NEW DIMENSIONS IN LARGE SCALE IRAVEL SURVEYS

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Abstract:

The State Transport Study Group has embarked on a long term programme to develop a complete disaggregate modelling system to assist in transport policy making for Sydney in the 1980's. Part of this programme involves a substantial survey to be conducted in 1981 (a census year) to collect appropriate behavioural data.

The conduct and results of an experimental pilot survey conducted in 1979 to test the feasibility of collecting appropriate behavioural and attitudinal on a large scale are discussed. The survey was extremely detailed and was deliberately designed to test out the limits of interviewee tolerance. Specific conclusions in relation to the conduct of the full survey were drawn and the adaption of these modifications to formulate a new-look travel survey are discussed in some detail.

The development of the operational aspects and questionnaire for the 1981 survey are presented, highlighting the measures taken to avoid past problems, reduce costs and yet incorporate the needs of current policy concerns and the latest modelling techniques.

NEW DIMENSIONS IN LARGE SCALE TRAVEL SURVEYS

INTRODUCTION

In 1971 the Sydney Area Transportation Study (SATS) was formed to prepare a long-term plan for Sydney's transportation needs. It was the last of a series of similar once-off studies conducted in most large western cities including the major cities of Australia. Consistent with other similar studies, the Sydney survey included a series of surveys embracing all facets of the transport system - a home interview survey, commercial vehicle survey, external cordon survey, and screenline survey. Since 1971 the resulting data base has proved to be a valuable resource both for modelling and other data requirement. It is still the only comprehensive data base for social and transport analysis in Sydney.

With time, however, several limitations in this data have been recognised.

- The data is now becoming dated and consequently of limited value particularly for the outer developing areas of Sydney.

- More important, the data is not directly applicable to the transport planning techniques of the 70's, such as individual choice modelling (ICM), which require disaggregate data, and data on alternative choices available as well as the actual choice made.

- The data focusses on transport issues which were the centre of transport concern in 1971. Thus data on many of the current issues such as energy, unemployment, weekend travel, flexitime effects, car pooling and public transport needs were not collected.

TOWARDS THE DEVELOPMENT OF A NEW DATA BASE

The limitations of the SATS data have been recognised by the Study Group for some time, particularly those relating to the application of contemporary modelling techniques. In recognition of the problem, a management decision was made in 1977 to undertake a long term programme aimed at assessing the benefits of new techniques and establishing desirable directions of development with all phases of the programme directed towards implementation.

In 1977, therefore, initial work began. Using data gathered in a 1974 Home Interview Survey (HIS) of the Newcastle region, an individual choice mode split model was developed for four travel modes. Unlike most studies, the actual model was not the main object; rather the interest lay in the modelling process, its possible applications and its data requirements.

The exercise provided encouraging results. The new mode split model could be incorporated into the existing 'four step' process without difficulties. The available data and networks could be used to develop ICM based models. However the analysis indicated that sensitivity of any model was limited by the available data variables. In particular two factors of importance were:

- The Newcastle work clearly indicated the importance of determining all available choice alternatives of each individual.

- The Newcastle study also indicated that whilst individual choice modelling is efficient, it still requires significant sample sizes. A full modelling system would require sample sizes only slightly smaller than past surveys.

The most important outcome of the Newcastle exercise was the decision to work towards implementing a totally disaggregate modelling system for Sydney. This program would require the collection of a completely new data base if the full advantage of ICM was to be achieved. Coinciding with other SATS data problems outlined above, this decision prompted the development of plans for a new Sydney Travel Survey. A census year, 1981 was considered particularly appropriate for the execution of the survey.

DEVELOPMENT OF SURVEY METHODOLOGY

In order to establish the methodological and cost parameters of an ICM-based survey at an early stage, an exploratory survey (300 households) was conducted in Sydney in 1979. It was designed to test the feasibility of collecting appropriate behavioural and attitudinal data at the same time gathering much of the 'normal' travel data (e.g. car ownership, trip data, etc.) associated with home interview surveys.

