CURITIBA, BRAZIL
A WORKING EXAMPLE OF SUSTAINABILITY WITHIN AN URBAN CONTEXT[1]

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1 INTRODUCTION

The creation of sustainable environments, i.e. environments which are self-supporting (or can be supported with available resources), is developing into an important goal for the planning professions.

In this paper, an attempt is made to motivate the need for this approach within the urban context. The city of Curitiba, Brazil, is then described as a working example of a city that has reached the point where it is functioning in a sustainable way.

2 THE NEED FOR SUSTAINABILITY IN THE URBAN ENVIRONMENT

It is now generally accepted by the planning professions that the compact city is more efficient and therefore more sustainable than the sprawling, motor-car dominated cities of the new world. Some of the reasons are:

- Higher densities in compact urban forms are necessary for efficient public transportation systems.
- The higher economic thresholds that are created when population and movement patterns are concentrated can stimulate economic activity.
- Engineering and social services can be more efficiently delivered, and
- Development at higher densities avoids urban sprawl. Sprawl exerts pressure on good agricultural land, as well as mineral, recreational and scenic resources.

In this regard two opposites may be compared: the compact City of London (population 6,8 million) and the sprawling city of Los Angeles (population 12 million). These in turn may be compared with the Central Witwatersrand Metropolitan Area (population 2,6 million) (See Figure 1).

The Los Angeles vision of large plots for two car families has resulted in a massive sprawling metropolis extending over 150 km in length. This city has one of the world's worst air pollution problems caused by emissions from motor vehicles. Freeway and parking requirements occupy 40% of the central business area, and low densities have resulted in an ineffective public transport system. The vast infrastructure is costly to maintain and the city is experiencing a growing inability to afford this development pattern.

Urban planners in South Africa have for many years also chased the "American dream" in their planning efforts. It has since been realized however, that this form of development is simply not sustainable due to the fact that the necessary resources are beyond the means of our economy. The provision of infrastructure is uneconomical, and the needs of the urban inhabitants in terms of quality of life are not satisfied. (Typically, a lack of urbanity is experienced, excessive time and money are spent on commuting, and many services and facilities remain inaccessible to those who do not own cars.)

Our cities are the centres where the economic wealth of our nation is generated and where the majority of our population lives. These cities should therefore not only work well, they should also provide pleasant living conditions in a sustainable environment.

New visions being developed for our cities therefore include densification, and the provision of efficient public transportation systems. Curitiba, a city in the south of Brazil, has been put forward as a working example of these ideas.

3 THE CURITIBA EXAMPLE

3.1 Introduction

Curitiba, a 300 year old city of some 1,3 million people, is located 340 km south west of São Paulo in the state of Parana, Brazil. It is the core city of a metropolitan area with a population of 2,5 million.

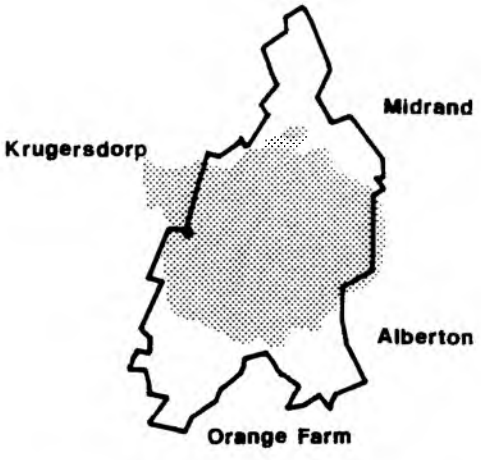
The population of Curitiba is not typical of that of other Brazilian cities. Large numbers of German, Italian and Polish immigrants have over the years settled in Curitiba, creating a cultural diversity which is still recognizable in different parts of the city. Due to a high economic growth rate of 5% per annum during the 60's and 70's, Curitiba is a relatively affluent city, with only 8% of its inhabitants living in informal housing areas, mainly on the outskirts of the city.

