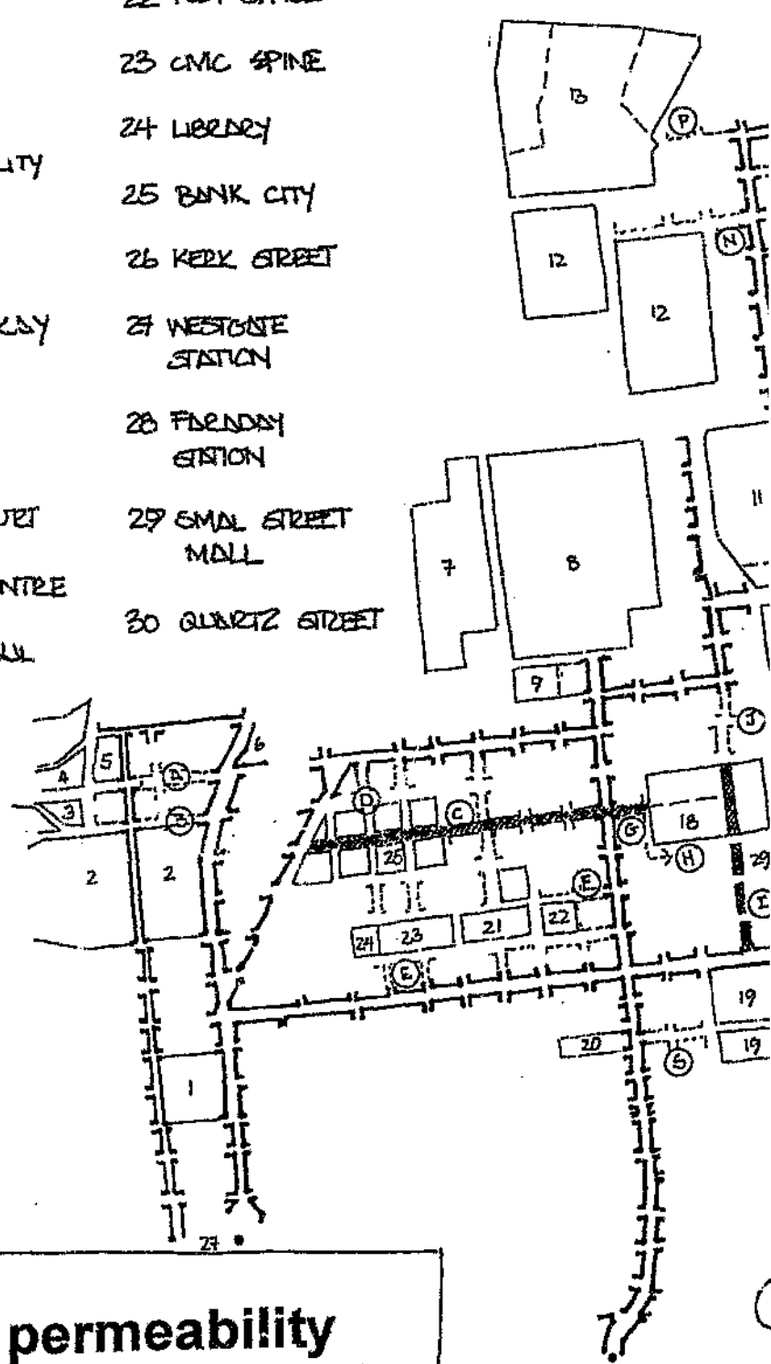
26 KERK STREET

27 WESTGATE STATION

28 FRIENDLY STATION

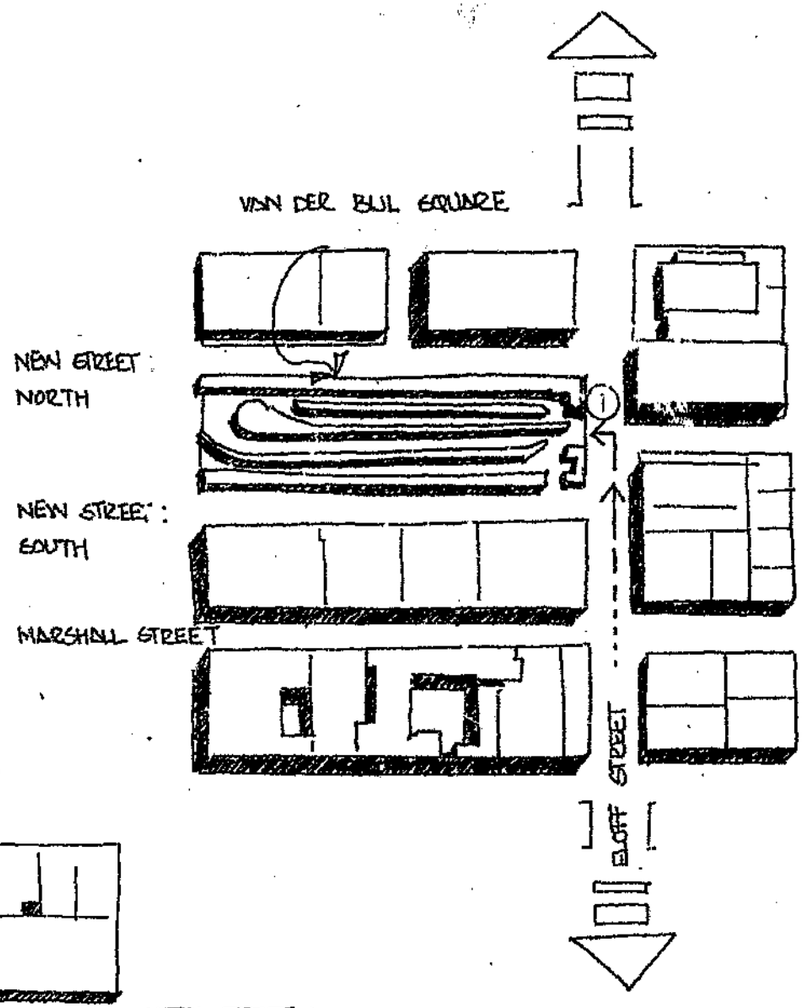
29 SMAL STREET MALL

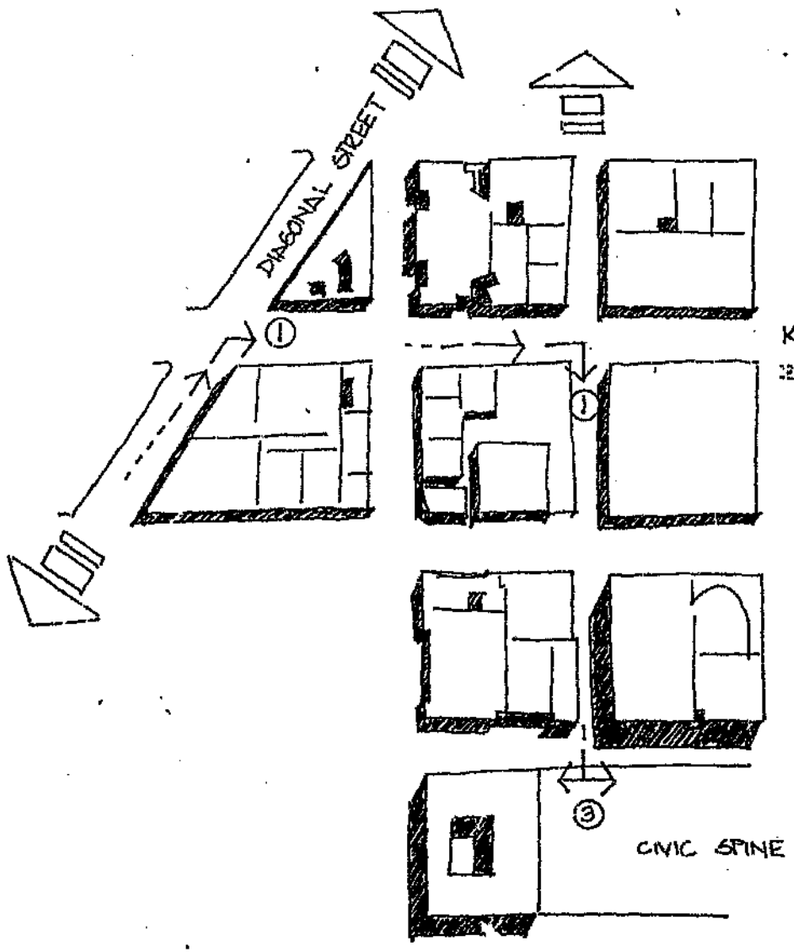
30 QUARTZ STREET



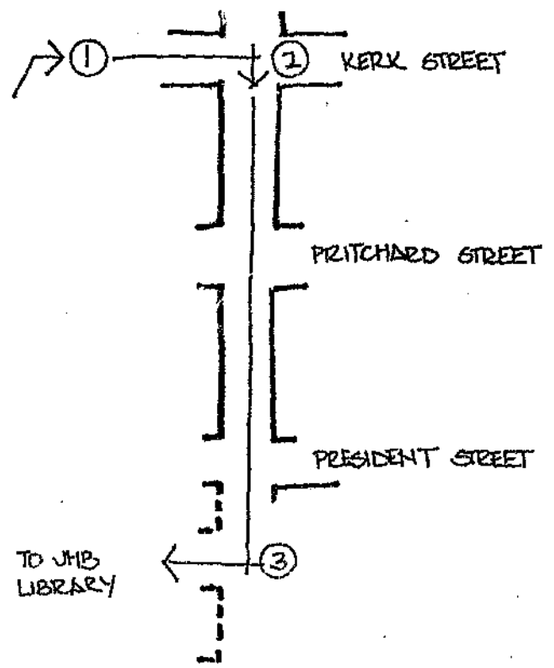
westgate tod
johannesburg inner city

permeability
enabling connectivity





