

COMPARATIVE EXPERIMENTAL APPLICATION OF ALTERNATIVE TRAVEL DIARIES IN CAPE TOWN AND DAR ES SALAAM

R Behrens and E Masaoe*

Centre for Transport Studies, Department of Civil Engineering, University of Cape Town, Private Bag X3, Rondebosch, 7701; roger.behrens@uct.ac.za

* Department of Transportation and Geotechnical Engineering, University of Dar es Salaam, PO Box 35131, Dar es Salaam; emasaoe@ce.udsm.ac.tz

ABSTRACT

Internationally, travel diaries of various forms have served as the principal means of collecting revealed preference travel data. Household interview travel survey experiences in African cities, however, have demonstrated that the collection of travel diary data is problematic for both respondents and interviewers. This paper reports on the development of a travel diary instrument for use in a planned 24-hour recall home interview survey in Cape Town, Dar es Salaam and Nairobi. As part of the development of this survey instrument an experiment was undertaken to assess the appropriateness and feasibility of different travel diary forms. In other parts of the world travel diaries have taken three main forms: trip-based, activity-based and place-based diaries. Variations of these three basic diary forms include: the recording of trips in either tabular or sequential question format; the prospective or retrospective request for respondent recall; and the use of memory joggers. The paper describes the impact of alternative travel diary forms on respondent burden, trip and trip stage recall rates, interviewer cognition and item recording or non-response errors, and respondent cognition and item recording errors. On the basis of the experiment findings, it is concluded that place-based diaries in sequential question format, with associated memory joggers, are likely to yield highest rates of trip recall and lowest rates of measurement error and item non-response in city contexts with respondent populations similar in socio-demographic nature to those in Cape Town and Dar es Salaam.

INTRODUCTION

A travel diary survey is planned in the cities of Cape Town, Dar es Salaam and Nairobi in 2009 (n = ±3,000 household). A travel diary is an instrument designed to record all the movements of a person over a prescribed period of time, typically accompanied by a 'person instrument' recording person specific information, a 'household instrument' recording relevant information relating to the household, and a 'resource instrument' recording relevant details concerning the means of travel and communication available to the household (Axhausen 1995). Travel diaries enable relatively rich data on travel behaviour to be collected fairly efficiently, and enable relative measurements of all trip purposes across the entire day, by all travel modes. This data comprehensiveness and richness, however, comes at the cost of greater complexity and respondent burden. For this reason many travel surveys in Sub-Saharan Africa have tended to omit them in favour of simpler instruments concentrating on a limited set of trips or types of passengers regarded by the commissioning agency to be of greatest importance. For example, work and education trips in the case of the South African Department of Transport's National Household Travel Survey of 2003, and work, business, education and social trips in the case of the household travel survey carried out in Dar es Salaam in 2007 as part of the development of the city's transport master plan). Nevertheless, travel diaries have become a fairly standard feature of representative sample national household travel surveys or city-wide origin-destination studies elsewhere in the world, and the African practice of omitting them in survey instruments is somewhat atypical in the field.

In contexts where diaries are commonly applied, growing concerns about the completeness and quality of the travel data collected, particularly through telephonic interviews and self-completed mail-back surveys, have led some authors to argue that they may one day be replaced by data collection methods using remote observation technologies (e.g. global positioning systems) that reduce respondent burden and potentially eradicate trip underreporting (see, for instance, Stopher and Greaves 2007, Stopher 2008 and Wolf 2000). It is argued here, however, that the need to

collect travel data through diary methods is likely to remain, at least in the short term, particularly in developing world countries with relatively less data collection resources and capacity. Hence research directed at improving their reporting capability and reducing respondent burden is deemed to remain important and necessary.

The purpose of this paper is to report on a travel diary experiment undertaken in Cape Town and Dar es Salaam as part of the preparation for the planned survey, and to draw conclusions with respect to which travel diary format is best suited to these city contexts. The paper is divided into six sections. The next section describes alternative travel diary formats. Section 3 discusses common problems reported in the application of travel diary surveys, particularly in Sub-Saharan African contexts. Section 4 explains the experiment's objectives and method, section 5 discusses findings, and section 6 draws conclusions.

ALTERNATIVE TRAVEL DIARY FORMATS

Travel diaries can be categorised into three main groups, on the basis of their principal object of recall: trip-based diaries; place-based diaries; and activity-based diaries.

The earliest form of travel diary, the *trip-based diary*, was developed in association with the early American city-wide transport planning studies in the 1960s and 1970s. Early trip-based diaries were completed by an interviewer in a face-to-face retrospective home interview (see Stopher 2008:5 for an illustrated example). The development of the earliest self-completed trip-based diary, the so-called Kontiv survey, is attributed to Socialdata in Germany in the late 1970s (see Brög *et al* 1983). Trip-based diaries essentially ask respondents to report each origin-to-destination movement they undertook over the diary period, without explicitly requiring that this reporting of trips is ordered chronologically. The information requested about each trip can vary, typically including, as a minimum, origin, destination, purpose, departure time, travel time, modes used, and main mode. A variant of the trip-based diary is the stage-based diary, in which each trip stage (as opposed to each trip) is reported.

The next form of travel diary, developed in the 1980s, was the *activity-based diary*. Pioneering studies into activity-based travel behaviour analysis were undertaken by Oxford University's Transport Studies Unit in the late-1970s and early-1980s (see Clarke *et al* 1981). Jones *et al* (1983:60) illustrate an early example of an activity diary applied in Banbury, Oxfordshire. In this survey seven-day activity diaries were collected from all household members. The premise of this and other studies was that it is not possible to understand how travel behaviour might respond to changes in the transport system, without a much deeper understanding of the everyday lives and activities within which travel decisions are embedded. In the activity-based diary, therefore, instead of asking first what trip was made, and later what the purpose of the trip was, the diary begins by asking the respondent what the next thing was that he or she did, and follows this by asking (if the respondent was not already there) how the respondent travelled to the place where this activity occurred. Importantly, the recall of activity participation is requested in chronological order for the entire diary period. Stopher and Greaves (2007) note that the trip rates derived from these diaries are around 20% higher than those found from trip-based diaries (corroborated by Behrens (2003) in an activity-based diary survey in Cape Town). The reason for this improved recall is argued to be that in activity-based diaries the respondent is required to account for his or her time continuously and is therefore forced to recall past events more rigorously, and that recounting activity participation (as opposed to trip-making) matches more closely the way people think and function.