3.2 Holistic approach

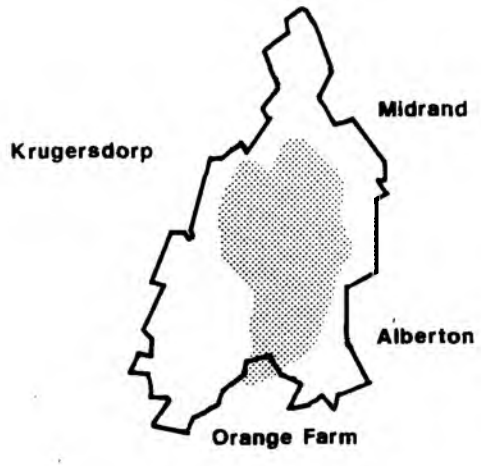
Sustainable urban environments can only be achieved by means of an holistic approach. In Curitiba an integrated management structure has resulted in a multi-disciplinary planning approach, which in turn led to integrated programmes to implement the vision of sustainability. Thus the Curitiba vision includes an awareness of man's *total* needs. The preservation of the natural environment, for example, was therefore not driven only by biological importance, but also by human needs such as recreation and affordability, as will be explained in later sections of this paper.

3.3 The plan

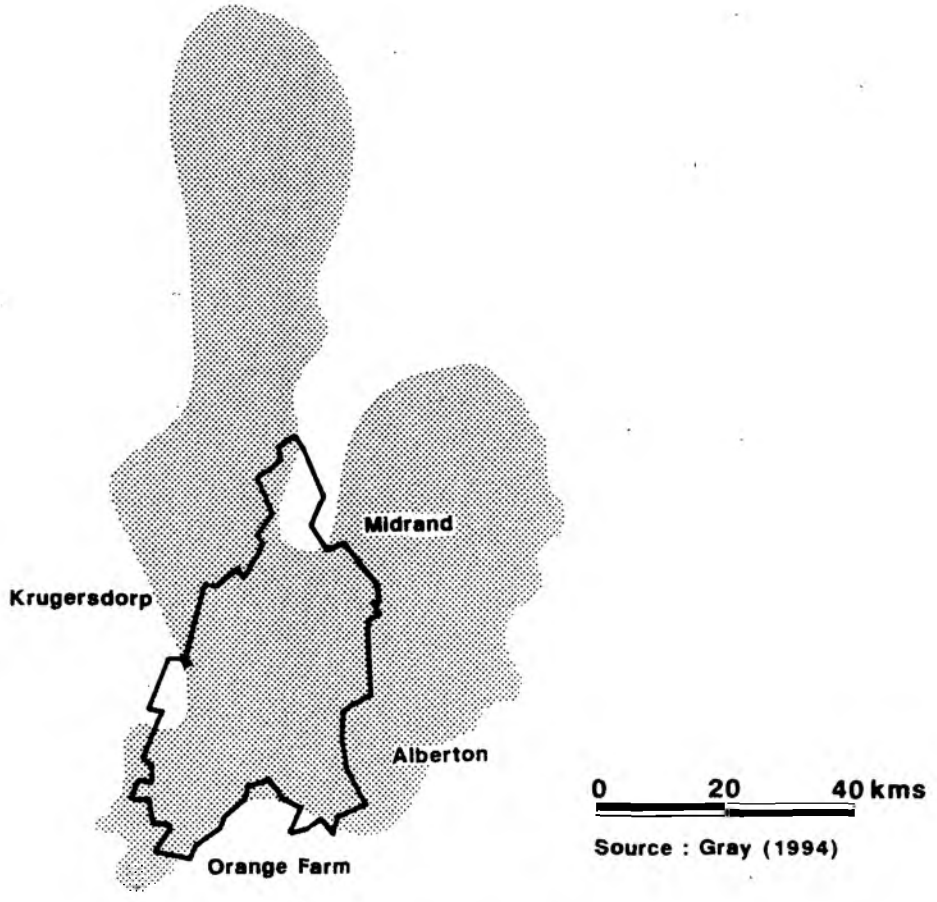
In 1965, the city decided to abandon its existing master plan, which had been prepared in the early 1940's. A new plan, with five corridors or axes, radiating from the city centre, was developed (Figure 2).



LONDON METRO AREA ON THE CENTRAL WITWATERSRAND METROPOLITAN AREA



CURITIBA ON THE CENTRAL WITWATERSRAND METROPOLITAN AREA



LOS ANGELES METRO AREA ON THE CENTRAL WITWATERSRAND METROPOLITAN AREA

FIGURE 1: Comparative urban areas

The corridors are the major structuring elements of Curitiba. By channelling all new high density development and commerce into these areas, two goals could be attained:

- High density residential development and job opportunities were decentralized in a manner which facilitated efficient public transportation, and
- The historic core could be preserved to retain its colonial character.