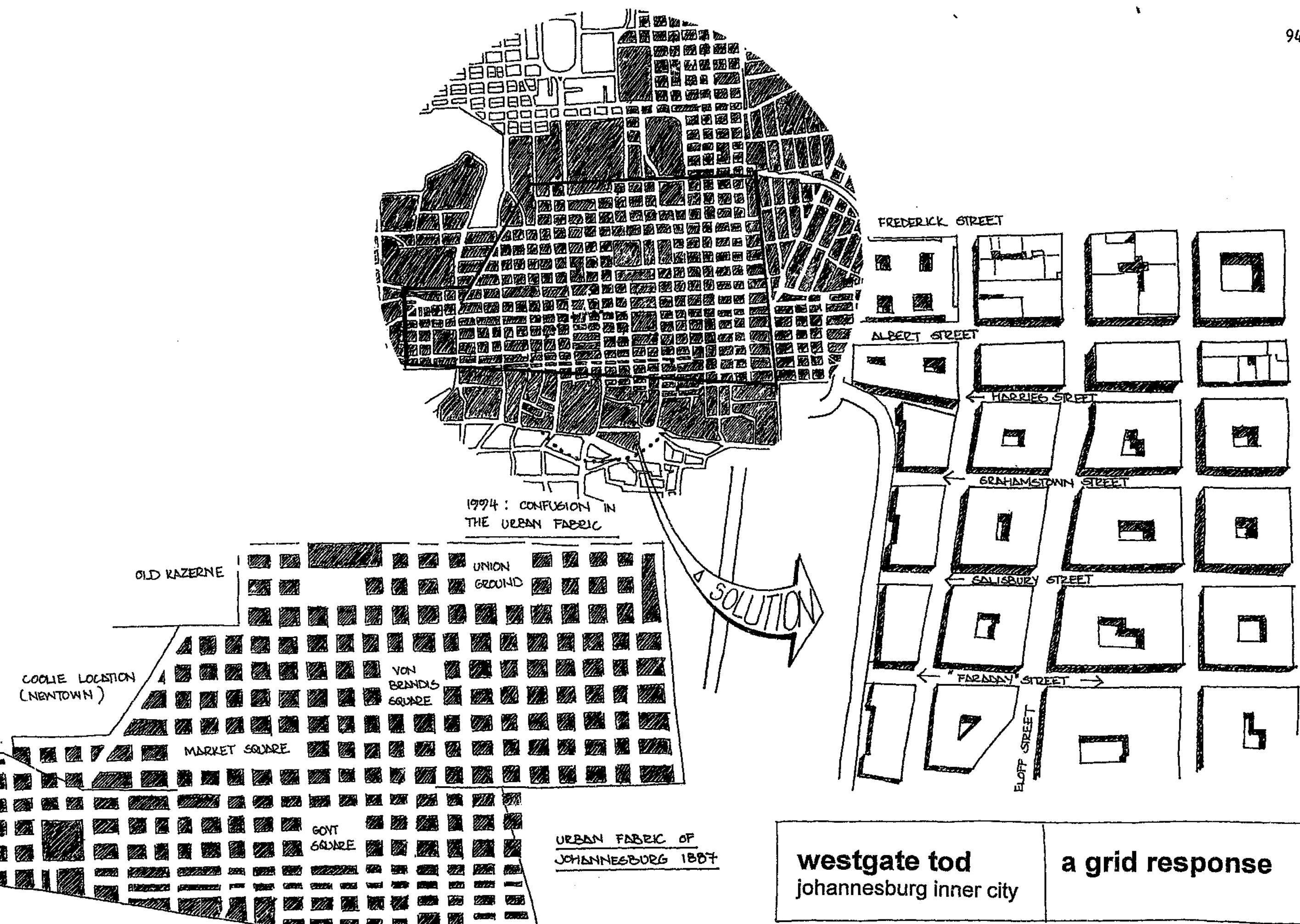
LOCAL CONNECTIONS : EXAMPLE
DIAGONAL STREET TO LIBRARY



A HIGH NUMBER OF 3 EXISTS ALONG THIS ROUTE . THE PEDESTRIAN ROUTE HAS STRONG EAST · WEST AND NORTH · SOUTH CONNECTIONS. RAPID TRANSIT CAN ENABLE STRONGER CONNECTIONS TO KEY INSTALLATIONS IN THE CITY BY ITS LOCATION OF TRANSIT STOPS .