The most recent innovation in travel diary surveys, developed in the 1990s, is the *place-based diary*. This is essentially a hybrid of a trip-based and an activity-based diary, in which the respondent is asked where he or she went to next in chronological sequence across the diary period, and is then asked how he or she got there. Wolf (2000) reports that this diary format has also been found to improve trip recall relative to trip-based diaries. As in activity-based diaries, the place-based diary is an attempt to align the respondent recall process to a more intuitive way of thinking about, and recalling, daily travel.

A variation across the main diary types, is the presentation of questions in either tabular or sequential question format. The rationale for the latter is that some respondents (and interviewers in the context of Cape Town at least) have been found to have difficulty in understanding table cells as a set of intersecting columns and rows. By presenting the questions sequentially the likelihood of recording information in the incorrect cells is reduced. A further variation is the use or not of 'memory joggers', typically in association with prospective diaries in which a future diary period is indicated at the time of respondent recruitment. The memory jogger is an abbreviated version of the actual diary that allows respondents to record the duration and nature of each trip or activity as it is undertaken. More detailed information on each trip or activity is then recorded in a diary booklet later in the day when it is more convenient to do so in the case of self-completed diaries, or during a subsequent home or telephonic interview.

COMMON PROBLEMS IN TRAVEL DIARY SURVEYS IN AFRICAN CITIES

Before discussing the problems commonly encountered in administering diary surveys, it is perhaps useful to first clarify selected travel measurement concepts applied in the experiment. Figure 1 illustrates the following definitions: a *trip* is a movement between two activity stations; a *trip stage* is a part of a trip in instances where more than one travel mode is used; the travel mode covering the longest distance is the *main mode*; and a *tour* is a sequence of linked trips starting and ending at the same point.

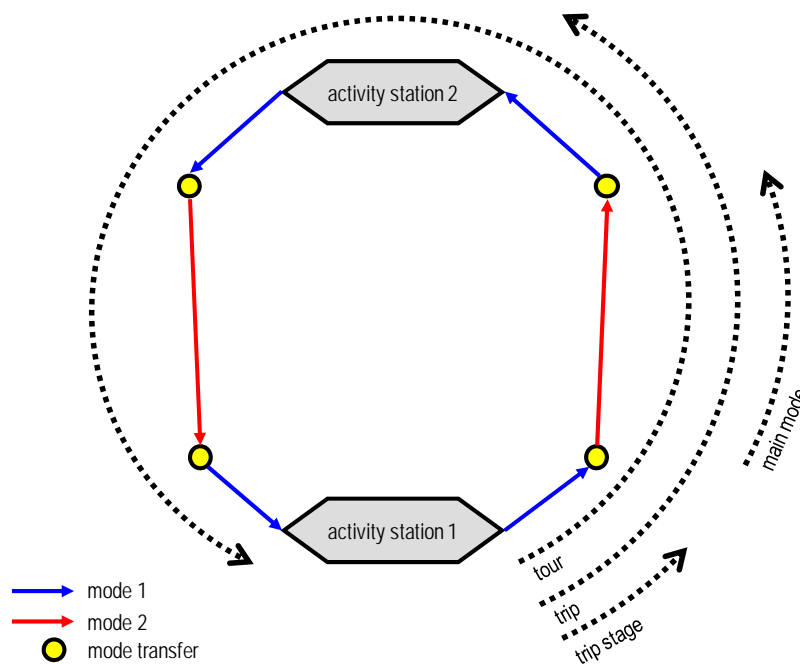


Figure 1: Definition of travel measurement concepts

Past representative sample travel survey practices in Cape Town, Dar es Salaam and Nairobi have typically taken the form of retrospective home or site interviews using pen and paper questionnaires, and often restricted to the weekday morning peak period, to trips by motorised main modes, or to commute trips. There have been, however, some innovations, notably in the use of computer-assisted interviewing methods, stated preference surveys, and in the largely experimental application of activity-based diaries, place-based diaries and global positioning system surveys. This section briefly summarises the problems that have been experienced in the limited examples of travel diary survey application, drawing more from the authors' experiences in practice than from a body of published literature (although some literature of this nature exists – see, for instance, Behrens *et al* 2006, and van der Reis and Lombard 2003).

Common observable errors, which can lead to a lack of precision and accuracy in datasets, include the following. Where necessary, an indication is provided of how they can be identified.

- *item non-response*, in which interviewers and/or respondents do not provide an answer to a question;
- *recording errors*, in which the interviewer or respondent records a response to the question, but the type of response provided is unrelated to the question – such errors are often associated with diaries in tabular format where interviewers or respondents insert information in the incorrect table cells.
- *missing trips*, usually apparent from diaries in which a forward trip to a non-home activity station is recorded, but not a return trip from this activity station (see figure 2a);
- *missing trip stages* in the case of trips involving mode transfers, usually apparent from asymmetrical forward and return trip stages (see figure 2b); and
- *incomplete diary period recall*, usually apparent because the diary starts after, or ends before, the designated diary period (see figure 2c), or, in the case of activity-based diaries, because the end time of an earlier activity does not correspond with the start time of the following activity.

