A critique of travel analysis practices in South Africa with respect to understanding the travel needs of the poor

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ABSTRACT: This paper examines the ability of conventional South African travel analysis practices to adequately analyse the travel needs of the poor. It describes the origins and nature of travel analysis practices, and observes that their scope has often been limited to motorised modes, commutes or peak periods. This limitation in analytical scope is argued to create misconceptions of the true nature travel needs and behaviour, particularly amongst low-income households. A case is made for more inclusive travel analysis practices.

RESUME: Cet article analyse la capacité des méthodes conventionnelles d'analyse des déplacements sud africaines à rendre compte des besoins de déplacement des pauvres. Il décrit la nature et les sources de ces méthodes d'analyse, et observe que leur champ a souvent été limité aux véhicules à moteur, aux dessertes des banlieues ou aux périodes de pointe. On peut penser que cette limitation du champ de l'analyse engendre une méconnaissance de la nature réelle des besoins et des comportements de déplacements, en particulier en ce qui concerne les ménages à faible revenu. Cet article plaide pour des méthodes plus complètes d'analyse des déplacements.

1 INTRODUCTION

This paper assesses the ability of conventional South African travel analysis practices to adequately analyse the travel needs of low-income households. It is divided into five sections. Section 2 (the next section) identifies the origins and nature of travel analysis practices. Section 3 describes the conventional scope of these practices and discusses why this has typically been limited. Section 4 discusses the implications this limitation in scope has for adequately analysing the travel needs of the poor. Section 5 concludes by discussing the dangers of routinely imposing these limitations on the scope of travel analysis in South African cities.

2 TRAVEL ANALYSIS PRACTICES IN SOUTH AFRICA

Since the first appearance of specialist transport planning and traffic engineering disciplines in the 1930s, a number of distinct methodological streams in the analysis of travel patterns have emerged – from the aggregate methods that emerged in the 1950s and 1960s, to the land use-transport interactive and disaggregate methods of the 1970s, to the micro-simulation, dynamic, activity-based and strategic policy appraisal methods of the 1980s and 1990s. Methods of data collection and travel analysis applied in South Africa – principally in the form of inter-zonal origin-destination surveys and four-step traffic forecasting models – have been drawn from that stream of aggregate methods developed in the United States in the 1950s and 1960s. The same can be argued to be true internationally, even though more recently many European, North American and Australasian countries have applied alternative methods – in the form of activity-based, stated preference and panel analysis – to a far greater extent.

Many present day travel analysis practices in South Africa were therefore developed during a period of relative economic prosperity in the developed world, in order to facilitate the large-scale construction of the inter- and intra-city freeways and arterials perceived at the time to be needed by rapid growth in private transport. One important factor in the development of these practices was the availability for the first time of computers capable of manipulating relatively large quantities of data, enabling the examination of travel patterns across large geographical areas. Pioneering studies were undertaken in Detroit (Michigan) and Chicago (Illinois) in the

1950s. The emphasis in these studies was on planning a road network that could cater for the large expected increases in private motor car travel. Both the natural and financial resources necessary to achieve this were seen to be abundant. The resulting plans were therefore heavily oriented toward long-term (i.e. ± 20 year), capital-intensive expansions of transport system capacities.

These pioneering studies of the 1950s established a procedural norm, and provided the basis for an institutionalisation of practices in the United States in the 1960s. A major turning point in this institutionalisation was the passage of the 1962 *Federal Aid Highway Act* which required urban areas to employ a continuing, comprehensive and co-operative transportation planning process (known as the '3C process') in order to receive federal funding. The US federal government made available as much as 90% of the funds needed to construct new freeways, provided the road network was built in accordance with comprehensive regional transport plans. The '3C planning process' included four technical phases: data collection, data analysis, travel forecasts, and the evaluation of alternative transportation networks. The models and procedures applied in the United States gradually diffused throughout the rest of the world, mainly to the United Kingdom and Europe, and ultimately to South Africa as well. (Weiner 1997)

A review of the South African literature on travel surveys and demand models reveals four discernible overlapping periods in which travel analysis was dominated by either a particular theme, or a group of related themes.