High residential densities were achieved because there is a culture of flat dwelling in Curitiba. During the economic boom years the private sector constructed blocks of flats up to 30 storeys high for the higher income groups along the axes. This was achieved during a period of economic growth and facilitated by the consistency of the master plan, which created investment confidence.

Other important elements of the plan are vast areas of open space provided on the edge of the city, as well as a large industrial park, established in the western sector of Curitiba. Three secondary axes link the industrial park to the south-western corridor.

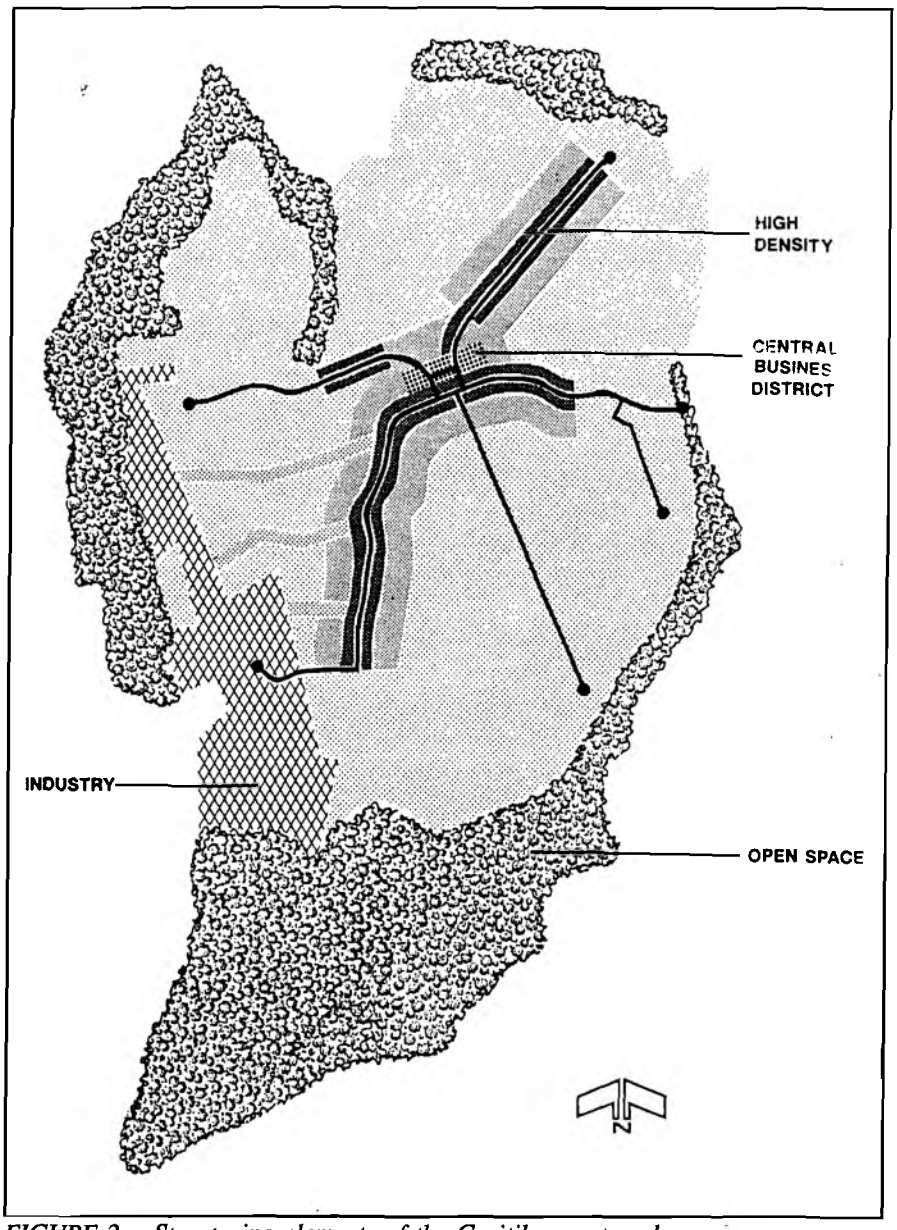


FIGURE 2: Structuring elements of the Curitiba master plan

3.4 Preservation of the urban fabric

Concern for the preservation of the urban fabric in Curitiba stems not only from respect for its history and urban environment, but also from economic realities enforced by a lack of government funds.