westgate tod
johannesburg inner city

permeability
enabling connectivity



westgate tod
johannesburg inner city

a grid response

1 MAGISTRATES COURT

2 NEWTOWN CULTURAL PRECINCT

3 MARY FITZGERALD SQUARE

4 MUSEUM AFRIKA

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6 TAXI RANK

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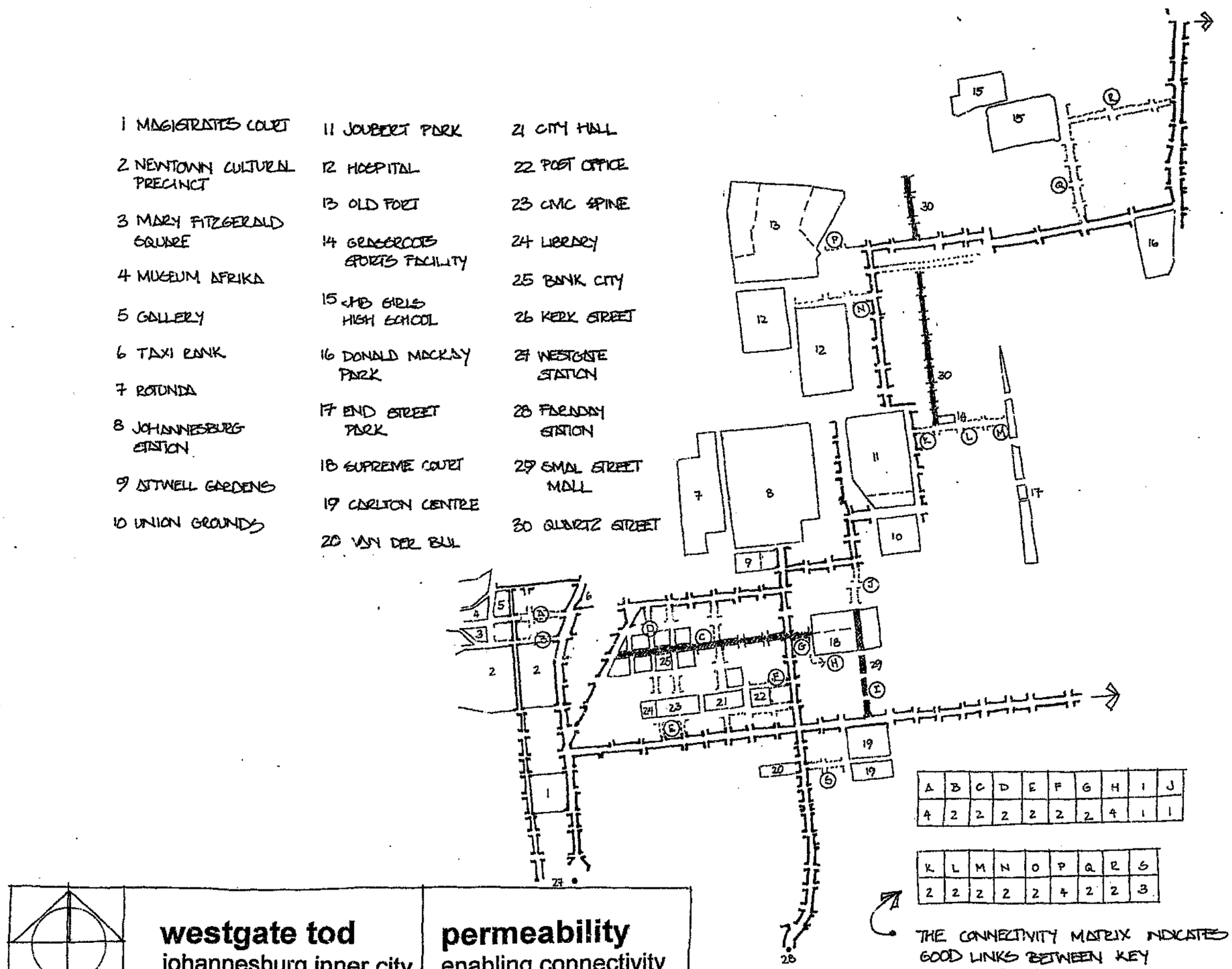