The major new issue in the design of a questionnaire was the problem of how to elicit choice set from the trip maker. Information on choices available but not taken, as well as options actually chosen, was required. An initial attempt at a completely structured approach made questioning tedious, with individual questions verging on trite. A swing to complete open-endness was equally unsuccessful, often producing incomplete responses in test runs.

The final questionnaire therefore dealt with choice set in a basically unstructured manner, but relied on fairly detailed prompting by the interviewer to ensure completeness. The chosen approach addressed another problem - the fact that choice set is determined partly by positive factors ('I like to drive a car') and partly by negative factors ('Public transport is uncomfortable').

In the questionnaire, which was completed by all household members 17 years and over, data were gathered for choice set associated with:

- mode choice
- car ownership
- frequency of trips
- timing of trips (time of day/day of week)
- deviation of trips
- destination of trips
- combination of trip purposes, and
- residential location.

The choice set questions remained within the framework of the traditional transportation survey with questions on person information, actual travel movements, and travel related variables like car ownership and availability also being asked. The evaluation of the survey had two definite components - the analysis of data and the review of methodological considerations.

In the analysis of data, several choice set delimiters became apparent. For example, on many occasions when two parents were in the workforce, public transport was effectively not a choice since the flexibility needed to leave children at babysitters or childminding centres en route to work effectively precluded public transport as an alternative in mode choice. Similarly, for shopping trips from exclusively residential zones to centres which did not offer delivery services, the volume of goods purchased excluded public transport from the choice set. Often bound to this limitation was a time constraint imposed by the fact that the vehicle in a one-car family was used for work trips and was therefore unavailable for family shopping trips except on Thursday nights, Saturday mornings or on days off.

Questions which queried the times and days chosen for particular activities as well as those asking whether activities could conceivably be done more or less frequently, gave rise to an interesting hypothesis. For a very large proportion of both individuals and households answers suggested that although other alternatives were possible, the existing pattern was considered fairly invariable. In other words, it appeared that existing behaviour could be described as a predeterminant of choice set in a large number of cases. The development of a system of grouping of 'habit types' could well facilitate the description of a corresponding family of choice sets.

During analysis it was observed that a combination of primary life style (life cycle) and economic factors, reflected in employment status, regulated choice set to a major extent. Individuals who opted for a particular set of working hours combined with a large number of social and recreational activities were very limited in time and distance choices relating to trip purposes considered to be of minor importance in the life style - e.g. shopping and banking. For other life styles, the same activities were significant parts of daily life and were extended over long periods, making the time and location choice sets very predictable and therefore more easily specifiable.

Although the significance of life style is not new its use as a grouping technique seemed potentially useful in a survey where a wide range of behavioural attributes as well as travel data were available. For example, although car ownership has been shown to determine travel behaviour to a large extent, the occurrence of a persistent pattern of car ownership with a particular life style could have modelling as well as policy implications.

Rough analysis using 12 life style categories[1] strengthened the belief that these groups represented powerful indicators to describe a similar set of behavioural characteristics. These behavioural characteristics, in turn were instrumental in the determination of choice sets underlying travel behaviour. This result is particularly interesting since it suggests that very basic data (marital and employment status) are potentially extremely useful, and have not been fully exploited from past surveys.

The second component of the evaluation was the methodological and operational aspects of disaggregate data collection. It was found after an extensive debriefing session with interviewers and after review of the questionnaires and data collected, that only minor modifications to traditional forms were needed to gain choice set data. The debriefing session also highlighted the need for much tighter question specification and suggested that in-depth questions could be minimised if greater emphasis were placed on questionnaire design in the developmental stages.

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1 The 12 categories were: 1) single adults/multiple economic units; 2) married, childless; 3)&4) Married 1/2 parents employed,1pre-school child; 5)&6) Married 1/2 parents employed, 1 dependent child; 7)&8) Married 1/2 parents employed, 1 independent child; 10) Retired, no children at home; 11) Retired independent children; 12) Parents unemployed, dependent children. The priority of children was - independent child takes precedence over dependent child takes precedence over pre-school child.

In summary, the exploratory survey demonstrated that choice set data could be collected within the existing survey framework, and that, with directed planning, the methodological aspects of questionnaire design could produce a data base capable of addressing the major problems experienced with the Sydney Area Transportation Study: data would be up-to-date, appropriate for disaggregated modelling techniques, and with the addition of choice set data, a new focus on policy issues would be possible.