The earlier master plan for the city called for the widening of the city's main thoroughfares, with the consequential demolition of many old and historic buildings. This would have been an expensive exercise, and would have destroyed Curitiba's historic core. This set of circumstances led to the development of a new master plan incorporating the corridor concept.

The first proposals for the corridors included 60 m wide arteries to accommodate dedicated bus lanes and to provide for conventional traffic movement. At the time, not a single street in Curitiba had a reserve width approaching 60 m. The opening up of these arteries would have required a similar intervention to that which the previous plan called for. The expropriation of property for the widening of streets would also have involved enormous expense.

The lack of funds generated an alternative solution to the problem; the need was for a *total* reserve width of 60 m, not necessarily a single *continuous* reserve width of 60 m. Investigations confirmed that it would be possible to provide three parallel routes along existing roads that would add up to a total reserve width of 60 m, without the need for expropriation. Thus the trinary road system was born (Figure 3).

The roads on the outside function as one-way bypass routes, accommodating faster moving traffic, travelling in opposite directions. The central road reserve provides for a two lane dedicated bus route, as well as two side lanes which have an access function only.

3.5 Density and public transportation

The urban pattern of Curitiba is characterised by high densities, structured in linear forms. Although there is a central core area, only one third of the resident population, as well as 33% of the job opportunities, are to be found there. A further 33% of inhabitants and jobs are located along the axes, and the remaining work opportunities are in the industrial area.

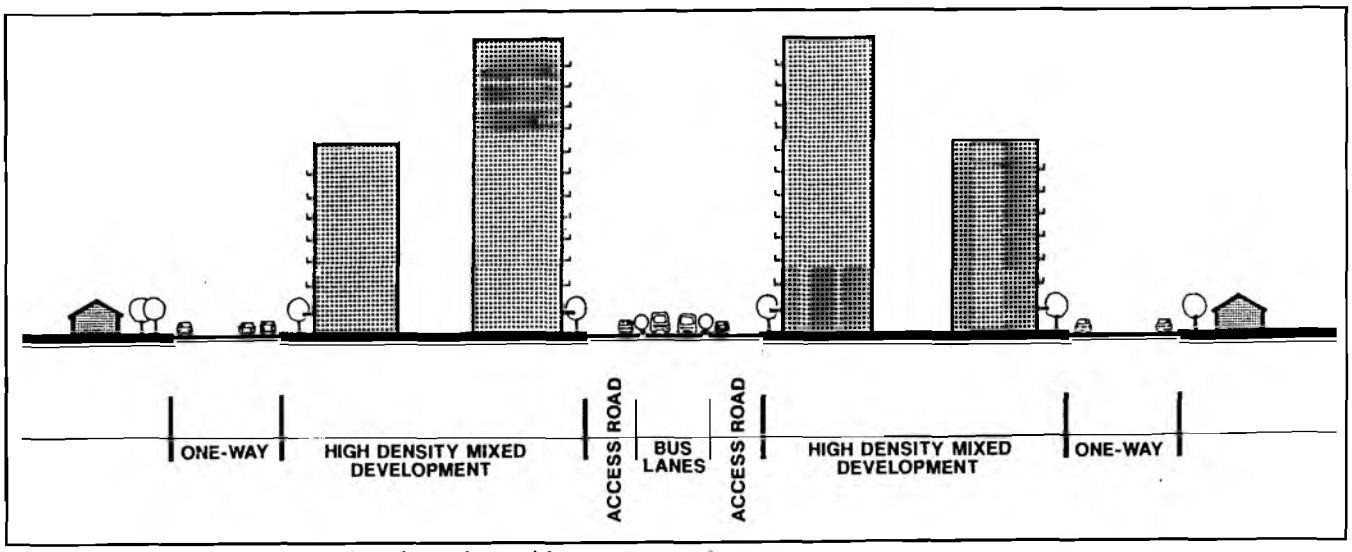


FIGURE 3: Typical cross-section through corridor

This decentralised, but structured pattern has assisted the provision of an efficient public transportation system so that 70% of urban trips are now handled by the system. These high bus ridership figures are attained in spite of the fact that Curitiba boasts the highest car ownership in Brazil (300 cars per 1 000 population; compared to 140 cars per 1 000 people in Cape Town in 1990).

