

SPATIAL DUALISM REVEALED BY THE GREATER PRETORIA HOUSEHOLD TRAVEL SURVEY

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1. BACKGROUND

The Greater Pretoria Metropolitan Council (GPMC) in partnership with the City of Pretoria and Akasia and Centurion Transitional Local Councils, updated its transportation model in 1997 in order to undertake a quantitative evaluation of the Land Development Objectives (LDO).

The second phase of this activity was intended to obtain strategically reliable base-year data to assist the Integrated Development Planning process (IDP) through the development of land-use/transport scenarios and trends. Accordingly, the Household Travel Survey was intended to provide matrices of the origins and destinations of all trips undertaken in the Greater Pretoria area in the morning peak period, as well as information on the purpose, duration, travel mode used and trip costs. Other attitudinal information was collected pertaining to the perceptions of travellers about the quality of the travel experience in Pretoria.

The general objectives of the study were:

- to provide basic information for the identification, design and economic evaluation of urban transport investment projects in Greater Pretoria; and
- to provide the data for the future calibration and operation of the city's urban transport modelling system, namely EMME/2.

2. SAMPLE DESIGN

The GPMC transport model demographic data base, recently prepared for Phase 1 of the 1996 update, was used for the sample design. The total number of dwelling units from which the sample was drawn was around 570 000. Table 1 shows the distribution of the sample and the sampling fraction.

Table 1: DISTRIBUTION OF THE GPMC SAMPLE

Region	N of households	Percentage of all households in study area	N in sample	Sampling fraction
New sub-regions in Metro	88 757	15.4	1 086	1.22
Northern Sub-structure	91 924	16	1 094	1.19
City Council of Pretoria area	302 090	52.6	4 546	1.50
Centurion	36 931	6.4	626	1.70
External Sub-regions	55 014	9.6	531	0.97
Study area	574 716	100	7 883	1.37

Owing to budget constraints, a sample size of 7 500 was determined for the study area. American experience has found sample sizes of between 2 500 and 10 000 to be acceptable for large cities. The results of the survey are provided in the final report on the Household Travel Survey (Greater Pretoria Metropolitan Council, 2000).

3. STUDY AREA

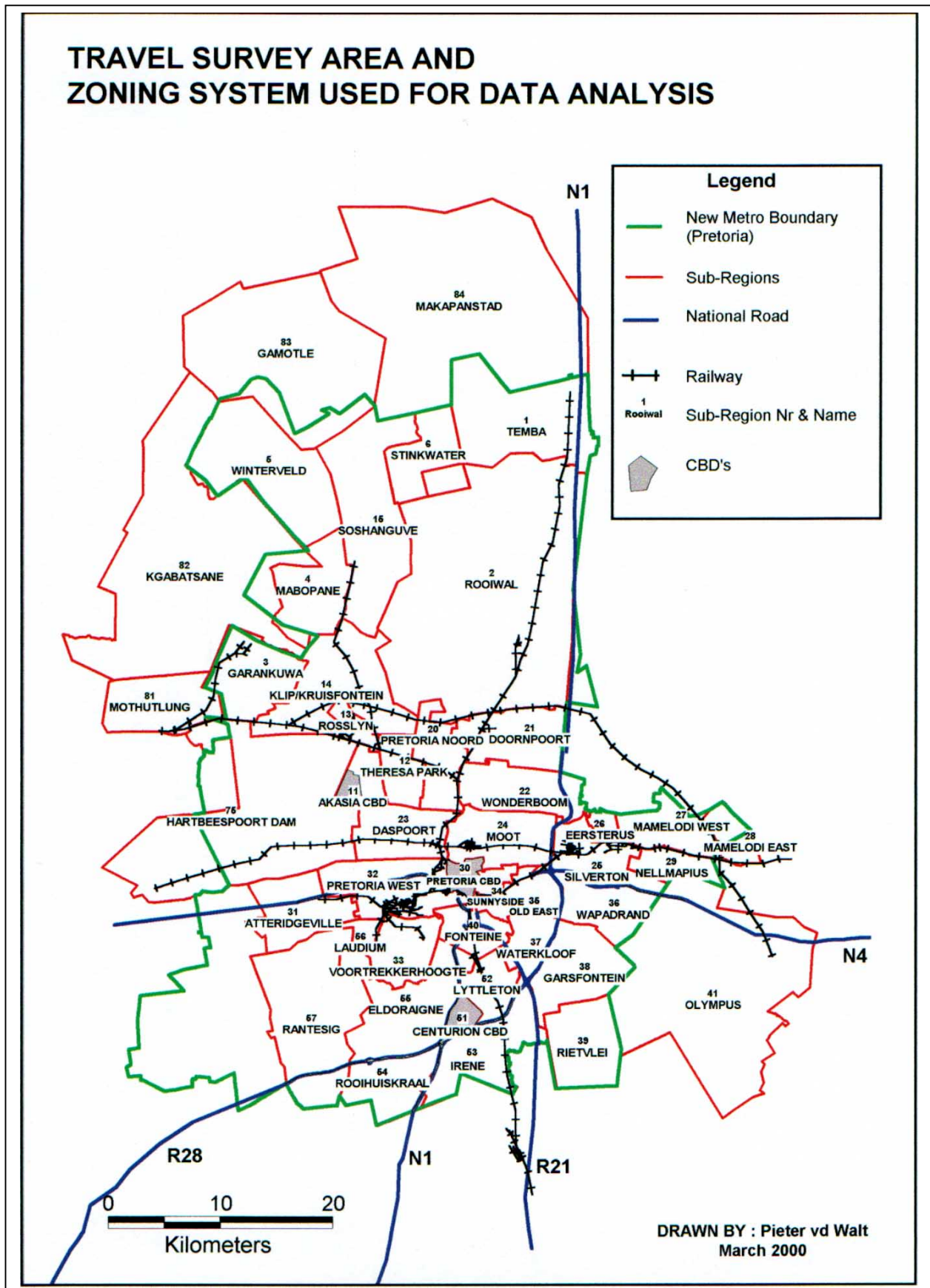
Figure 1 shows the Travel Survey Area and the coarse zoning system used for data analysis. The study area encompasses the current GPMC area which comprises the Metropolitan Local Councils of Northern Pretoria, Pretoria and Centurion. It also encompasses the new metropolitan boundary as provided by the Demarcation Board. There was, however, no sample drawn in the areas to the south-west of the city, namely Hartebeespoort Dam and Crocodile River. The peripheral settlements north and north west of the city including Makapanstad, Gamotle, Kgabatsane and Mothulung were included. The large extent of the study area is indicated by the fact that the vehicles transporting fieldworkers covered 65 000 kilometres during the course of the survey.