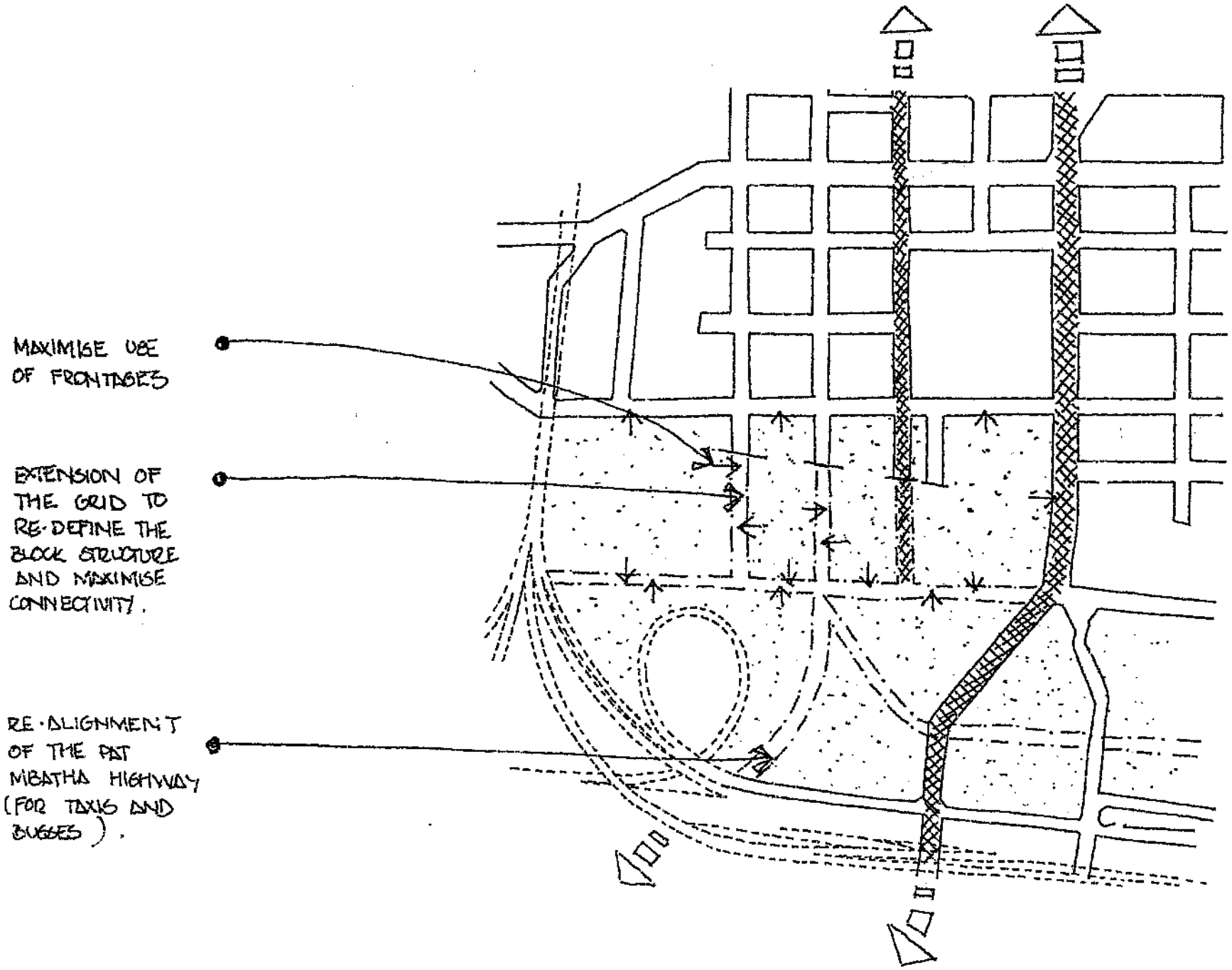
A	B	C	D	E	F	G	H	I	J
4	2	2	2	2	2	2	4	1	1

K	L	M	N	O	P	Q	R	S
2	2	2	2	2	4	2	2	3

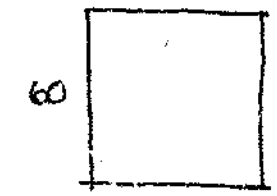
THE CONNECTIVITY MATRIX INDICATES GOOD LINKS BETWEEN KEY INSTALLATIONS AND THE PROPOSED RAPID TRANSIT ROUTE, FACILITATED BY THE GRID STRUCTURE

westgate tod
johannesburg inner city

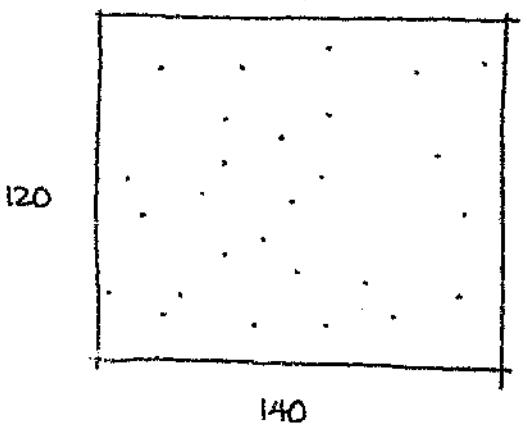
permeability
enabling connectivity

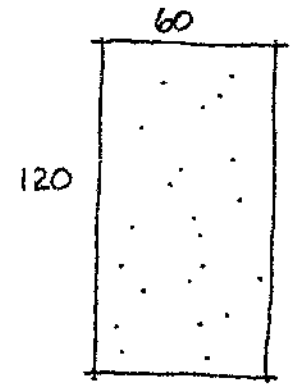


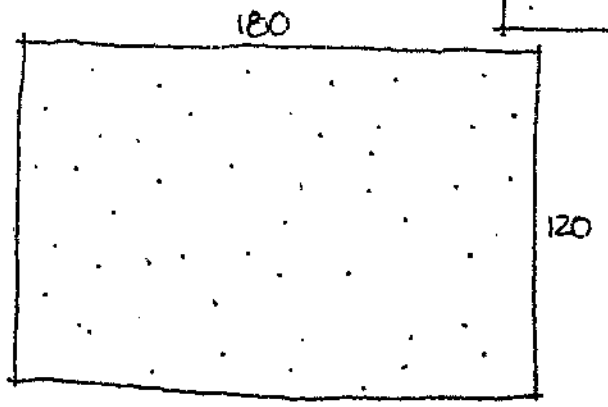
TYPOLOGY OF BLOCK STRUCTURES



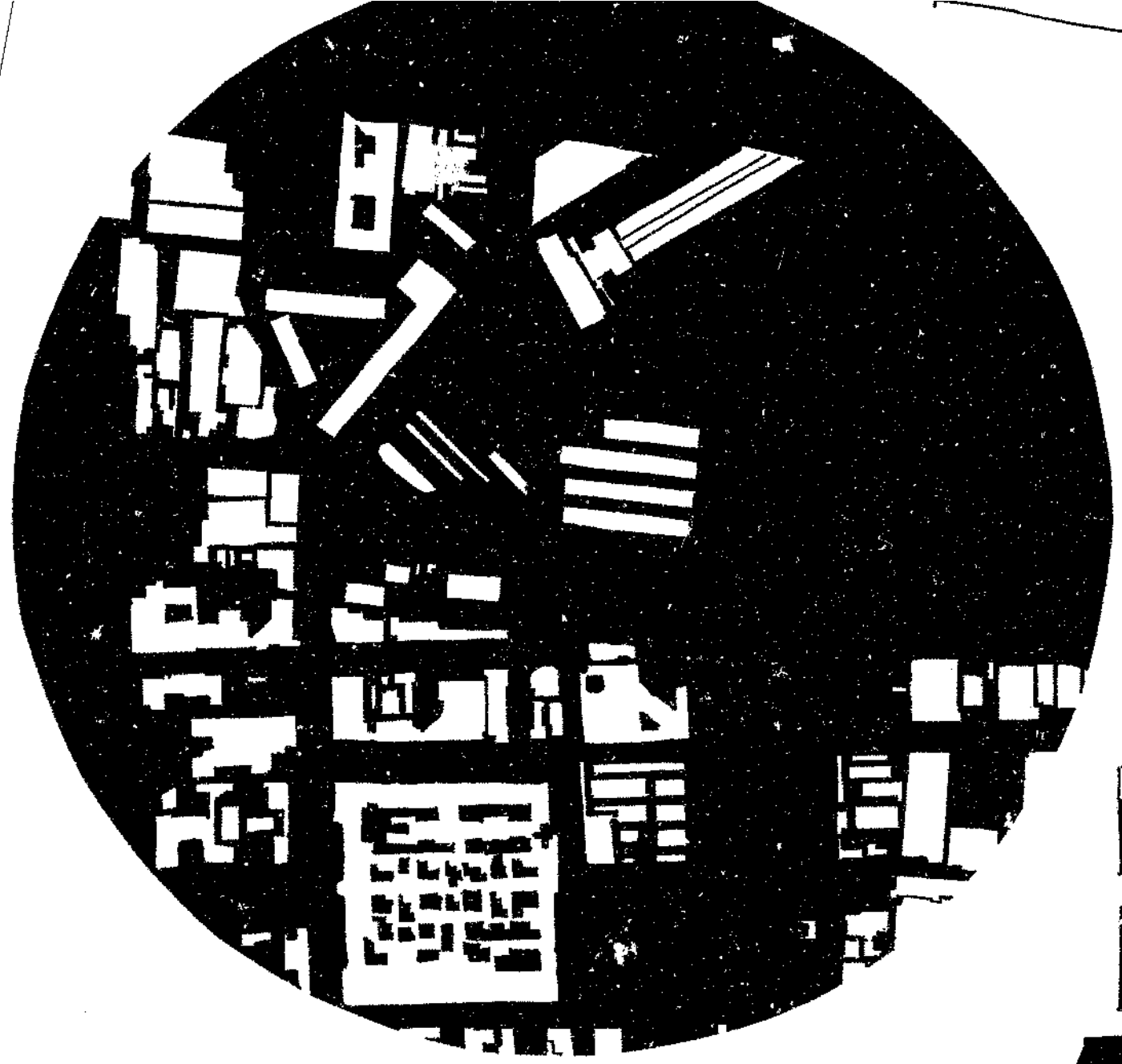
A TYPICAL JOHANNESBURG BLOCK.