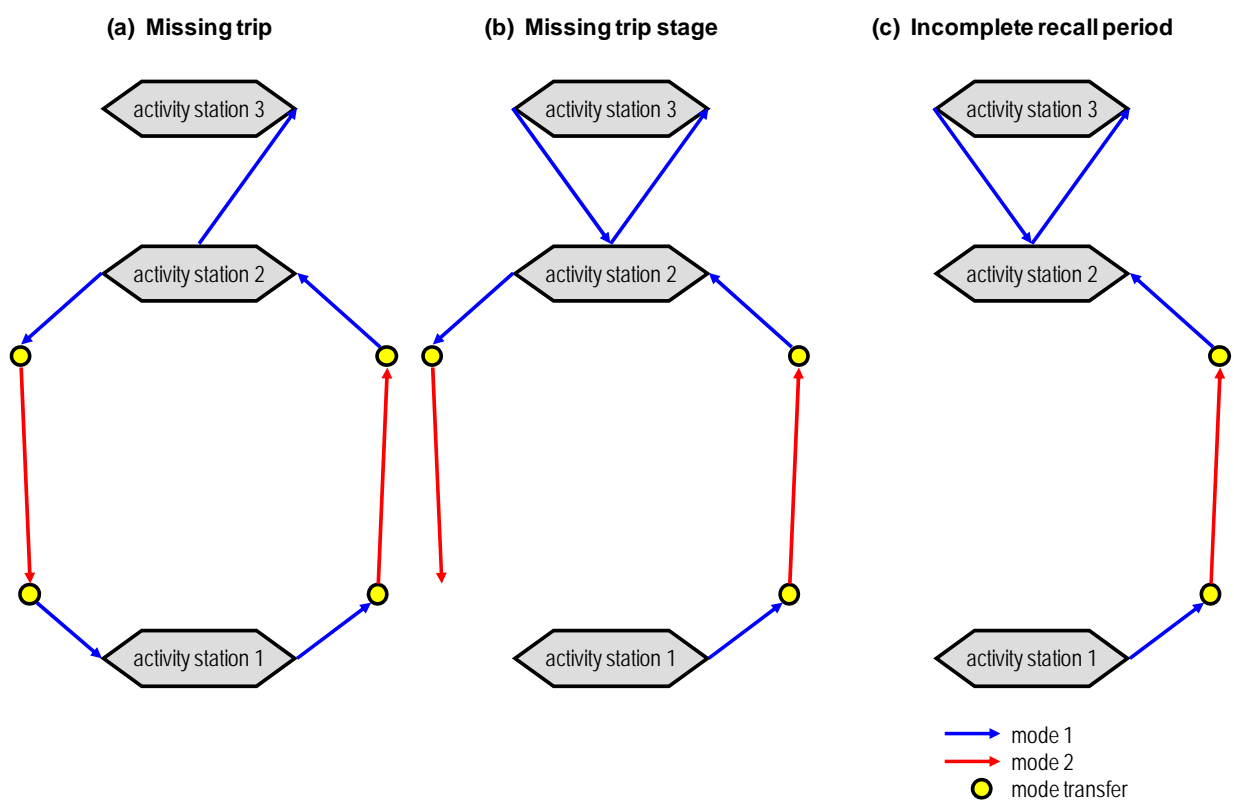


Figure 2(a-c) Illustration of common travel diary measurement errors

TRAVEL DIARY EXPERIMENT OBJECTIVES AND METHOD

Given an absence of prior systematic comparisons of the impact of different travel diary types on measurement and non-response errors in Sub-Saharan Africa, as well as the limited experience in applying diary instruments in this context more generally, the purpose of the travel diary experiment was to test which diary format would be most appropriate for use in the planned 2009 survey in Cape Town, Dar es Salaam and Nairobi. The following nine previous 24-hour weekday travel diary variations, covering the three main diary formats discussed in section 2, were developed for inclusion in the experiment:

- 1) a trip-based diary in tabular format;
- 2) a place-based diary in tabular format, with a memory jogger;
- 3) a place-based diary in tabular format, without a memory jogger;
- 4) a place-based diary in sequential question format, with a memory jogger;
- 5) a place-based diary in sequential question format, without a memory jogger;

- 6) an activity-based diary in tabular format, with a memory jogger;
- 7) an activity-based diary in tabular format, without a memory jogger;
- 8) an activity-based diary in sequential question format, with a memory jogger; and
- 9) an activity-based diary in sequential question format, without a memory jogger.

(a) Trip-based travel diary in tabular format (instrument 1)

Thinking about (the previous 24-hour weekday) what were ALL the TRIPS you made?:

Where was the trip to?	When did the trip start?	When did the trip finish?	What was the (1 st /2 nd /3 rd /4 th) travel mode used for this trip? (mark each box with the number)	How many times a week do you usually make this trip?	How many people did you travel with?
<input type="checkbox"/> home <input type="checkbox"/> work <input type="checkbox"/> pre-school <input type="checkbox"/> school <input type="checkbox"/> tertiary education <input type="checkbox"/> shops <input type="checkbox"/> other, specify	__h__	__h__	What travel mode covered the longest distance? (circle correct box) <input type="checkbox"/> car/bakkie driver <input type="checkbox"/> car/bakkie passenger <input type="checkbox"/> motorcycle rider <input type="checkbox"/> motorcycle passenger <input type="checkbox"/> train <input type="checkbox"/> other, specify		Who were they? number of companions ____ <input type="checkbox"/> adult from household <input type="checkbox"/> adult not from household <input type="checkbox"/> child (<16 years) from household <input type="checkbox"/> child (<16 years) not from household
<input type="checkbox"/> home <input type="checkbox"/> work <input type="checkbox"/> pre-school <input type="checkbox"/> school <input type="checkbox"/> tertiary education <input type="checkbox"/> shops <input type="checkbox"/> other, specify	__h__	__h__	<input type="checkbox"/> bus <input type="checkbox"/> car/bakkie driver <input type="checkbox"/> car/bakkie passenger <input type="checkbox"/> motorcycle rider <input type="checkbox"/> motorcycle passenger <input type="checkbox"/> train <input type="checkbox"/> other, specify		number of companions ____ <input type="checkbox"/> adult from household <input type="checkbox"/> adult not from household <input type="checkbox"/> child (<16 years) from household <input type="checkbox"/> child (<16 years) not from household

continued ...