4. GENERAL CHARACTERISTICS OF THE POPULATION OF GPMC AND ENVIRONS

The following general characteristics of households in the study area are germane to the subject of the paper and are highlighted to draw attention to key facts:

- two thirds of the population are Black and comprise 370 000 households. White households account for 30 per cent of the population while Coloureds and Asians account for only 2.5 per cent of households in the study area;
- almost two thirds of the population reside in conventional detached houses. Some 10 per cent live in flats or duplexes and 14 per cent, or 80 000 households, live in shacks or informal houses;
- some two thirds of households do not own cars, whereas 18 per cent of households own two or more cars; and
- the mean monthly income of Black Households is around R2 400 per month, which contrasts sharply with that of White households at R9 800 per month.

Figure 1: HOUSEHOLD TRAVEL SURVEY STUDY AREA



Income distribution, the number of workers per household, the number of households with economically active people who are unemployed and the work status of all household members, provide contrasting pictures in different parts of Greater Pretoria as follows:

- there are stark disparities in income, with some 13 per cent of households earning less than R600 per month, while at the other end of the scale, some 13 per cent earn R12 000 or more per month. It is convenient to group households into three income bands, namely, low-income households earning less than R3 000 per month (37.6%) middle-income households earning between R3 000 and R8 000 per month (38.8%) and a high-income group which earns R8 000 or more per month, and which comprises 23.6 per cent of all households in Greater Pretoria;
- the average number of unemployed persons is 0.61 per household. Nearly a quarter of all households have at least one unemployed family member; and
- there is a marked contrast in the proportion of Black and White households in full-time work, with only 23 per cent of the Black population being in full-time work in contrast to 44 per cent of the White population.

The household structure, age profile and education of residents of the study area, are fairly typical of the urban population of a developing country, namely:

- the mean household size is 3.86 persons per household, but there are a large number of households with 6 or more family members (22 per cent);
- the age structure is typical of a developing country, with 50 per cent of the population being under 25. The elderly comprise a small proportion at 4 per cent; and
- 40 per cent of the population have no high school education and only 23 per cent have completed high school.

Table 2 shows the characteristics of peak-period travel in Greater Pretoria. The following general characteristics are worthy of note:

- most peak-period trips are for educational purposes, either to school or tertiary institution (43.4%);
- work trips comprise 35.6% of all peak-period trips and the other significant peak trip purpose is to serve a passenger, usually to take children to school (113 000 trips);
- the most common mode of travel is walking (33.4%), followed by the motor car (32.8%). Walking is the predominant mode for educational trips. Some 65 per cent of peak-period trips are made by motorised modes and amongst these, the private motorised modes account for 53 per cent of trips. Public transport carries the remaining 47 per cent; and
- total peak-period travel times range from about 25 minutes for car, walking and cycle trips up to an average of 87 minutes for those who commute by train. The reason for the long travel times by rail is that access to stations, waiting at stations, transfers and the movement from stations to final destinations, consumes on average, around 30 minutes. The in-vehicle time for those who travel by train occupies only 57 of the 87 minutes which constitutes the average travel time of train users. The advantage of the car as a travel mode is amply demonstrated in the table, which reflects short total times and minimal walking times at trip origins and destinations.