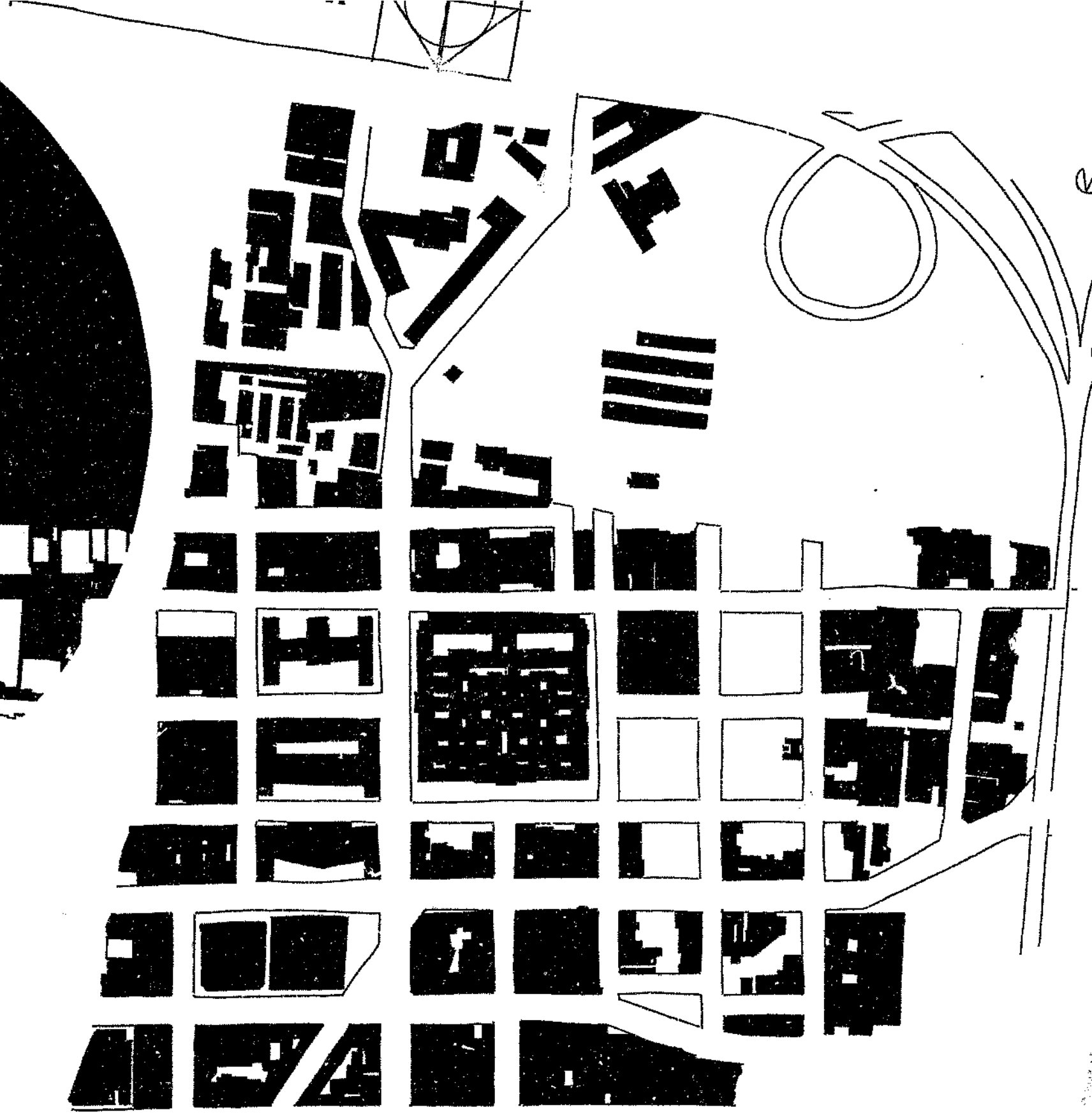


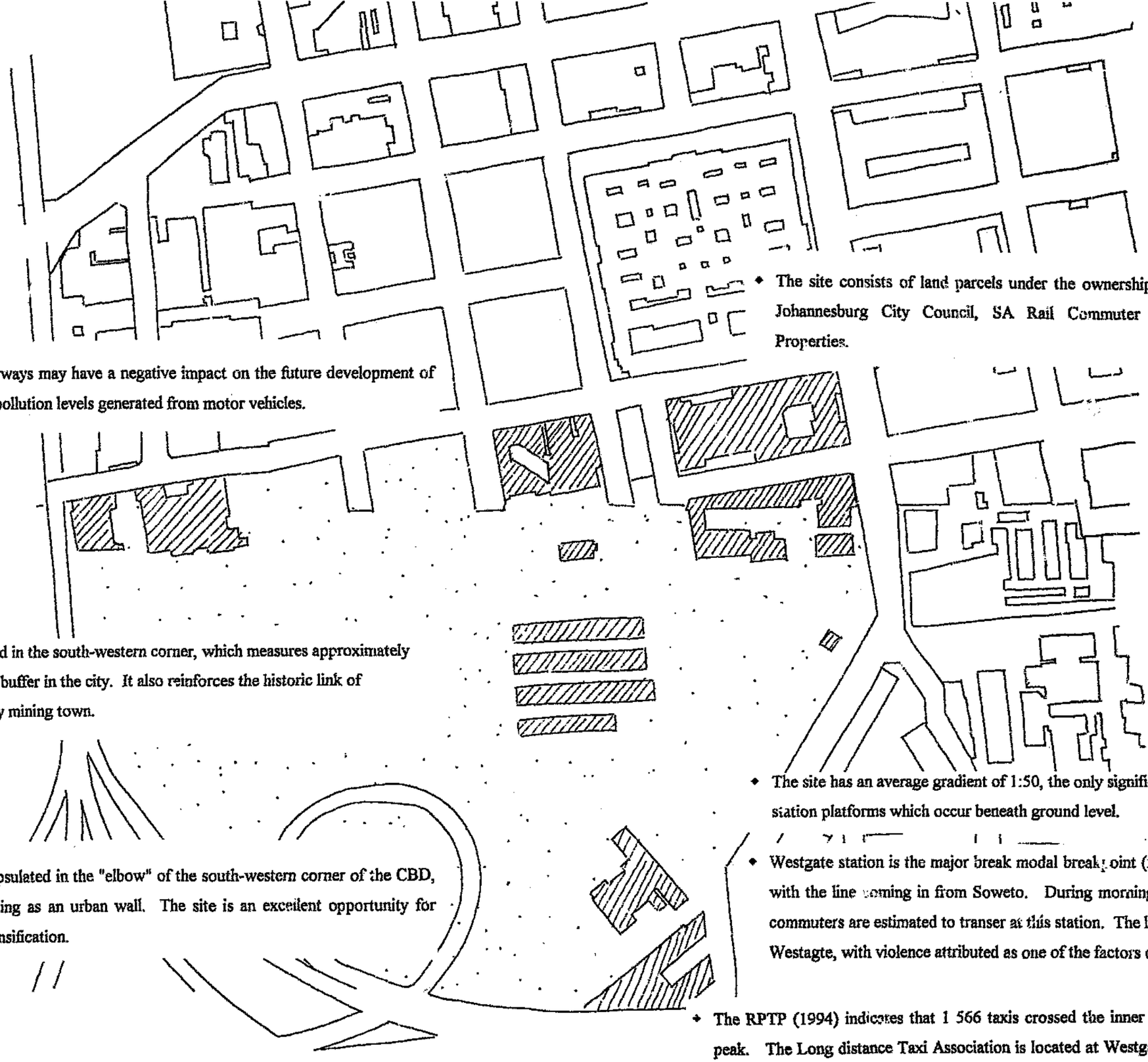




westgate tod johannesburg inner city	**a grid response**







- The site consists of land parcels under the ownership of Rand Mines Properties, the Johannesburg City Council, SA Rail Commuter Corporation, and Pangbourne Properties.
- The M2 and M1 motorways may have a negative impact on the future development of the site in terms of the pollution levels generated from motor vehicles.
- The mine dump, located in the south-western corner, which measures approximately 12m in height, forms a buffer in the city. It also reinforces the historic link of Johannesburg as a early mining town.
- The site is clearly encapsulated in the "elbow" of the south-western corner of the CBD, with the motorway acting as an urban wall. The site is an excellent opportunity for redevelopment and intensification.