The first period occurred during the late 1960s, 1970s and early 1980s and was concerned primarily with the collection of the data necessary for the calibration of the earlier travel demand forecasting models run in South Africa. Most of these models took aggregate four-stage form, with MINI-TRAMP and DELTRAN the most commonly applied software. Some land use-transport interaction and disaggregate mode choice methods were also applied, but to a limited extent. In reviews of transport modelling software and travel data sets available in South Africa, Ferreira (1977), Jordaan (1989), Crous and Price (1993) and Wilmot *et al* (1990) illustrate that between 1965 and 1985 most of the major urban centres applied these models in one form or another, and administered the surveys and traffic counts necessary for their calibration and updating (generally at 8-9 year intervals). The surveys that were administered typically took the form of racially stratified home interviews.

The second discernible period of travel analysis occurred during the mid 1980s and early 1990s and was concerned primarily with analysing the impacts of apartheid urbanisation and segregation policies on the travel patterns of 'black' workers, and with gathering data on the travel patterns of the 'black' population necessary for either informing urban transport policy formation or for including previously excluded township areas in travel demand forecasting studies. Studies concerned with the travel impacts of apartheid policies were undertaken by Fourie and Morris (1985) and Morris (1982, 1986), and by various urban geographers (Pirie and Khosa 1992).[1] Studies concerned with gathering data to inform policy and travel demand forecasting studies were undertaken by various consultants and transport authorities.[2]

A third period of travel analysis occurred during the early 1990s and was concerned primarily with the collection of the travel data necessary for the calibration of newly acquired EMME/2 four-stage travel demand modelling software. Whereas numerous software packages were in application in the late 1980s, Davies *et al* (1995) demonstrate that by the early 1990s almost all South African transport authorities had converted to the Canadian software EMME/2. This shift can be attributed to the, at the time, superior flexibility, multi-modal assignment and graphics capabilities of EMME/2 over earlier four-stage modelling software (Crous and Price 1993, Davies and Rontiris 1992). Data collection to calibrate and update these models occurred between 1989 and 1999 (Davies *et al* 1995).

The fourth, and most recent, period of travel analysis occurred during the latter half of the 1990s and was concerned primarily with the collection of data to inform a post-apartheid government policy shift from 'commuter-based' to 'customer-based' passenger transportation (i.e. a shift in concern from transporting peripherally located labour into and out of employment centres, to improving the access of peripheral township populations to the full range of educational, social and economic opportunities offered by urban agglomerations). The identification and analysis of 'customer segments' in post-

[1] Fourie and Morris (1985) and Morris (1986) studied the effect of long journey times on the daily activities of black commuters in Pretoria. Data were collected on work trip lengths, time budgets and mode use.

[2] Personal or home interview surveys of the trip generation, travel characteristics and infrastructure needs of 'black' travellers were undertaken by Davies and Bester (1994), de Lange and Vorster (1989) and Pienaar (1994). Survey and cordon counts of 'black' and 'coloured' commuters were undertaken by Aron *et al* (1990), CTCC (1981) and VKE (1986, cited in Wilmot *et al* 1990). Surveys of the impact of the emerging mini-bus taxi industry on the mode choice of 'black' travellers were undertaken by Freeman (1987), and Oosthuizen (1986) and VKE (1989) (both cited in Wilmot *et al* 1990). Perhaps the most important study however was the national passenger panel survey run between 1987 and 1994, which collected longitudinal data on the transport expenditure, mode availability, mode use and transfer and travel time of 'black' (or 'disadvantaged') commuters (van der Reis *et al* 1993, van der Reis and Lombard 1995).