TOWARDS AN OPERATIONAL SURVEY

Encouraged by the exploratory survey, the Study Group began detailed planning towards the 1981 survey. The data objectives were clearly specified, and systematic refinements to the questionnaire format used in the exploratory survey as well as to the routine operational approach, have resulted in a well-defined programme, as set out in Figure 1.

A study of documented travel surveys both in Australia and overseas (e.g. Stockholm Area Transportation Study (1971), Auckland Comprehensive Transportation Study (1973), Dutch National Travel Survey (1978) and surveys in Perth, Melbourne, Adelaide, etc.) revealed numerous unresolved problems in all aspects of survey development and implementation. A critical appraisal of past problems of Australian surveys had been undertaken by the Australian Road Research Board.(1) An attempt was therefore made, at all levels, to address past problems and to seek positive solutions to them. Two aspects will be discussed to highlight this approach - survey operations and questionnaire design.

Operation

Three important problem solving measures characterise the operational approach adopted for the 1981 Sydney Travel Survey.

Planning Period: Disregarding time spent on model development and analysis of data needs, the planning period will total two years including three pilot surveys (see Figure 1). Clear working objectives have allowed ample time for careful consideration of all aspects of data collection.

1979 —

1980 —

1981 —

FIGURE

1 Dumble, 1979, An Appraisal of Australian Urban Transport Study Data. The twenty eight large scale home interview surveys carried out in the last twenty years are reviewed.

1979	July	Exploratory Survey — included training and debriefing of interviewers
1980	August 22–28	Small Pilot Survey — to test question wording
	October 28–29	Interviewer Training
	October 30 — November 7	Pilot Survey — includes debriefing of interviewers
1981	February 23–27	Interviewer Training
	March 1–14	Dress Rehearsal — includes test of coding procedures and debriefing
	July 6–17	Interviewer Training
	July 27— December 18	1981 Sydney Travel Survey

FIGURE 1 OPERATIONAL TIMETABLE FOR THE DEVELOPMENT OF THE 1981 SYDNEY TRAVEL SURVEY

Management of the Survey: The extensive time period allocated to the developmental stages has been the primary reason for the decision to keep the management of the survey within the Study Group. The clear cost advantages are almost secondary to the value of the insight and experience acquired by the research staff.

The limiting of the work to members of an applied transport research unit continually reinforces the necessity of defining data needs rigorously at the same time as developing a workable survey format.

Co-operation with the Australian Bureau of Statistics (ABS): Extensive co-operation with the ABS Population Survey Operations team has been developed for all stages of planning and execution.

The experienced assistance offered by ABS has led to a tight questionnaire format and to the adoption of many levels of quality control previously not common, or not documented in home interview surveys. Recruitment of interviewers will incorporate rigid screening techniques. Interviewer training is planned to extend over 8-10 days which will include home study exercises, group practice and in-field training. Retraining (½ day) sessions will occur at intervals for the duration of the enumeration period. Supervisors will take part in all pilot testing to acquaint them with all aspects of the interviewing operations as well as with the functions of the Study Group. Reinterviewing will occur periodically to complete field control.

Coding Techniques: Up to now the lack of validation of survey results has always been a problem. To counteract it, the coding of data will take the form of interactive on-line computer coding. A menu-driven edit programme will allow rapid checking of coder and interviewer errors. Coding will be quick and accurate, and daily summaries of trends may be obtained. This process gives the capability of providing contemporary validation procedure, e.g. in case of underenumeration of an important category of respondents.

Commercial Vehicle Survey: In the past, surveys of commercial vehicle movements have been conducted using a sample of vehicles, often selected from motor vehicle registration records. An innovation in the current survey is the incorporation of the commercial vehicle survey into the home interview survey sample frame - i.e. persons driving these vehicles are sampled. The technique adopted is to supply any respondents who made more trips than readily re-callable with a self-enumerating form to be completed on the next day on which comparable trips are made. Details of all vehicles are collected as a matter of course. Pilot testing is not yet complete, but the co-operation of the respondents achieved by the interviewers during the first part of the interview is expected to result in relatively high response rates.