(b) Place-based travel diary in tabular format (instrument 3)

Thinking about (the previous 24-hour weekday) what were ALL the PLACES you visited?:

Where did you start your day?	Where did you go next?	How did you get there?	What was the (1 st /2 nd /3 rd /4 th) travel mode used for this trip? (mark each box with the number)	When did the trip start?	When did the trip finish?	How many times a week do you usually make this trip?	How many people did you travel with?
<input type="checkbox"/> home <input type="checkbox"/> work <input type="checkbox"/> pre-school <input type="checkbox"/> school <input type="checkbox"/> tertiary education <input type="checkbox"/> shops <input type="checkbox"/> other, specify	<input type="checkbox"/> home <input type="checkbox"/> work <input type="checkbox"/> pre-school <input type="checkbox"/> school <input type="checkbox"/> tertiary education <input type="checkbox"/> shops <input type="checkbox"/> other, specify	<input type="checkbox"/> offices <input type="checkbox"/> health care <input type="checkbox"/> family/friend <input type="checkbox"/> entertainment <input type="checkbox"/> sport/recreation <input type="checkbox"/> serve passenger <input type="checkbox"/> other, specify	What travel mode covered the longest distance? (circle correct box) <input type="checkbox"/> car/bakkie driver <input type="checkbox"/> car/bakkie passenger <input type="checkbox"/> motorcycle rider <input type="checkbox"/> motorcycle passenger <input type="checkbox"/> train <input type="checkbox"/> other, specify	__h__	__h__		number of companions ____ <input type="checkbox"/> adult from household <input type="checkbox"/> adult not from household <input type="checkbox"/> child (<16) from household <input type="checkbox"/> child (<16) not from household
<input type="checkbox"/> home <input type="checkbox"/> work <input type="checkbox"/> pre-school <input type="checkbox"/> school <input type="checkbox"/> tertiary education <input type="checkbox"/> shops <input type="checkbox"/> other, specify	<input type="checkbox"/> home <input type="checkbox"/> work <input type="checkbox"/> pre-school <input type="checkbox"/> school <input type="checkbox"/> tertiary education <input type="checkbox"/> shops <input type="checkbox"/> other, specify	<input type="checkbox"/> offices <input type="checkbox"/> health care <input type="checkbox"/> family/friend <input type="checkbox"/> entertainment <input type="checkbox"/> sport/recreation <input type="checkbox"/> serve passenger <input type="checkbox"/> other, specify	<input type="checkbox"/> bus <input type="checkbox"/> car/bakkie driver <input type="checkbox"/> car/bakkie passenger <input type="checkbox"/> motorcycle rider <input type="checkbox"/> motorcycle passenger <input type="checkbox"/> train <input type="checkbox"/> other, specify	__h__	__h__		number of companions ____ <input type="checkbox"/> adult from household <input type="checkbox"/> adult not from household <input type="checkbox"/> child (<16) from household <input type="checkbox"/> child (<16) not from household

continued ...

(c) Activity-based travel diary in tabular format (instrument 7)

Thinking about (the previous 24-hour weekday) what were ALL the ACTIVITIES ... participated in?:

What did you do on ... (previous 24-hour weekday)?		If the activity you listed involved travelling ...					
When did the activity start?	What kind of activity was this? (describe the activity using only a couple of words, e.g. 'slept', 'got ready for school', 'waited for bus', 'travelled to school', 'cleaned house', 'shopped', etc.)	Where did you do it?	When did the activity finish?	How did you travel?	How far was this journey? (in metres)	How many times a week do you usually make this trip?	How many people did you travel with?
activity 1 24h00		<input type="checkbox"/> home <input type="checkbox"/> work <input type="checkbox"/> pre-school <input type="checkbox"/> school <input type="checkbox"/> tertiary education <input type="checkbox"/> shops <input type="checkbox"/> other, specify	<input type="checkbox"/> offices <input type="checkbox"/> health care <input type="checkbox"/> family/friend <input type="checkbox"/> entertainment <input type="checkbox"/> sport/recreation <input type="checkbox"/> travelling	_h_	<input type="checkbox"/> car/bakkie driver <input type="checkbox"/> car/bakkie pass. <input type="checkbox"/> motorcycle rider <input type="checkbox"/> motorcycle pass. <input type="checkbox"/> train <input type="checkbox"/> other, specify	<input type="checkbox"/> bus <input type="checkbox"/> minibus-taxi/mataiatu dala <input type="checkbox"/> bicycle <input type="checkbox"/> bicycle passenger <input type="checkbox"/> walk	number of companions ____ <input type="checkbox"/> adult from household <input type="checkbox"/> adult not from household <input type="checkbox"/> child (<16) from household <input type="checkbox"/> child (<16) not from h.hold
activity 2 _h_		<input type="checkbox"/> home <input type="checkbox"/> work <input type="checkbox"/> pre-school <input type="checkbox"/> school <input type="checkbox"/> tertiary education <input type="checkbox"/> shops <input type="checkbox"/> other, specify	<input type="checkbox"/> offices <input type="checkbox"/> health care <input type="checkbox"/> family/friend <input type="checkbox"/> entertainment <input type="checkbox"/> sport/recreation <input type="checkbox"/> travelling	_h_	<input type="checkbox"/> car/bakkie driver <input type="checkbox"/> car/bakkie pass. <input type="checkbox"/> motorcycle rider <input type="checkbox"/> motorcycle pass. <input type="checkbox"/> train <input type="checkbox"/> other, specify	<input type="checkbox"/> bus <input type="checkbox"/> minibus-taxi/mataiatu dala <input type="checkbox"/> bicycle <input type="checkbox"/> bicycle passenger <input type="checkbox"/> walk	number of companions ____ <input type="checkbox"/> adult from household <input type="checkbox"/> adult not from household <input type="checkbox"/> child (<16) from household <input type="checkbox"/> child (<16) not from h.hold
activity 3 _h_		<input type="checkbox"/> home <input type="checkbox"/> work <input type="checkbox"/> pre-school <input type="checkbox"/> school <input type="checkbox"/> tertiary education <input type="checkbox"/> shops <input type="checkbox"/> other, specify	<input type="checkbox"/> offices <input type="checkbox"/> health care <input type="checkbox"/> family/friend <input type="checkbox"/> entertainment <input type="checkbox"/> sport/recreation <input type="checkbox"/> travelling	_h_	<input type="checkbox"/> car/bakkie driver <input type="checkbox"/> car/bakkie pass. <input type="checkbox"/> motorcycle rider <input type="checkbox"/> motorcycle pass. <input type="checkbox"/> train <input type="checkbox"/> other, specify	<input type="checkbox"/> bus <input type="checkbox"/> minibus-taxi/mataiatu dala <input type="checkbox"/> bicycle <input type="checkbox"/> bicycle passenger <input type="checkbox"/> walk	number of companions ____ <input type="checkbox"/> adult from household <input type="checkbox"/> adult not from household <input type="checkbox"/> child (<16) from household <input type="checkbox"/> child (<16) not from h.hold