apartheid transport policy was based on October Household Survey (OHS) data, and a home interview survey to compensate for the work trip focus of the OHS. In the survey, data were collected mainly on mode use, availability and satisfaction, travel time and expenditure, and attitudes towards mode switching. More recently, the *National Land Transport Transition Act (No. 22)* of 2000 has required the collection of public transport ridership data in the major urban centres for the purposes of formulating public transport rationalisation and licensing strategies, in the form of 'current public transport records'. (NDoT 1998, TRC Africa 2000)

3 THE SCOPE OF TRAVEL ANALYSIS IN SOUTH AFRICA

What then has been the analytical scope of the South African travel analysis practices described above? A combination of apartheid policies, that dictated an analytical focus on the daily transportation of labour in and out of cities, and the dominance of predictive four-stage travel demand models and their data requirements in South African travel analysis, has resulted in most representations of travel needs and behaviour being restricted to either commuting or travel occurring within peak periods. The implicit underlying assumption being that a transport system which satisfies the need for travel during the commuter peak, will be able to satisfy all other travel needs worth satisfying.

In many, if not most instances, the travel demand models developed were calibrated for the weekday morning peak period when congestion is generally worst, and consequently travel data were collected on trips occurring within this period. Baseline data were collected on variables like trip purpose, origin, destination, mode use, travel time, timing and distance. In some instances, as a primary contributor to trips during peak periods, only data on home-based work trips were collected and modelled. The analytical focus has also been on interzonal (i.e. longer distance) travel by motorised modes.

There have of course been exceptions to this motorised, commuter and peak period focus that provide insights into non-work, off-peak and non-motorised travel needs and behaviour, but these are limited and many had as their underlying purpose the development of trip generation rates for use in the first stage of the four-stage travel demand forecasting procedure, rather than the development of a complex understanding of travel behaviour, choices and constraints.

4 IMPLICATIONS FOR ADEQUATE ANALYSIS OF THE TRAVEL NEEDS OF THE POOR

While the travel analysis practices discussed earlier have been refined and improved over time, to a level of sophistication probably unimaginable by their pioneers, they remain, procedurally and substantively, essentially the same as those first developed in the late 1950s in cities like Detroit and Chicago. They remain centrally focused on the problem of traffic congestion, and on the construction of highways in its alleviation. What implications then do the limitations in the analytical scope of these practices have for how adequately the travel needs of low-income households can be analysed? I argue that as a result of the application of these practices in South African cities, little is currently understood of non-home-based, non-work, off-peak and non-motorised trip-making generally, and how this behaviour varies across different individuals and households. These analytical methods are incapable of identifying which groups in society are most disadvantaged in transport systems (i.e. 'equity gaps'). In particular, travel by the poor using low cost modes – primarily in the form of walking (as will be demonstrated later in this section) – has thus either been overlooked or poorly understood in South African travel analysis. Past commuter surveys have found that this mode accounts for only 5-15% of main mode splits, creating a perception that travel by foot is relatively unimportant.

In order to, amongst other things, assemble better data on the travel patterns of low-income households and ascertain the extent to which conventional travel analysis practices misconstrue the travel needs of the poor, I conducted an activity-based household travel survey in metropolitan Cape Town which extended the scope of data collection to include all trips undertaken by all household members over all times of the day over an entire 7-day week (Behrens 2002). The survey was administered in October-November 2000 and January-February 2001 during school terms. Data were collected through the use of a CAPI previous 24-hour day recall activity diary. The survey sample was stratified into three proportionate combined household income bands. High-income households earn more than R5 500/month, middle-income households earn between R1 801 and R5 500/month, and low-income households earn R1 800/month or less.

Bearing in mind the relatively low confidence interval of the sample – the sample size was restricted to 204 households, representing a confidence interval of around 16% at a 95% level of confidence – the remainder of this section briefly discusses the findings of this survey with regard to the impact of household income on trip generation, trip purpose and mode use in particular, and reflects upon the de-

gree to which past restrictions in analytical scope might have distorted perceptions of the travel needs of the poor.