Table 2: CHARACTERISTICS OF PEAK PERIOD TRAVEL IN GREATER PRETORIA

Trip purpose	N of trips	% of trips
Go home	48 831	3.0
Go to work	582 507	35.6
Part of work	21 186	1.3
Go to school, college	708 920	43.4
Serve passenger	112 896	6.9
Shops/doctor/hospital	93 787	5.7
Recreation/social	5 373	0.3
Other	34 916	2.1
Visiting	26 215	1.6
All purposes	1 634 631	100

Main mode	N of trips	% of trips		% of motorised trips	
Train	105 559	6.5		9.9	
Bus	155 382	9.5		14.5	47.4
Taxi	246 832	15.1		23.0	public
Lift club	10 250	0.6	65.6	1.0	
Car driver	358 017	21.9	motorised	33.4	
Car passenger	177 168	10.9		16.5	52.6
Company transport	15 579	1.0		1.5	private
Motor cycle	2 573	0.2		0.2	
Walk	544 468	33.4			
Bicycle	13 617	0.8			
Other	3 084	0.2			
All modes	1 632 528	100		100.0	

Main mode	Total travel time	In-vehicle time
	(mean minutes)	(mean minutes)
Train	87	57
Bus	62	44
Taxi	50	35
Car	25	24
Walk/cycle	24	
Other	41	38
All	36	33

5. ECONOMIC SEGREGATION IN GREATER PRETORIA: 'A TALE OF TWO CITIES'

Table 3 shows the areas in Greater Pretoria where more than 50 per cent of households earn less than R3 000 per month (disadvantaged) in contrast to those where more than 50 per cent of households earn over R7 000 per month (privileged). Superimposed on the table is a map, which contrasts the disadvantaged areas of the city with those occupied by the privileged. The concentration of poverty on the margins is evident, as is the polarisation between the disadvantaged north and the more affluent south. Table 3 shows that the largest concentrations of poor people are found in the zones outside the proposed metropolitan border, and those in the North West Province which will form part of the cross-border metropolitan council. In the extreme south of Pretoria, Olympus, the New East and Centurion contain the largest proportion of relatively affluent households. Households with moderate incomes are clustered in the central corridor between Atteridgeville and Mamelodi.

Table 3: GPMC MONTHLY HOUSEHOLD INCOME BY PLANNING ZONE (HOME ZONE OF HOUSEHOLD)

Zone Number	Disadvantaged	Monthly household income		
		R1-R2 999 %	R3 000-R6 999 %	R7 000 %
NM6	Stinkwater	91	9	-
E3	Gamotle	91	9	-
A1	Soshanguve N	90	9	1
E4	Makapanstad	90	8	3
NM5	Winterveld	90	10	1
E2	Kgabatsane	87	12	1
NM1	Temba	86	13	1
P4	Mamelodi West	78	18	3
A5	Soshanguve C	78	22	-
P6	Atteridgeville	76	22	3
A3	Klip/Kruisfontein	74	13	13
P11	Voortrekkerhoogte	71	20	9
NM4	Mabopane	71	25	5
E1	Mothutlung	69	25	5
P5	Mamelodi East	67	28	5
A2	Soshanguve S	55	36	9
NM3	Garankuwa	51	44	5
	Privileged			
P3	Silverton	17	36	47
C3	Rantesig	22	24	53
P2	Moot	17	29	54
NM2	Rooiwal	9	29	63
P11	Wonderboom	10	27	64
C1	Centurion	16	19	64
A4	Akasia	6	20	75
P10	New East	4	18	78
P12	Olympus	5	15	80
C2	Eldoraigne	4	12	84

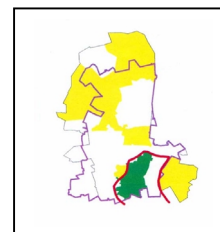


Table 4 provides a similar statistic, indicating the planning zones where more than 50 per cent of persons who work there, earn either more than R7 000 per month, or less than R2 000. Areas attracting high-income workers are the Old East, Lyttleton and Centurion. With the exception of Voortrekkerhoogte (military) and Olympus (agricultural), the zones in which the majority of jobs are relatively low paid (workers earning less than R3 000 per month) are largely concentrated in the north.

The average personal income of employees working in each of the planning zones is also provided in Table 4. The average monthly personal income ranges from a low of R1 800 for those working in Makapanstad in the extreme north, to a high of R5 000 for those working in Pretoria Old East. The average monthly income of those working to the south of Pretoria, in Midrand and Johannesburg, is over R7 500 per month.