continued ...

Figure 3(a-c) Requested travel diary information in trip-, placed- and activity-based tabular formats

To the greatest degree possible the range, order and phrasing of questions included in each diary variation were held constant, to ensure that the performance of the different diary formats could be directly compared. Figure 3 (a-c) illustrates the requested diary information in trip-based, placed-based and activity-based tabular formats. In addition to diary questions, each instrument included the same set in questions in relation to the interviewer, the respondent and the difficulties encountered. The application of memory joggers was atypical in that they were applied immediately before detailed diary questioning and retrospectively (as opposed to prospectively, whereby the jogger is issued before, and filled in during the course of, the diary period), to assist the respondent in recalling places visited or activities performed.

Five tertiary education students, ranging between 22 and 33 years in age, were recruited as interviewers in each city. Interviewers were fully briefed on the differences between the different diary instruments, trained, debriefed following a pilot run, and supervised in the field. To ensure that the sample adequately covered gender, age and education differences and thereby control for unwanted biases associated with a small sample survey, and to ensure that all interviewers applied all diary formats and thereby control for varying interviewer skill and diligence, interviewers were allocated quotas of diary types in relation to respondent age, gender and education level categories. In addition, only persons who had undertaken some form of out-of-home activity on the previous weekday were selected (hence findings with respect to the minimum rates of respondent trip recall indicated in the following section do not fall below a value of one). Table 1 presents the demographic characteristics of the respondents interviewed.

Table 1 Demographic characteristics of respondents by city (2008, n=492)

	Gender		Age (years)					Education level ⁽¹⁾			
	male	female	12-16 yrs	17-25 yrs	26-40 yrs	41-60 yrs	> 60 yrs	< gr 7 (std 5)	gr 7-11 (std 5-9)	gr 12 (std 10)	> gr 12 (std 10)
Cape Town	99	130	35	85	65	36	8	15	116	76	22
Dar es Salaam	142	119	8	96	129	25	2	100	114	13	28
Whole sample	241	249	43	181	194	61	10	115	230	89	50

Notes: (1) To enable comparison, Tanzanian education levels have been equated to the South African categories indicated.

In order to ensure that respondents most likely to experience difficulty in participating in a diary survey were included in the sample, respondents were selected from lower income residential areas in the two cities where it was assumed a greater number of less educated respondents would be encountered. In Cape Town, Gugulethu was selected at the site of data collection. In Dar es Salaam, data collection was spread across the three municipalities constituting the city (Kinondini 60%, Ilala 20% and Temeke 20%).

Data were collected in October 2008, through a combination of home and intercept interviews. In total, 509 diary surveys were conducted, of which 17 were discarded in the data checking and cleaning process, resulting in a database comprised of 492 respondent records (230 in Cape Town, and 262 in Dar es Salaam). Following data collection, a focus group discussion was held with interviewers to enable open-ended questioning around the difficulties they experienced in administering the different diary types. Data were coded and captured into a flat-line database comprised of 43 data fields. A somewhat unique feature of the database is that the majority of fields recorded the number of observable non-response and measurement errors discussed earlier in section 3, as opposed to simply the travel behaviour of the respondent.

FINDINGS

Analysis of the database concentrated on understanding the impact of diary type, memory jogger and question format on: interview duration; recall rates; item non-response; recording errors; missing trips or trip stages; and incomplete diary recall periods. The main findings of the experiment are summarised and illustrated below.

With respect to interview duration and associated respondent burden, it was found that, on average, trip-based diaries took the shortest time to complete and activity-based diaries the longest (see figure 4). The mean duration of activity-based diary interviews needs to be considered in the light of the high percentage of incomplete diary periods discussed below, suggesting that this duration is considerably shorter that it could have been. The use of memory joggers was not found to increase mean interview duration, recording only a four second difference between diaries with and without memory joggers. Similarly, question format did not have a significant effect, with sequential question-based diaries lasting, on average, only 18 seconds longer than diaries with tabular formats.