4.1 *Trip generation*

The survey found that the greater private mobility and spending power of wealthier households result in relatively higher out-of-home activity participation and therefore higher trip generation rates. Trip generation declines steadily with decreasing income. In fact significantly more lower income household members undertook no travel activity at all on their diary day (22% and 21% amongst middle and low-income household members vs. 5% amongst high-income household members). The survey data suggest that mean household trip generation is around 11.11 trips/weekday amongst high-income households (or 3.44 person trips), 9.69 trips/weekday amongst middle-income households (or 2.37 person trips), and 8.21 trips/weekday amongst low-income households (1.97 person trips).

Mean household main mode walking trip generation was found to be around 1.00 trips/day (or 0.31 person trips) for high-income households, 4.17 trips/day (or 1.02 person trips) for middle-income households, and 4.93 trips/day (or 1.20 person trips) for low-income households. The focus on motorised modes in much past travel analysis has therefore prevented an examination of the full extent of trip-making amongst lower income households.

4.2 *Trip purposes*

Tables 1 and 2 illustrate 7-day week trip purpose distribution findings across the three income bands. Table 1 suggests that the proportion of trips to work and education activities remains fairly similar and constant across income bands, while higher income households undertake relatively more shopping and business trips at the expense of social and personal business (e.g. healthcare, job-seeking) trips. Table 2 indicates that trip purposes defined on a home-based basis offer a similar pattern, only home-based work trips are relatively smaller amongst higher income households – due probably to greater trip chaining associated with journeys to or from work. As a result of greater (and more flexible) private mobility, the proportion of non-home-based trip-making generally appears to increase as incomes rise.

The restriction of much past travel analysis to either home-based work trips or trips occurring within peak periods would therefore have distorted examinations of travel patterns across income bands in different ways. In the case of higher income households, the nature and extent of business and shopping trips would not have been fully analysed. In the case of lower income households, the nature and extent of social and personal business trips would not have been fully analysed. In both cases the full importance of home-based education trips on travel patterns would have been overlooked.

Table 1. Percentage destination activity trip purpose distribution by household income (n = 204 h)

	high-income	middle-income	low-income
work	10	11	12
education	10	9	9
shopping	14	9	5
business	4	1	0
social	9	13	14
personal business	2	0	9
recreation	9	11	9
serve passenger	5	4	0
home	38	42	42

Table 2. Percentage home-based trip purpose distribution by household income (n = 204 h)

	high-income	middle-income	low-income
work (h-b)	12	17	21
education (h-b)	15	17	17
shopping (h-b)	19	14	6
business (h-b)	2	1	0
social (h-b)	10	17	20
personal business (h-b)	3	1	11
recreation (h-b)	11	18	14
serve passenger (h-b)	5	3	0
non-home-based	23	13	10

Table 3. Percentage main mode use for all trip purposes by household income (n = 204 h)

	high-income	middle-income	low-income
walk	9	43	61
minibus-taxi	2	8	12
bus	1	6	5
train	1	3	13
car driver	56	17	1
car passenger	32	22	6
other	0	0	2

Note: Despite a bicycle ownership ratio of 77 bicycles/1000 people, no bicycle use was recorded in the survey.

4.3 *Mode use*

As one would expect the survey data indicate that vehicle availability declines sharply with reduced income. Amongst the high-income households surveyed, 58% have access to the use of two or more motor cars, 36% have access to one motor car, and 6% are without access. Amongst middle-income households 39% have access to one motor car, and 50% are without access. Amongst low-income households 97% are without access. This highly differentiated pattern of private mobility is reflected strongly in mode use findings. Table 3 illustrates

main mode use for all trips. It indicates that car use as the main mode increases dramatically as household incomes rise. Around 88% of all trips by high-income households appear to be undertaken by car (as either driver or passenger). The table also indicates that walking as the main mode increases rapidly as household incomes decline – at 9% amongst high-income households, 43% amongst middle-income households, and 61% amongst low-income households. Public transport ridership increases with declining income as well. Interestingly a 48% car share of main mode split for the sample as a whole is very similar to that portion of households found to have access to cars (49%), suggesting that once a household gains access to a car its members switch modes extensively.