Table 4: GPMC MONTHLY PERSONAL INCOME OF WORKERS (WORK ZONE OF COMMUTERS)

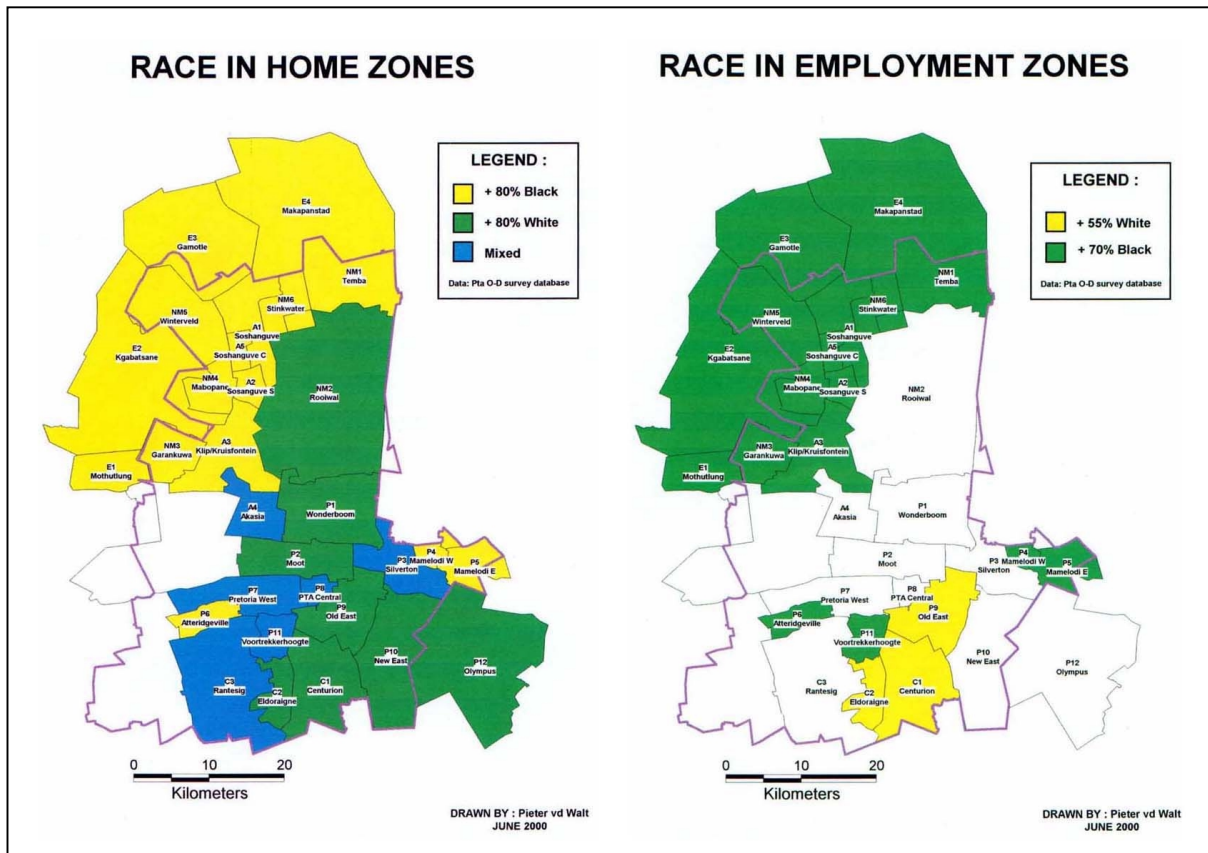
Zone Number	Disadvantaged	Monthly personal income			Mean income per month (R)
		R1-R2 999 %	R3 000-R6 999 %	R7 000 + %	
E4	Makapanstad	78	16	6	1 854
E2	Kagabatsane	72	21	7	1 998
NM1	Temba	72	20	8	2 146
NM5	Winterveld	72	28		1 773
A3	Klip/Kruisfontein	63	24	13	2 237
A1	Soshanguve N	60	10	30	2 984
NM6	Stinkwater	60	20	20	2 490
A5	Soshanguve C	59	38	3	1 918
A2	Soshanguve S	52	37	12	2 107
	Privileged				
C2	Eldoraigne	26	19	55	4 762
P9	Old East	23	22	55	5 024
	External South	17	20	63	7 541



The pattern revealed by Figure 2, which shows the distribution in Greater Pretoria according to race, more or less mirrors the distribution of income. The zones in which more than 80 per cent of the total population is Black are all in the northern portion of the metropolitan area or in the extreme east and west of the City Council of Pretoria area. Whites occupy the zones in the central and eastern portions of the Pretoria and Centurion areas. Planning zones of mixed race occupy the central and south western parts of the GPMC area.