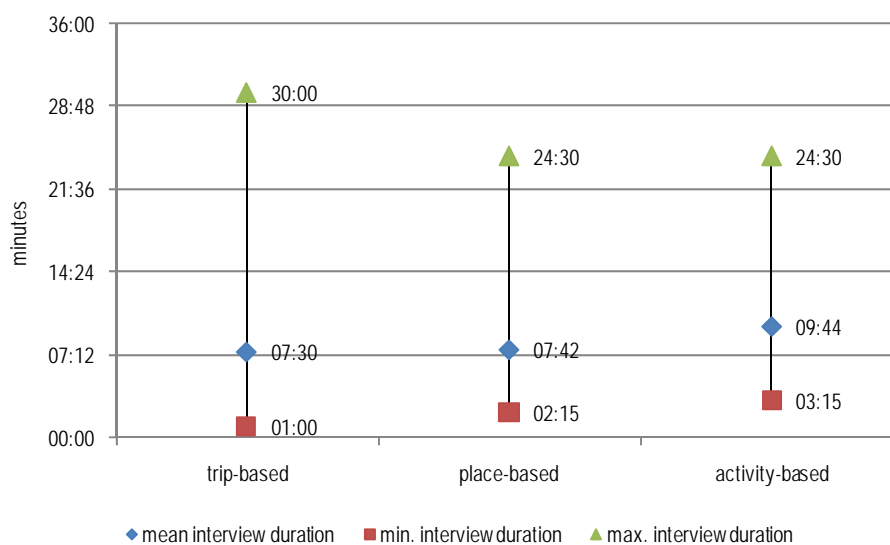


Figure 4 Interview duration by diary instrument (2008, n=492)

With respect to trip and trip stage recall, it was found that the placed-based diary yielded the highest rate of mean trip recall (3.5 trips) and trip stage recall (5.5 trip stages). Figure 5 (a-b) presents an aggregated analysis of the impact of the main diary types, and table 2 presents a disaggregated analysis of the impact of memory jogger and question format variations. Table 2 indicates a reasonably consistent set of findings across the two cities.

Given the approximately 20% higher trip reporting in activity-based diaries reported in the international literature mentioned earlier, a somewhat surprising and unexpected finding was the lower trip and trip stage recall of the activity-based diary relative to the trip-based diary. This can be explained by the high percentage of activity-based dairies that did not cover the full diary period (40%), indicating that interviewers struggled to get respondents to complete the interview, and suggesting that if these diary periods had been accounted for fully, trip and trip stage recall may have been considerably higher.

Table 2 Trip and trip stage recall (per person) by city and diary instrument (2008, n=492)

	Trip-based diary	Place-based diary				Activity-based diary				All diary types
		tabular		sequential question		tabular		sequential question		
		MJ	no MJ	MJ	no MJ	MJ	no MJ	MJ	no MJ	
Cape Town	mean	2.83	3.18	3.77	3.50	3.42	3.52	3.18	2.75	3.26
	stddev	1.48	1.37	2.01	1.82	1.58	1.64	1.74	1.07	1.61
	max.	7.00	6.00	9.00	9.00	8.00	8.00	9.00	5.00	9.00
Dar es Salaam	mean	4.90	4.09	6.04	5.81	4.12	4.28	4.00	3.11	4.68
	stddev	2.94	2.09	3.35	3.03	2.07	2.26	2.35	1.10	2.68
	max.	12.00	8.00	15.00	14.00	10.00	9.00	9.00	5.00	15.00
Whole sample	mean	3.62	3.53	3.50	3.79	3.20	3.30	3.11	2.57	3.32
	stddev	1.21	1.38	1.14	0.96	1.32	2.00	1.69	0.97	1.39
	max.	6.00	8.00	6.00	7.00	6.00	10.00	9.00	5.00	10.00
memory jogger	mean	5.55	5.93	5.75	6.61	4.76	4.90	4.00	3.20	5.02
	stddev	3.02	3.13	1.99	3.46	2.64	2.88	1.87	1.61	2.73
	max.	14.00	14.00	10.00	18.00	10.00	13.00	9.00	7.00	13.00
memory jogger	mean	3.15	3.38	3.63	3.65	3.30	3.40	3.14	2.64	3.29
	stddev	1.42	1.37	1.61	1.43	1.44	1.83	1.69	1.01	1.50
	max.	5.17	5.15	5.89	6.22	4.45	4.62	4.00	3.16	4.86
memory jogger	mean	2.97	2.87	2.71	3.25	2.39	2.61	2.07	1.42	2.71
	stddev									
	max.									

Notes: (1) MJ = memory jogger

Table 3 Observable recording errors and item non-response (per interview) by diary instrument and trip characteristic (2008, n=492)

	Destination			Departure time			Travel time			I mode			Main mode			Trip frequency			Trip coupling			Travel companions		
	TBD	PBD	ABD	TBD	PBD	ABD	TBD	PBD	ABD	TBD	PBD	ABD	TBD	PBD	ABD	TBD	PBD	ABD	TBD	PBD	ABD	TBD	PBD	ABD
	mean recording errors	0.37	0.14	0.17	0.51	0.11	1.83	0.41	0.25	0.64	0.30	0.26	0.70	0.21	0.20	0.05	0.24	0.14	0.13	0.14	0.12	0.12	0.11	0.17
standard deviation	0.64	0.44	0.68	1.06	0.35	1.71	1.06	0.55	1.12	0.94	0.65	1.05	0.63	0.59	0.32	0.93	0.46	0.43	0.57	0.51	0.40	0.43	0.60	0.34
max. recording errors	3.00	2.50	4.00	5.00	1.50	6.50	5.00	2.25	4.50	5.00	3.00	3.25	3.00	2.75	2.25	7.00	2.50	2.25	4.00	3.00	2.00	2.00	3.25	2.33
mean item non-resp.	0.06	0.00	2.88	0.03	0.02	0.66	0.03	0.02	0.67	0.04	0.12	0.16	0.17	0.61	0.09	0.10	0.16	0.19	0.04	0.05	0.24	0.03	0.04	0.14
standard deviation	0.23	0.00	2.07	0.17	0.15	1.24	0.17	0.12	1.28	0.20	0.36	0.46	0.59	1.20	0.42	0.42	0.47	0.59	0.20	0.22	0.57	0.17	0.25	0.45
max. item non-resp.	1.00	0.00	8.75	1.00	1.00	5.00	1.00	1.00	5.50	1.00	1.75	2.50	3.00	5.75	2.75	3.00	2.25	3.25	1.00	1.25	3.00	1.00	1.50	2.25

Notes: (1) TBD = trip-based diary; PBD = place-based diary; ABD = activity-based diary; ABD = activity-based diary. (2) Highlighted cells indicate lowest mean recording errors and item non-response rates.