- The site has an average gradient of 1:50, the only significant level changes being at the station platforms which occur beneath ground level.
- Westgate station is the major break modal break point (for trains, taxis and pedestrians) with the line coming in from Soweto. During morning peak, in excess of 10 000 rail commuters are estimated to transer at this station. The line capacity utilisation is 28% at Westagte, with violence attributed as one of the factors of its declining usage.
- The RPTP (1994) indicates that 1 566 taxis crossed the inner city cordon in morning peak. The Long distance Taxi Association is located at Westgate, with destinations to areas such as Bedfordview, and as far as the Transkei.

ANDERSON STREET EXT.

HISTORIC MONUMENT – ST. ALBANS ANGLICAN CHURCH

VENTILATION SHAFT

SUBSTATION

PARKING BAYS

BUS SHELTERS

INFORMAL TRADING SQUARE

WEST STREET

SELBY OFFRAMP

SERVITUDE

BUSWAY SERVITUDE

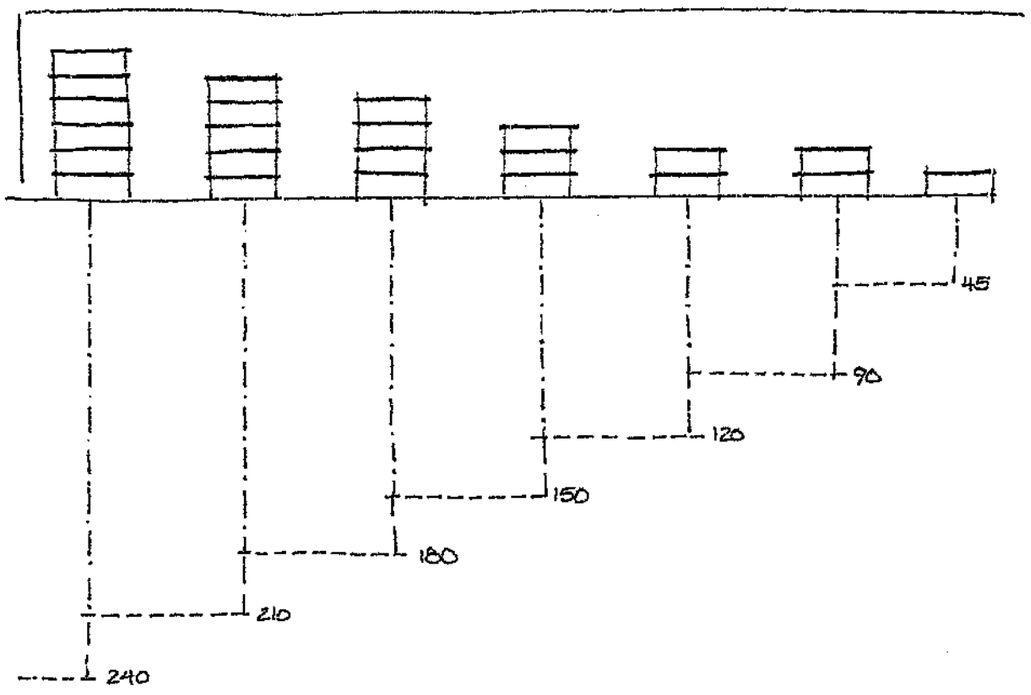
WESTGATE STATION

SOLID WASTE MANAGEMENT DEPT.