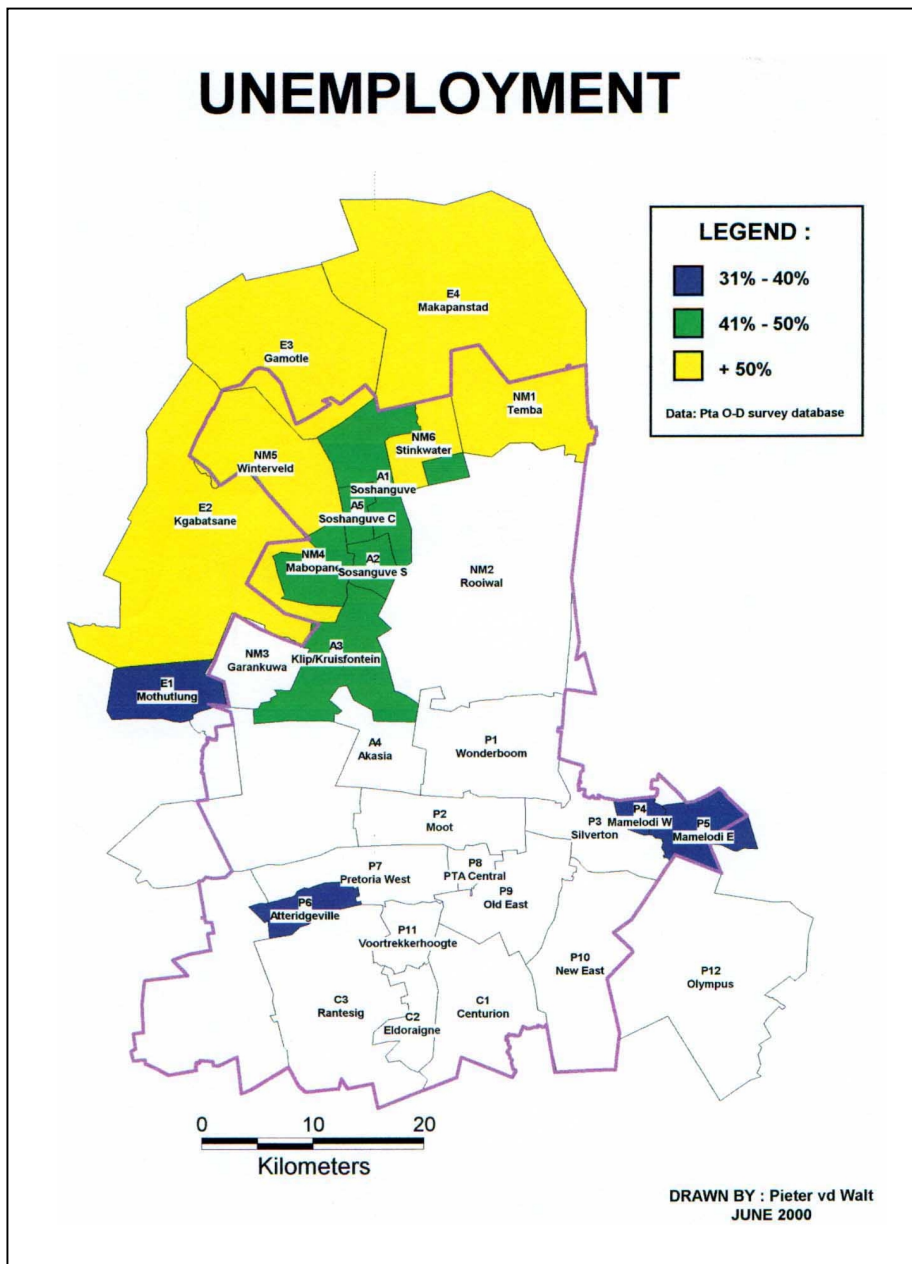
A similar pattern pertains to the planning zones which are the destination of work trips. Centurion, Eldoraigne and the Old East of Pretoria have a working population of which more than 55 per cent of total jobs are occupied by Whites. In the Black areas in most instances, well over 90 per cent of the work opportunities are filled by Blacks.