The main elements of the public transportation system are the express and feeder bus services. This network is shown diagrammatically in Figure 4.

The express buses operate on dedicated bus lanes along the corridors. These buses are conventional 100 passenger vehicles or articulated vehicles with a capacity of 160 passengers. As some of these corridors have reached their capacity, a system of "speedy buses" was introduced, operating on the parallel one-way bypass routes along the corridors. Bi-articulated buses with a capacity of 270 passengers have been developed for this service.

Innovative "tube" bus stations have also been developed to speed up the handling capacity of the system. Fares are collected before passengers board the buses, and the stations also provide shelter and an elevated platform to ease ingress and egress. Together with the bi-articulated buses, these stations are a vital component of the system which carries the same volume of passengers as the subway in Rio de Janeiro. The difference is that Rio's subway has cost 300 times more than the bus system in Curitiba to implement.

Feeder lines (or interdistrict lines) connect the residential areas to interchange terminals located along the corridors.

Depending upon the densities along the different corridors, passenger volumes differ significantly, with the total daily flow varying from 40 000 to 280 000 passengers per corridor.

The peak period travel demand is more directionally balanced along the corridors than the one way commuter flows normally experienced in centrally oriented urban forms. This characteristic results in a short average home-work trip length of 5,5 km in Curitiba, compared to 16 km in Cape Town.

The short commuting trips and the high level of public transportation use have positive environmental consequences. Due to the efficiency of the system, savings are achieved in the use of oil derivates, and pollution is reduced.

3.6 Job opportunities

Apart from the economic activities which were generated along the highly accessible movement corridors, an industrial park was established in 1973. The involvement of the City in the establishment of the park did not stop at the point where serviced land was made available, but extended to negotiations with prospective industrialists. The State's Development Bank also acquired shares in companies that were willing to establish factories in

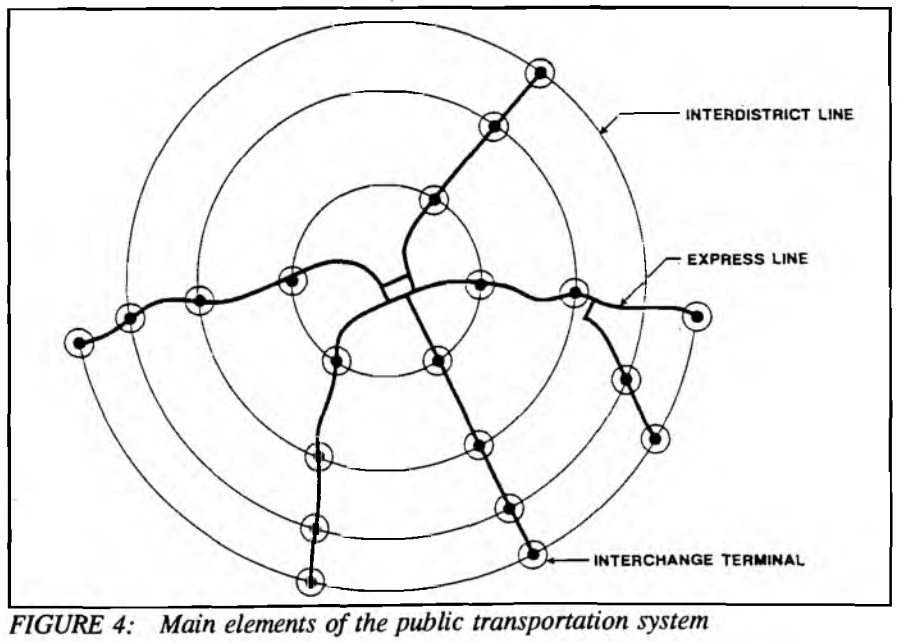


FIGURE 4: Main elements of the public transportation system

Curitiba. The shares were later sold at a profit.

Another factor that has attracted industries to Curitiba is the quality of life that is offered. The integrated transportation network and the short home to work trip lengths result in an average 3 hours less commuting time per day for Curitiba workers, compared to that spent by commuters in São Paulo.