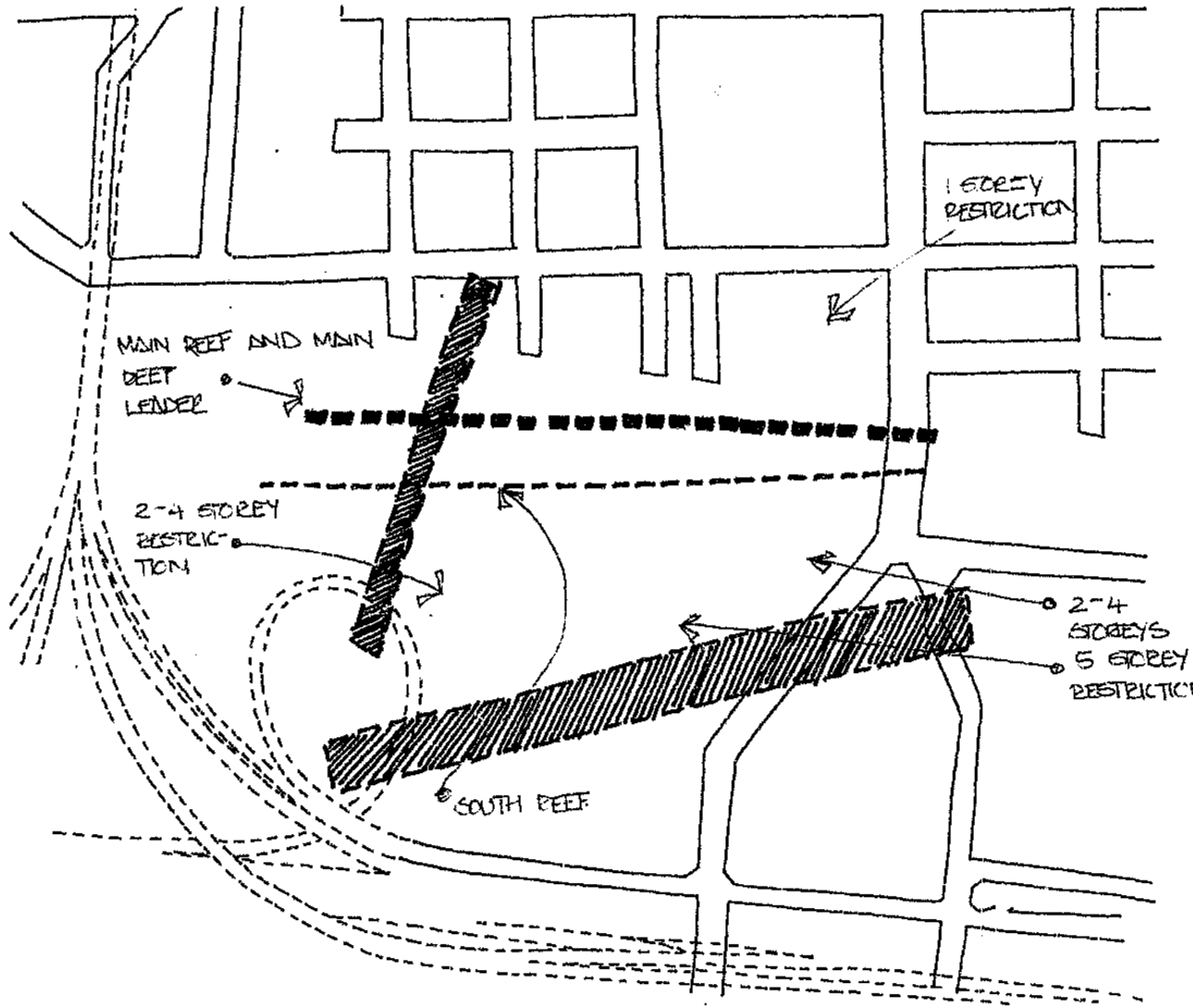
WESTGATE SHOPPING CENTRE

westgate tod
johannesburg inner city

westgate district
site conditions



- WHERE THE REEF EXCEEDS 240 M. NO BUILDING RESTRICTIONS ARE IMPOSED.
- COMMERCIAL AND INDUSTRIAL USES ARE PREFERRED BETWEEN 0 - 240 MBS
- WITH RESIDENTIAL LAND USE, SPECIAL MOTIVATION IS REQUIRED.
  IN PRINCIPLE, RESIDENTIAL USAGE IS ACCEPTED TO 120 MBS OR 3 STOREYS.



- The geology of the site is that of the Central Rand Group (Witwatersrand Supergroup). Westgate lies within the band of undermined land to the south of the CBD core, with the Main Reef Main Reef Leader, and South Reef running in an east west direction across the site. Back-filling of stopes in the area has resulted in instability and potential surface subsidence. In accordance with these conditions, a series of design guidelines have been developed by the Government Mining Engineer.

Art features are used to characterise the Westgate District at it's main node, as well as to create linkages with the Newtown Cultural Precinct.

Trees should be placed so as to enhance the streetscape, provide protection from the elements, and "soften" the urban environment.

Vertical elements to define and emphasis the corridor effect. At nodal interchanges, a clustering of vertical elements provide legibility and orientation.

Together with street furniture, landscaping should enhance the linear movement pattern of rapid transit.

Ensure a continuity in street furniture design along the route of the system and particularly at transit stops.

Perimeter block developments with defined fronts and backs to define the public realm and spatial hierarchies.

Transit interchanges to be major urban gateways into the city, with marker buildings for legibility and significance to the transit core.

Eliminate ground floor parking, and replace with underground structured parking. At ground level, retail activity should be established.

Enhance views of the historic monument (church), particularly from the core area.

Multi-functional use for a 24-hour district.

Enforce build-to lines, particularly when enhancing the public, civic realm. Building setbacks should therefore be minimised.

westgate tod
johannesburg inner city

urban design directives

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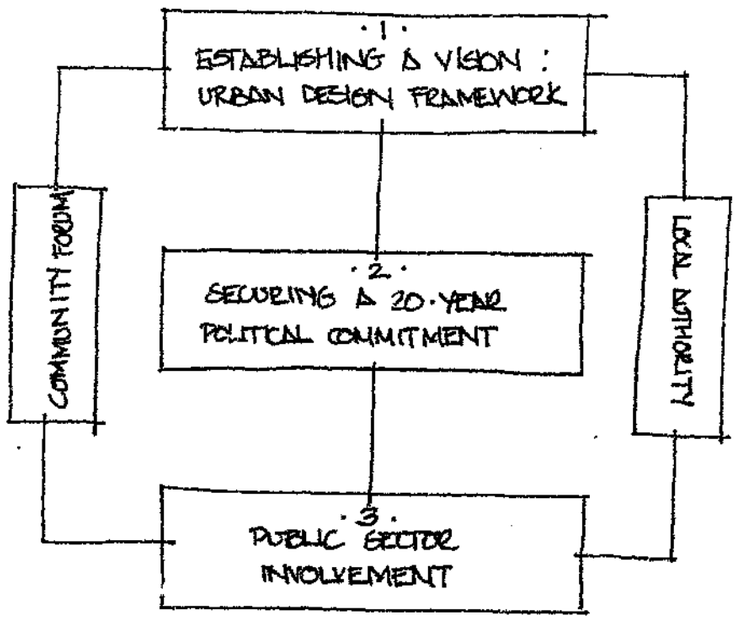
johannesburg inner city

urban design directives



THE PROCESS TO ESTABLISH TODS.

Critical to the implementation strategy is joint development. Integral to the success of joint public/private ventures,

> *" ... transit agencies may need to be entrepeneurial. In some joint development efforts, the public transit agency might even be the developer. That is quite different from the mission that most transit agencies assume, which is merely to provide transportation service"* (Martz, in Attoe 1988, p.161).