Figure 2: DISTRIBUTION OF HOUSEHOLDS IN PRETORIA BY RACE



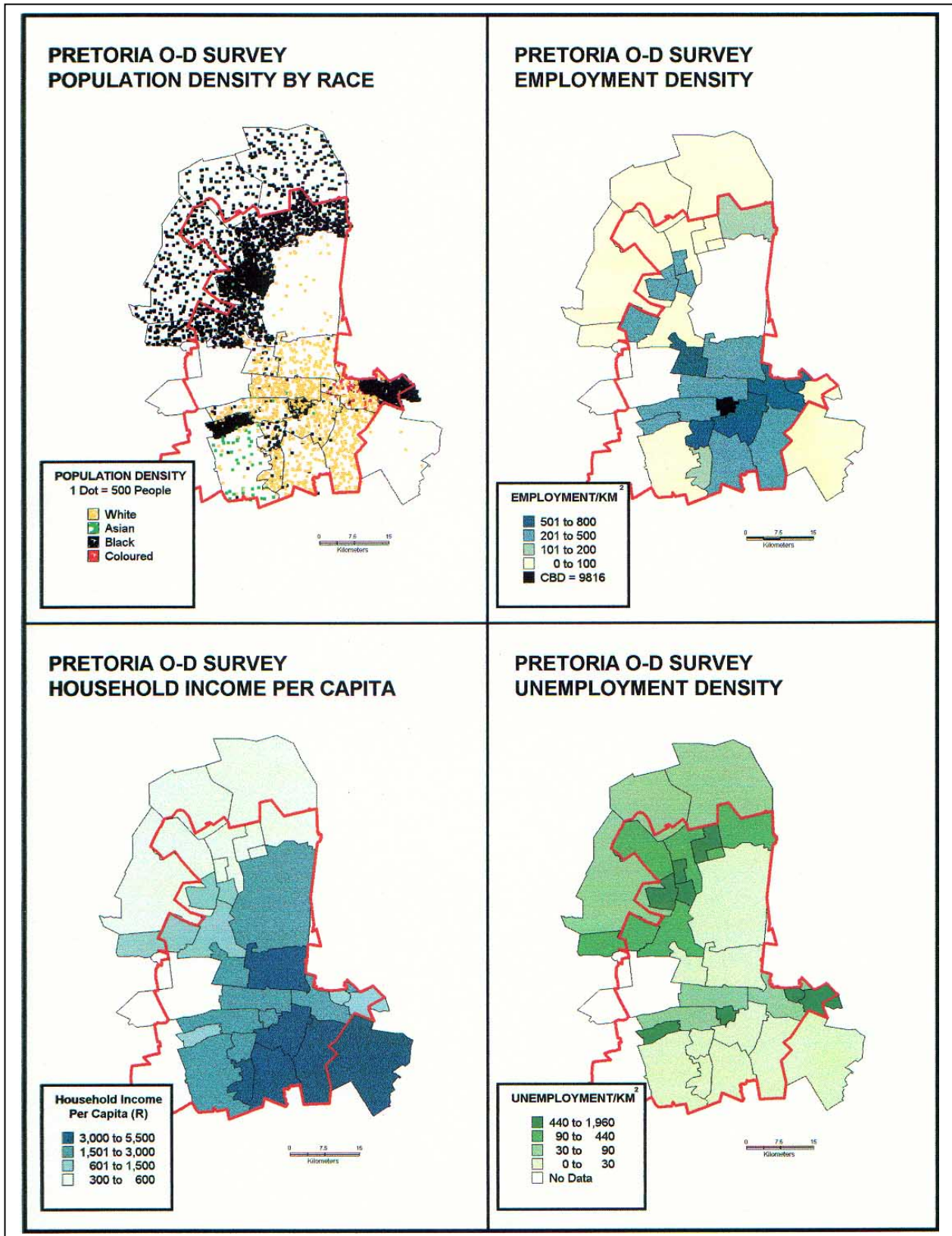
A most significant demographic statistic is that provided in Figure 3, which shows the spatial distribution of unemployment in Greater Pretoria. Unemployment is high in all of the Black areas, with the exception of Garankuwa. The general trend is that the more accessible Black residential areas such as Atteridgeville and Mamelodi have lower levels of unemployment, at between 31 and 40 per cent of all economically active persons. The Soshanguve, Mabopane and Klip-Kruisfontein areas have unemployment levels of between 41 and 50 per cent. The remote northern zones have unemployment levels in excess of 50 per cent. Even the Mamelodi unemployment is unacceptably high, if one considers that employment figures include informal jobs.

Figure 3: SPATIAL DISTRIBUTION OF UNEMPLOYMENT IN GREATER PRETORIA



The racial and economic polarisation of Greater Pretoria is depicted in Figure 4, and will continue to be a serious challenge to the metropolitan council. Councillors elected to represent these disparate groupings, will need to adopt policies which address the problems associated with poverty and unemployment. Politicians will thus need to be advised by technical officials who are capable of providing innovative policies and intervention strategies, to alleviate the debilitating cost burdens imposed by these spatial development patterns. The cost burden on the disadvantaged applies to transport in particular, but also access to education, health and recreational activities.

Figure 4: SPATIAL CHARACTERISTICS OF POPULATION IN GREATER PRETORIA BY RACE, EMPLOYMENT AND INCOME



Travel and transport patterns in Greater Pretoria are illustrated in Figure 5, which shows the modal split, the number of peak-period work trips and car availability to households in each of the planning zones. The following reflect the socio-economic structure of the population:

- public transport is the dominant form of travel in the disadvantaged areas;
- private transport predominates in the south and south east;
- pedestrian movement is only significant in the central areas of the CBD, Sunnyside and Voortrekkerhoogte;
- taxi is the dominant mode amongst public transport users;
- train travel only features in areas where there are services; and
- the number of peak-period work trips is higher in the affluent areas, as is the number of cars available to households.

The spatial pattern of morning peak-period trips is highlighted in Figure 6. The following patterns may be noted:

- all the public transport modes are providing line-haul services, in direct competition with each other;
- the competition between train and taxi modes in the same corridors is particularly pronounced. This applies particularly to the Soshanguve CBD corridor and the Atteridgeville/Mamelodi corridor which also converges on the Pretoria CBD;
- the bus mode has a less pronounced convergence on the CBD, except in the case of the Hammanskraal CBD corridor but provides a radial pattern of supply from the disadvantaged areas (townships) to the dispersed employment centres mainly in the Moot and in the south and south east of Pretoria; and
- the pattern of car trips is completely different to public transport with the greatest concentration of car trips being made in the south and central parts of Greater Pretoria.