Today the industrial area contains more than 400 firms, providing approximately 20% of the jobs in the Curitiba metropolitan area, where the unemployment rate is currently about 12%.

3.7 Public open space

A programme for the creation of parks and the planting of trees in Curitiba was launched in 1971. This resulted in an increase of green space per person from around 0,5 m^2 to over 50 m^2.

As in the case of the preservation of the City's urban fabric, the increase in public open space stems not only from an awareness of man's environmental needs, but also from economic realities. Starting in the early fifties, the city's continuous growth led to greater stormwater runoff and the flooding of its rivers. Seasonal floods inundated large stretches of land, such as the seat of the state government and the airport.

Expensive, conventional engineering solutions were at first applied to accommodate, in the same physical space, the variable volumes of the rivers. Long stretches of rivers were canalised, without solving the problem.

Then, during the period in which the new master plan was developed, the idea of creating large parks in those areas where the flooding occurred came to the fore. However, money from the State was available only for engineering solutions, not for the creation of parks and lakes. So, projects copying the (then) conventional methods of flood control were submitted to the Federal Government, but the financial assistance granted for canalising stretches of the rivers, was used to expropriate land for parks and for building stormwater retention ponds within those parks. In this way the flow of the rivers could be regulated, and seasonal flooding in other areas could be accommodated within the parks.

Some of these parks have since been developed to serve the recreational needs of the citizens of Curitiba, many of whom are living in high rise buildings along the corridors. Scarce financial resources have thus been used to serve more than one purpose: environmentally friendly flood control measures have been provided which also serve the recreational needs of people.

"Today, if the Iguacu river rises as a result of rains and floods, the only thing likely to happen is that the duck in the zoo, instead of swimming at elevation 875, will be swimming at elevation 876. Two or three days later the river will come down and the duck will again be swimming at elevation 875" (J Lerner).

3.8 Waste management

By 1989 the existing sanitary landfill site was saturated and new solutions had to be found. Conventional alternatives such as new landfill sites and expensive recycling plants were investigated, but rejected in favour of an innovative low cost alternative.

Approximately 40% of domestic waste consists of recyclable materials such as paper, cardboard, glass, plastics and metals. Normally these materials are separated at recycling plants. Curitiba's "invention" was simply manual selection performed at home, in other words to avoid the mixing that normally occurs in a garbage bin.

A "waste which is not waste" programme was launched to make people aware of the advantages of recycling. Today approximately 1 000 trees are saved every day by recycling used paper in Curitiba. At the same time the life of the sanitary disposal site (which receives non-recyclable waste), has been doubled as far less waste than was originally generated is now dumped.

A significant spin-off of this programme has been the opportunities created for the people living in the poorer areas of the city. Because it is difficult to manoeuvre garbage trucks in the slums, the city has instituted a process whereby the people can exchange garbage for a transport token to be used on the public transportation system, or for food parcels.

The system has also resulted in some of the unemployed becoming entrepreneurs by collecting recyclable materials which are then sold to the city. This has resulted in less litter in streets and parks, and employment for people who would otherwise not have had an income.

3.9 Management structure

As sustainability can only be achieved by an holistic approach, it follows naturally that an integrated approach to city management is a prerequisite for a well managed city.

The government units in Curitiba are grouped according to functional issues, rather than administrative functions. All units report directly to the mayor's office. One of the most powerful units, the Institute of Research and Urban Planning (IPPUC), is responsible for forward planning in *all* sectors of city government. This unit also coordinates the city budget every year, which functions as an annual operating plan and gives effect to the city's vision and ethic. The city is thus run and managed on the basis of integrated programmes.

3.10 Implementation of the Physical Structure

In Curitiba, the proper integration of land use and transportation was achieved by the implementation of the five transportation corridors, thus creating a sustainable urban structure. It is important to note how this was brought about, as it has a bearing on the application of similar concepts elsewhere.

Curitiba's growth over the past 29 years has been guided by a typical "blue print" master plan: a plan that has remained basically intact since 1965. Herein lies both its strength and its weakness. The strength of the plan

derives from its consistency, which has facilitated the implementation of the proposals for more than 20 years. The weaknesses of the plan include the lack of process, public involvement, and flexibility.