Table 4 indicates main mode use by trip destination activity. It indicates that while walking as a main travel mode seldom accounts for more than 10% of mode splits amongst high-income households (recreation is the exception), amongst middle- and low-income households main mode walking has the largest share of numerous trip purposes. Amongst low-income households in particular it has the largest mode share in all trip purpose categories, with the exception of work trips. While accounting for a relatively small share of commuter mode use, walking is thus an important travel mode amongst lower income households. The exclusion of walking in past surveys and models has therefore excluded much of the travel activity of lower income households.

5 CONCLUSION

What then are the dangers of imposing limitations on the scope of travel analysis? The focus on motorised modes, commutes and peaks in past travel surveys and models has in all likelihood distorted widely held perceptions of travel needs and patterns. More specifically a perception has probably been created that shorter slower journeys are quantitatively significantly less important than longer faster journeys. As a result of being routinely excluded or underestimated, the importance of walking trips in particular – in terms of their roles in satisfying travel needs and in analysing road safety problems – has not been fully understood. At best the restricted scope of past travel analysis has introduced a routine bias in the way in which the urban transportation problem has been framed, and, because the greatest misrepresentation of travel needs occurs amongst lower income households, at worst, has led to underestimation or neglect in the planning and design of infrastructure improvement for the poor and vulnerable road users.

Table 4. Percentage main mode use by trip destination activity purpose and household income (n = 204 h)

		work	educ.	shop.	bus.	social	p. bus.	rec.	serve p.	home
high-income	walk	9	7	10	5	8	0	16	6	9
	taxi	0	13	1	0	0	0	0	0	2
	bus	2	3	0	0	0	0	0	0	0
	train	2	0	0	9	0	0	0	0	0
	car driver	79	39	57	82	55	70	47	61	53
	car pass.	7	37	31	5	37	30	37	34	34
	other	2	1	0	0	0	0	0	0	0
middle-income	walk	19	63	47	17	53	75	44	18	45
	taxi	19	11	9	0	2	0	5	0	8
	bus	14	4	9	0	1	0	1	0	7
	train	10	1	2	0	0	0	5	0	4
	car driver	22	6	17	48	14	25	15	52	15
	car pass.	16	15	16	36	30	0	31	30	21
	other	0	0	0	0	0	0	0	0	0
low-income	walk	23	62	73	0	92	38	73	100	61
	taxi	18	8	8	0	2	25	11	0	10
	bus	11	13	0	0	0	0	7	0	6
	train	30	12	7	0	1	23	2	0	15
	car driver	2	0	0	0	0	0	3	0	1
	car pass.	3	5	11	0	4	14	3	0	6
	other	12	0	0	0	0	0	0	0	2

Note: The relative importance of walking as a travel mode is underestimated in main mode use analysis as walking trip segments are invariably attached to both ends of public transport trips and sometimes to an end of motor car trips as well.

To identify problems of equity between different categories of users, the scope of travel analysis needs to extend to cover all travel undertaken by all people. Of particular importance, given the conclusions drawn above, walking needs to be analysed as a travel mode in its own right so that it can be accommodated equitably in plans and improvement programmes. I am not suggesting that every travel survey undertaken needs to include all forms of trip-making, or that every model developed needs to include both motorised and non-motorised modes. Clearly the purposes of different analytical exercises will continue to require particular foci and limitations of scope. What I am suggesting however is that some collection and analysis of data on all travel behaviour is required at regular intervals, of say 2-5 years (depending on resources), so that shifts in need and adaptations in behaviour can be identified. While such surveys could be administered by local transport authorities, in order to ensure data consistency and enable comparisons between geographical areas, it would probably make greatest sense for them to be administered under the auspices of a national authority. The type of survey instrument and procedure, and the timing of data collection (e.g. during or outside school terms), can have a significant effect on trip recall and travel behaviour, and in order for data from different parts of the country to be compatible these would have to be constant.

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