Figure 5: TRANSPORT PATTERNS IN GREATER PRETORIA

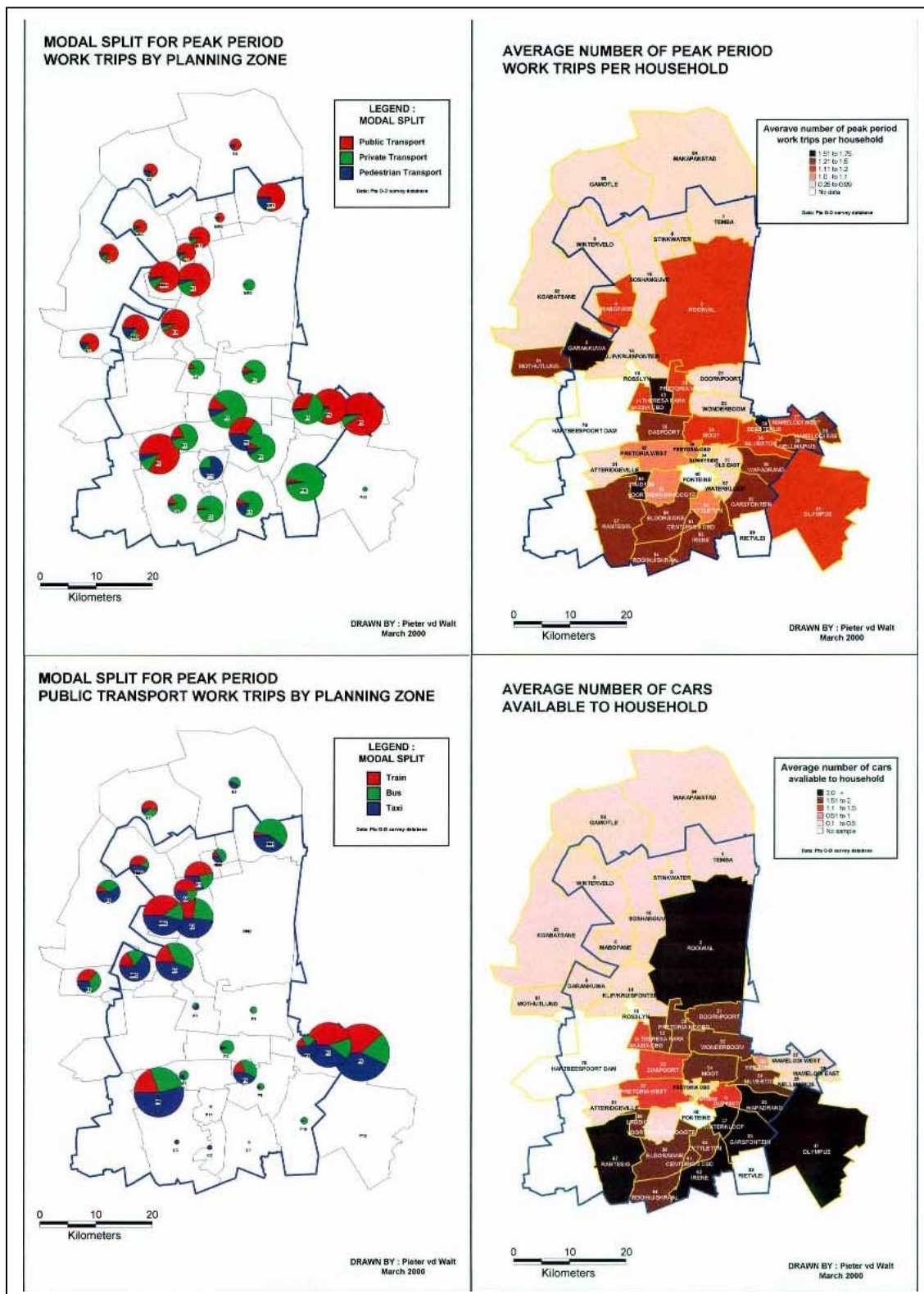
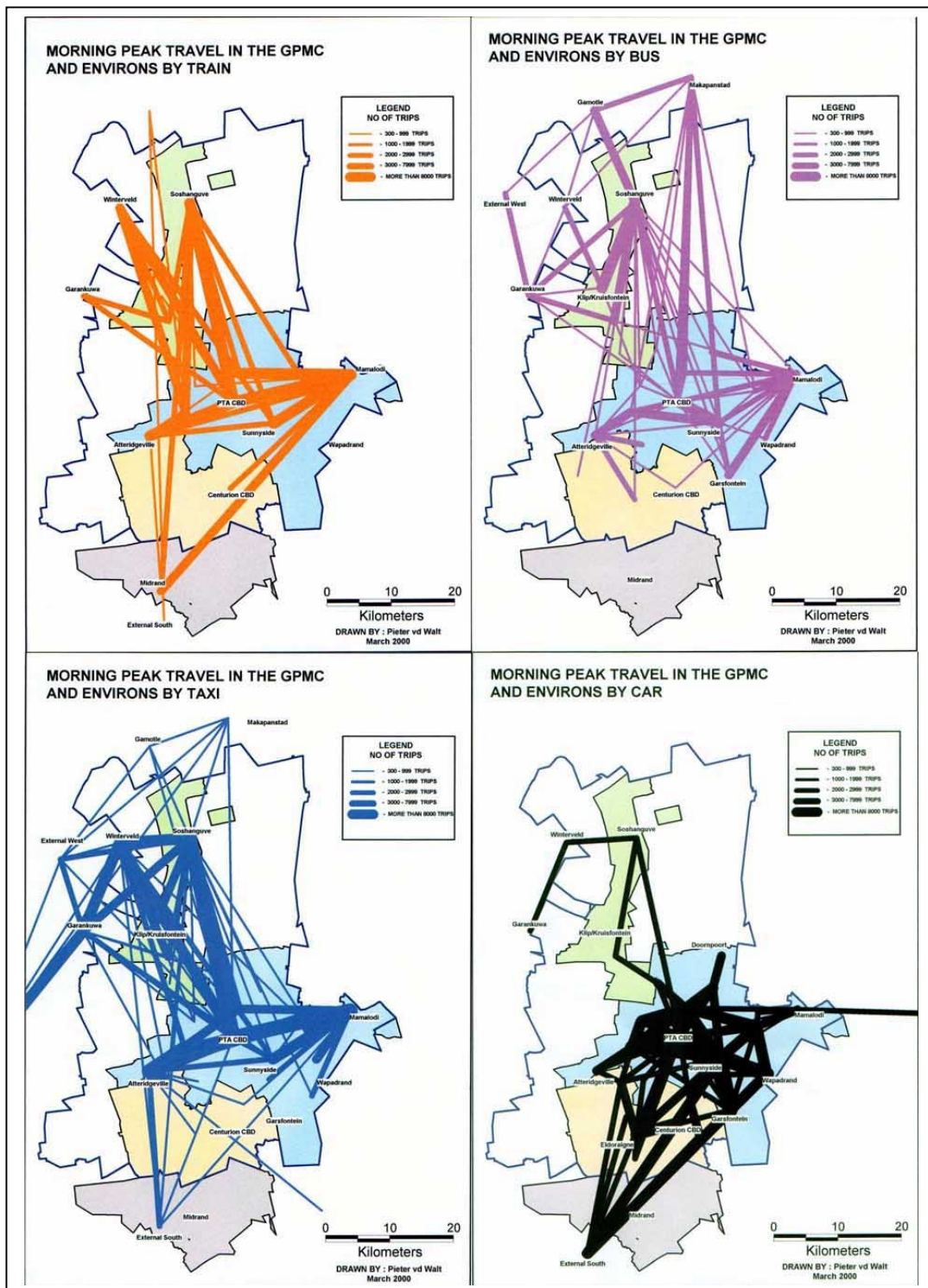