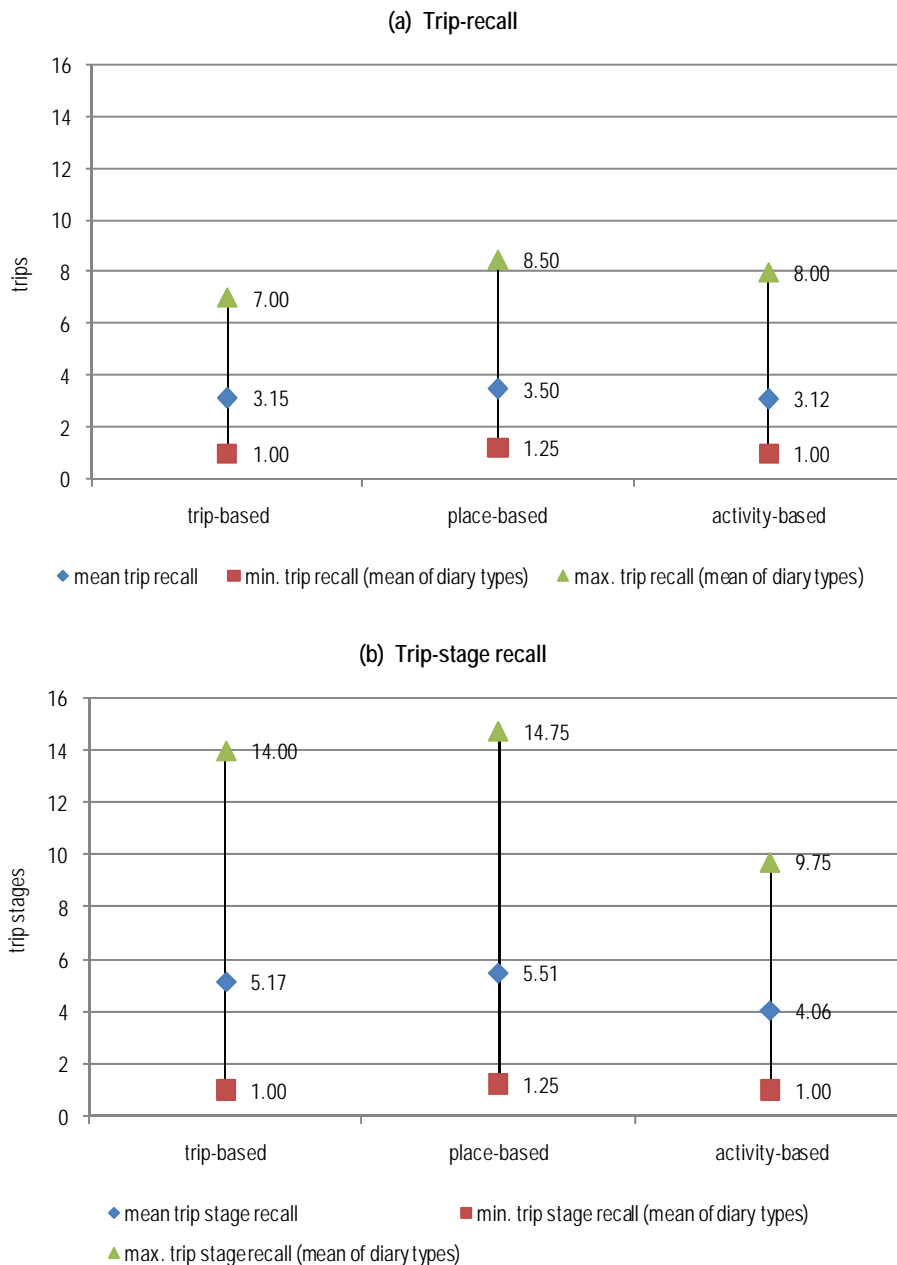


Figure 5(a-b) Mean number of trips and trip stages (per person) by diary instrument (2008, n=492)

While imperfect in various ways, as discussed below, the converse indicator of trip recall is observable missing trips and trip stages. It was found that, on average, marginally fewer missing trips are observable in place-based diaries (0.15 vs. 0.17 trips in the case of both trip- and activity-based diaries). With respect to missing trip stages, fewest were observable in the trip-based diary (0.03), followed by the place-based diary (0.10) and the activity-based diary (0.20). Comparisons across diary types are problematic in this instance, however, as the potentially non-chronological sequence of trip recall in trip-based diaries makes missing forward or return trips more difficult to observe. Similarly, comparisons of incomplete diary period across diary types are problematic, as incomplete diary periods cannot be observed in trip-based diaries as all time does not have to be accounted for. As indicated earlier, in the experiment 40% of activity-based diaries did not account for the full diary period, and 9% of place-based diaries did not have the final trip destination recorded as home, thereby indicating incompleteness. A weakness in this comparison is that even if the last trip recorded in the place-based diary was the home, there is no way of knowing whether any potential subsequent tours had been omitted. The 40% incomplete activity-based diary periods

is perhaps a more useful indicator that these types of diaries are simply difficult to complete in this context.

With respect to observable item non-response rates and recording errors, it was found that the place-based diary consistently performs best with respect to destination, departure time, travel time and mode use data, with a less consistent pattern of relative performance emerging with regard to trip frequency, coupling and travel companion data (see table 3).

Findings with respect to the impact of memory joggers, applied in the atypical retrospective manner discussed earlier, on reducing trip underreporting indicate a slight improvement compared to diaries without memory joggers (see table 4). Somewhat surprisingly, given the past difficulties experienced with tabular diaries discussed in section 3, diaries in tabular format were found to yield the same or marginally higher trip and trip stage recall, and marginally lower observable missing trips and trip stages (see table 4).