The master plan remained inactive for the first five years after its inception. It was only in 1971 that programmes for its implementation were seriously considered. At that time Brazil was ruled by a military dictatorship, which appointed J Lerner as mayor of Curitiba. The mayor had wide powers and ruled by decree. As Lerner (an architect) had been involved in the creation of the plan five years earlier, he became the driving force in its implementation.

The basic building blocks of the master plan were thus put into place without public involvement. One example of this modus operandi was the construction over a weekend of the first phase of the pedestrian network in the central business district, without involving the affected parties. Today, however, the plan has been implemented to such an extent that its advantages can be clearly demonstrated. It is therefore not under any pressure from a more democratic system of government.

4 LESSONS FOR SOUTH AFRICA

Curitiba is not a model which can be transplanted "as is" to all other situations. The principles which underlie the Curitiba approach should rather be distilled and carefully adapted to local circumstances.

- Recent South African experiences in public participation for instance, have emphasised the fact that most people resist change to their physical living environments (where their houses, which normally represent the bulk of their investments, are situated). There might be agreement on the principles which point to change, but please: Not in my backyard! The new democratic order in South Africa and the need for transparent planning processes, could therefore render the implementation of major restructuring proposals problematic.

- South Africans in general still seem to prefer low density housing. The Urban Foundation points out that there are several factors that undermine the potential to achieve higher densities. For instance:

  - A tradition of high density (particularly high-rise) living is absent in South Africa; and

  - high density housing needs certain design elements to be acceptable, which tend to make such housing more affordable for the wealthy.

  In addition, it can be argued that if one accepts that the higher accessibility, and therefore higher economic thresholds, created along movement corridors would also lead to higher land values, it may be difficult to satisfy the housing needs of the majority of our population along these corridors.

- Grandiose, First World planning solutions are not applicable to cities in developing countries. Affordable solutions which serve more than one purpose and which can be implemented over time, must be developed.

- The transformation of our cities will only be possible under circumstance of sustainable economic growth; not only because this broadens the tax base and provides income to the authorities for the provision of infrastructure, but also because the private sector will have to make a major contribution towards the development of the proposed land uses. This is only possible under circumstances where the private sector can satisfy market needs.

- Sustainability can only be achieved by means of an holistic planning approach. This means that the existing compartmentalised management structures of our cities may have to be reassessed. All agencies in local government should be properly integrated and contribute to a central vision for the city.

- The political will to implement a central vision, and strong leadership to achieve its goals, are prerequisites for the creation of a winning city. In Curitiba, a professional who understood the issues involved, provided such leadership. Implementation is the key to growth management; the preparation of proposals only achieves little.

5 CONCLUSION

Curitiba is a good example of a city which has reached a high level of sustainability. The illusive goal of the proper integration of land use and transportation systems has been attained. Environmentally friendly, cost effective engineering solutions to the problems in Curitiba have been developed. This has resulted in an efficient, pleasant living environment. But the holistic vision and integrated management approach is perhaps the greatest achievement in Curitiba. This approach can, and should be, emulated in our cities if we are serious in our quest for sustainable urban environments.

NOTES

1 This paper is based partly on a four day visit to Curitiba during May 1994.

BIBLIOGRAPHY

GRAY BK (1994). *Urban Activity Corridors; Capitalising on the experiences of others in the quest for creating viable urban environments*. Paper presented at a SA Roads Federation Seminar. Johannesburg.

HERBST K (1992). "Brazil's Model City". *American Planning Association Journal* (September) pp 24-27.

KAY JH (1994). "Hell on Wheels". *American Planning Association Journal* (January) pp 7-10.

LERNER J (Undated). *Curitiba: The Ecological Revolution*. Jaime Lerner Institute, Curitiba, Brazil.

NICKS SC and STURGEON K (Editors) (1994). *First unpublished report by members of a touring group which visited Curitiba in May 1994*. Cape Town.

NICKS SC (1994). *Curitiba: Some lessons for planning in South Africa*. Proceedings of the SA Institute of Town and Regional Planner's 1994 conference. Cape Town.

Urban Foundation (Undated). *Urban Debate 2010: Policies for a new urban future*. No 9.

Western Cape Economic Development Forum (1993). *Interim Metropolitan Development Framework: Cape Metropolitan Area*. MDF Co-ordination Working Group. Cape Town.