Figure 6: SPATIAL PATTERN OF MORNING PEAK-PERIOD TRAVEL IN GREATER PRETORIA



6. CONCLUSION

The results of the Household Travel Survey, particularly the origin-destination information, can, and will be used to calibrate the EMME/2 model, in order to test the possible impact of different land-use and transport policies in Greater Pretoria. Of necessity, the land-use policies will be relatively long term because it will take considerable time for urban restructuring to occur in response to alternative land-use policies. It is suggested that land-use policy tests should be applied as follows:

- a realistic trend scenario with respect to population and employment location over a ten-year horizon; and
- a realistic urban restructuring scenario, also over a ten-year horizon, based on a relatively modest relocation of population, and trends in the location of employment.

The urban restructuring scenario should largely be based on policies over which planning authorities have some control, namely the location and form of housing. The location of employment activities is largely outside the control of a municipality. The results of the two scenario tests should be evaluated with respect to economic criteria, particularly the differences between the two with respect to travel times and travel costs.

Both the base-year condition and the two horizon-year scenarios, should be tested with regard to transport policies which are aimed at achievement of the objectives of national transport policy, namely:

- avoidance of parallel public transport subsidisation;
- elimination of the duplication of services;
- better targeting of subsidy;
- elimination of destructive competition in public transport; and
- full user-cost recovery where practical and socially justified.

These policy tests will reveal how planning interventions can give effect to urban restructuring, result in significant savings and improvement in the delivery of services, which are both more sustainable and better targeted on customer needs. The results of the tests should be brought to the attention of politicians, together with recommendations about actions which will be needed to give effect to the necessary urban restructuring.

The socio-economic polarisation and spatial disfunctionality of Greater Pretoria, demonstrated in this paper, is evidence of a potential 'time bomb' ticking in the city.

7. REFERENCES

Greater Metropolitan Council Household Travel Survey, 1998/99: '*Household Travel Survey*', Pretoria, South Africa.