Several key elements are important in joint developments :

- *Land needs to be acquired at station areas or along the designated route.* The public authority needs to ensure that land aquisition does not result in negative property values.

- *The costs of station construction need to be shared.*

- *Concessions may be granted on lease agreements.* The transit station can contribute towards the agency's finances and opening up opportunities to the private sector.

- *Benefit assessment fees may be considered.* The local authority's role is to determine a fee to be aid by property owners in the transit district, which would contribute towards specific improvements in the district.

- *Tax increment financing is an option.* An increase in property taxes could be directed towards public project financing.

- *Competitive service contracting.* Savings on service contracts and multi-year, fixed-fee contracts, which may be of the order of 20-30 %, can be used.

- *Turkney-plus.* This involves the design, construction, servicing and maintenance of transit-related developments by the private sector. Appropriate development controls,

such as additional density bonuses can have a significant impact on the success of the transit station.

- *Interface between the transit station and adjacent development.* Good pedestrian access needs to be facilitated, which takes into account safety, convenience and aesthetic considerations.

six

conclusions and recommendations

6.1 CONCLUSIONS

The approach of inserting rapid transit into the fabric of the urban environment may be paralleled to a chemical reaction, whereby one requires all the necessary elements to ensure that a catalytic reaction may take place.

Rapid transit is considered to be of benefit in the sphere of transportation, environment and image, with definite catalytic impacts on the urban environment if approached correctly, thereby improving urban structure. The findings of international case studies indicate significant correlations identified as integral to the reconstruction of the South African city, and with wider application to cities worldwide.

An important issue is that of political motivations and agendas. Rapid transit systems have attracted much attention from local politicians - enthusiasm often seems to outweigh the economic issues relating to such systems. Two related points need to be made - firstly, it becomes apparent that a strong local figure is necessary or assists in the formation of a rapid transit project, as indicated in Curitiba, Nantes and Grenoble, and secondly, that the process should be people-driven to ensure that the chance of success be greater from the outset, a lesson that can be taken up in Johannesburg.

6.2 RECOMMENDATIONS

There is a need to determine the appropriateness of application of a rapid transit scheme in terms of the current planning system of a particular city. This raises questions pertaining to metropolitan and substructure restructuring in the Central Witwatersrand Metropolitan area. As part of this restructuring there needs to be a clear determination of roles and functions, to help clarify the approach undertaken for a rapid transit scheme. The public sector plays a critical role in initiating the processes of large scale developments necessary for TODs and its associated routes. The local authorities role should be directed towards implementing and

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financing (at least in part) the line to secure private sector confidence for further investment in TODs and extensions of the route.

The success of rapid transit also lies in the approach to integrate this mode as part of a series of actions, and not as single programme. It is not an either-or situation, for example, car versus light rail, but rather shifting the emphasis of mode where required.

The idea of rapid transit does not only pertain to technical considerations. The role of urban design should be towards a more environment- and people-friendly process. If a more sensitive approach can be adopted, indications are that the catalytic spinoffs will occur within the systems zone of impact. Furthermore, it may be used as a tool for restructuring the urban form if appropriate uses and measures are applied.

The approach of joint development of rapid transit needs to be further explored in a third world context. Much time and money is expended on comparative technical evaluations, whereas increasingly the focus should orientate towards process related matters such as the "how to implement" issue.

Further applications to other fields of study of the approach extrapolated from Rapoport (1990) used herein as the underlying methodology should be investigated.

Further exploration of TODs and more comprehensive empirical data regarding transit impacts on surrounding districts, needs to be carried out on a range of cities. In addition, comparative analysis on the impact of different transit modes needs to be carried out.

There is a need to rethink the composition of land uses and densities in inner city areas in South Africa, and Johannesburg specifically, as well as their mix. By implication, this means the moulding of ideas pertaining to the TOD "model" indicated in this study to local conditions.

The application of certain principles integral to the TOD may be applied in other circumstances, for example, mixed land use developments can be applied throughout the city.

Monitoring processes need to be initiated if a rapid transit scheme is to be implemented in Johannesburg, so as to contribute to comparative studies on rapid transit throughout the world.

Increasingly, the South African city displays similar symptoms evident worldwide, of user-unfriendly cities, of sprawling urban form, and of fragmentation, segregation and introversion of areas and land uses. The role facing all professionals and stakeholders with an interest in the public realm is to act proactively to redress such issues. The way forward is inherently reliant and on historic precedent and lessons, as indicated in this study.

seven

appendix : terminology

Rapid transit

The renaissance of rapid transit worldwide, sparked in the 1980s and 1990s, as well as the variations of theme of such systems facilitated by technological advancement, has led to a range of type of rapid transit. It is therefore imperative that these types be classified. The broad term of urban rail may be classified in terms of light, medium, and heavy systems. This is derived principally from the type of construction, although the vehicle weight can contribute significantly. Simpson (in Walmsley and Perret 1992, p.4) indicates that urban rail systems may be classified into:

- suburban railways (conventional heavy rail commuter services),
- metros (traditional, generally underground, medium weight railways),
- light rail or LRT, and
- tramways (which includes traditional city trams and new systems).

From a traffic management perspective, the light rail system is classified as :

•LRT1 - the system shares the road space with other forms of traffic, including pedestrian,

•LRT2 - the system occupies a reserved space on the road, and

•LRT3 - the system is segregated from other traffic and occupies the road exclusively.

Furthermore, characteristics of a typical light rail system include station spacing less than 1 km, capacity of approximately 20 000 passengers per hour, and an average speed of 22-30 km/hour (Walmsley and Perret 1992, 5).

While this discourse aims to focus on light rail/ rapid rail options, particularly in terms of international precedence, this classification is a guide, and is not definitive or fixed. However, due to the need to study the broad impacts which transit systems have in the past had on urban development, it is necessary to also consider suburban and metro systems. Inclusion of these forms of transit assists in an understanding of medium and longer term impacts, that is at least 10-15 years.

Urban reconstruction

With particular reference to the South African city, urban reconstruction pertains to a concerted, proactive effort to integrate the fragmented urban form, thereby embodying restitution of past actions under colonial and apartheid rule.

Urban catalysis

The process whereby rapid transit is viewed as a structuring element in the urban realm, integral to the process of integrating and compacting the city. The analogy is drawn from the sciences : rapid transit as a catalyst for positive spinoffs in nearby proximity, forms part of an incremental and continuous process. Thus, in aiming to play a role in regenerating the urban fabric on an ongoing basis, it does not change itself, but rather facilitates change.

Urban compaction

The process whereby intervention is aimed at intensifying and densifying development patterns to limit the horizontal growth of the urban form. In this manner, the essential functions of the city are brought in closer proximity to each other.

Joint development

This has been defined by Cervero (1994, p.83) as

> *"any formal, legally binding arrangement between a public entity and a private individual or organization that involves either private-sector payments to the public entity or private-sector sharing of capital or operating costs, in mutual recognition of the enhanced real estate development potential or higher land values created by the siting of a public transit facility".*

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