Table 4 Trip and trip stage recall and observable missing trips and trip stages recording errors and item non-response rates (per interview) by diary instrument and trip characteristic (2008, n=492)

	With memory jogger	Without memory jogger	Tabular format	Sequential question format
mean trip recall	3.50	3.12	3.31	3.26
<i>standard deviation</i>	1.45	1.49	1.49	1.43
minimum trip recall	1.25	1.00	1.20	1.00
maximum trip recall	8.50	8.00	8.20	8.00
mean observable missing trips	0.15	0.17	0.12	0.22
<i>standard deviation</i>	0.35	0.44	0.33	0.48
maximum observable missing trips	1.25	2.00	1.20	2.00
mean trip stage recall			4.83	4.82
<i>standard deviation</i>			2.62	2.36
minimum trip stage recall			1.00	1.00
maximum trip stage recall			12.60	12.25
mean observable missing trip stages			0.11	0.17
<i>standard deviation</i>			0.41	0.45
maximum observable missing trip stages			2.00	2.25

Notes: (1) Highlighted cells indicate highest recall rates and lowest number of observable missing trips or trip stages.

In the focus group discussion with interviewers subsequent to the completion of data collection, interviewers indicated fairly unanimously that they found the trip-based diary (in tabular format) easiest to administer, primarily as it was the instrument that took the least amount of time to complete. They indicated that the activity-based diary was the most difficult to administer because it was often difficult to explain to respondents the appropriate detail of activity scheduling information required, and because it took longest to complete. They indicated that they preferred the tabular formats because they were less cumbersome to page through and less intimidating to respondents. They also indicated the use of memory joggers, as a retrospective recall aid, was at times confusing to respondents who were unclear on why they were being asked to recall the same information twice. It was anticipated that the memory jogger would assist respondents in sequencing places or activities chronologically, but this benefit was not perceived by the interviewers.

CONCLUSION

The purpose of the travel diary experiment reported upon in this paper was to test which diary format would be most appropriate for use in the planned 2009 survey in Cape Town, Dar as Salaam and Nairobi. The experiment findings discussed in the previous section provide clear and fairly consistent evidence upon which to conclude that place-based diaries, notwithstanding the stated preference of fieldworkers for the shorter duration trip-diary, are likely to be able to yield the

greatest trip and trip stage recall and the least recording and item non-response errors in this survey. The shorter duration of trip-based diaries (preferred by interviewers) is likely to be due to greater trip and trip stage underreporting. The relatively high level of incomplete diary periods found amongst the activity-based diaries, indicates that these diary instruments will be difficult to apply in the Cape Town, Dar es Salaam and Nairobi context, and would certainly require better skilled and more experienced interviewers, and perhaps also the use of incentives to attain greater higher rates of respondent completion.

The experiment findings with respect to the benefits of memory joggers and sequential question formats are less conclusive. Future development and testing of the survey instrument will need to establish whether the more conventional use of memory joggers as a prospective recall aid, is both feasible in Sub-Saharan fieldwork contexts, and beneficial in terms of improved trip reporting. While no significant advantage or disadvantage to sequential question formats was revealed in the experiment, prior experiences in practice suggest it would be prudent to avoid tabular formats, and attempt to present the diary booklet in a less intimidating way.

It is concluded, therefore, that place-based diaries in sequential question format, with associated memory joggers, are likely to be most appropriate for use in the planned 2009 survey, as well as in other city contexts with respondent populations similar in socio-demographic nature to those in Cape Town and Dar es Salaam.

ACKNOWLEDGEMENTS

The research presented in this paper was funded by the Volvo Research and Educational Foundations, and forms part of a broader research programme conducted by the African Centre of Excellence for Studies in Public and Non-motorised Transport (ACET, www.acet.uct.ac.za). The assistance of university students Sonwabo Nongogo and Francis Maganga in collecting data in Cape Town and Dar es Salaam respectively, and of Jacomien Spamer in capturing, cleaning and analysing the data, is also acknowledged.

REFERENCES

- Axhausen K, 1995: *Travel diaries: An annotated catalogue* (2nd ed.), Working Paper, Institut für Straßenbau und Verkehrsplanung, Leopold-Franzes-Universität, Innsbruck.
- Behrens R, 2003: Looking beyond commuter travel in Cape Town: Methodological lessons from the application of an activity-based travel survey, in Stopher P and Jones P (eds), *Transport survey quality and innovation*, Pergamon, Amsterdam.
- Behrens R, Diaz Olvera L, Plat D, Pochet P, 2006: Collection of passenger travel data in Sub-Saharan African cities: Towards improving survey instruments and procedures, *Transport Policy*, Vol 13, No 1, pp85-96.
- Brög W, Fallast K, Katteler H, Sammer G and Schwertner B, 1985: Selected results of a standardised survey instrument for large-scale travel surveys in several European countries, in Ampt E, Richardson A and Brög W (eds), *New survey methods in transport*, VNU Science Press, Utrecht.
- Clarke M, Dix M, Jones P and Heggie I, 1981: Some recent developments in activity-travel analysis and modelling, *Transportation Research Record*, No 794, Transportation Research Board, National Research Council.
- Jones P, Dix M, Clarke M and Heggie I, 1983: *Understanding travel behaviour*, Gower, Aldershot.
- Stopher P and Greaves S, 2007: Household travel surveys: Where are we going?, *Transportation Research Part A*, Vol 41, pp367–381.

Stopher P, 2008: *The travel survey toolkit: Where to from here?*, Keynote Paper prepared for the 8th International Conference on Travel Survey Methods, Annecy, France.

van der Reis P and Lombard M, 2003. Multi-cultural and multi-lingual surveys, with special reference to the African experience, in Stopher P and Jones P (eds.), *Transport survey quality and innovation*, Pergamon, Amsterdam.

Wolf J, 2000: *Using GPS data loggers to replace travel diaries in the collection of travel data*, PhD Dissertation, Georgia Institute of Technology, Atlanta.