Questionnaire Design

The design of the questionnaire has also been the subject of innovations aimed at reducing inconsistencies and deficiencies of former surveys. The subject matter of the questionnaire can be divided into 7 parts which will be discussed in the order in which they are presented.

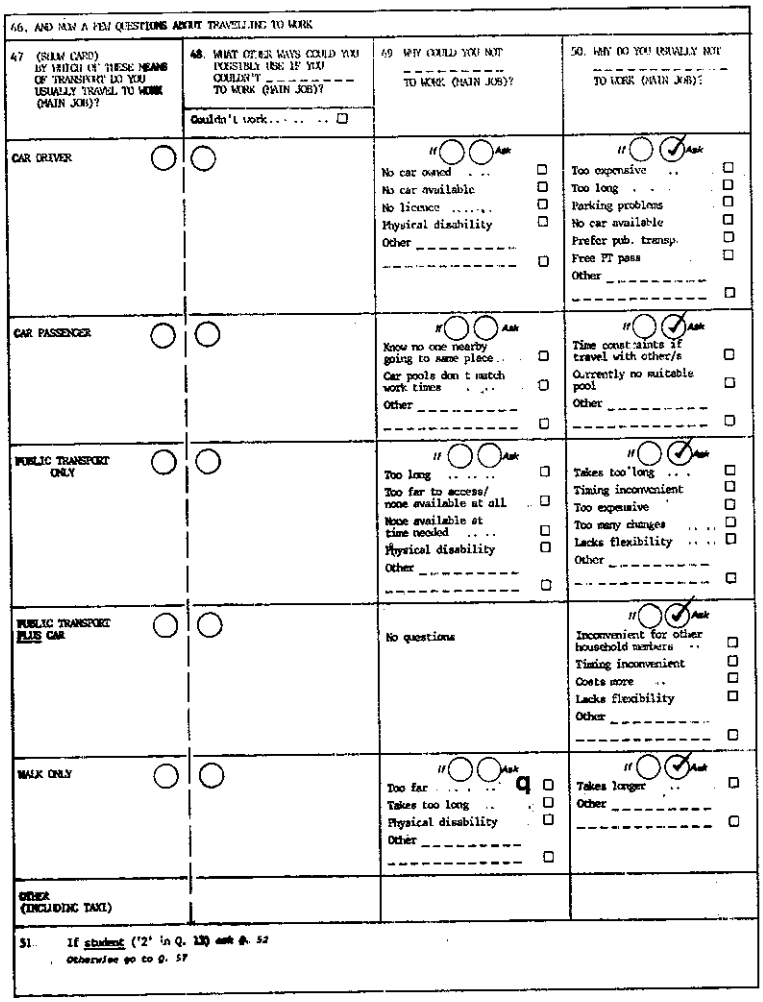
The Household Form: This form is a standard part of home interview surveys and is administered to any one household member who is in the scope of the survey (i.e. 17 years of age or more). Household composition questions appear on this form and, in addition, detailed information on the vehicle fleet of the household (including make, model, year, number of cylinders, and most frequent user) is located on the back of the 4 page form for easy reference at the time when individual trips are reported. Space is also provided for the addition of information on other cars used as part of the household's individual trips.

Car-Related Information: Traditionally these data are limited to licence and car ownership. The current survey establishes reasons for ownership/non ownership as well as reasons for increase or decrease of car availability over the last 12 months.

Employment Status: This section collects data on employment status and probes to determine part time workers at all levels. Usual details of occupation and industry are complemented with information on number of days worked last week and reasons for absences. Trip generation models have generally lacked adequate details on this information.

Mode Choice Set: Results of the exploratory survey provided guidelines for the design of this part of the questionnaire. Respondents provide reasons for non-choice of alternatives. Testing in the earlier survey also suggested that the negative approach (why do you not usually drive to work?) proved most effective to obtain this information. Choice set is obtained for four trip purposes - work, grocery shopping, school and recreation. The example of work choice set questions is shown in Figure 2.

Trip Data: Several important features characterise the collection of trip data. First, it is collected personally for all tripmakers 17 years old and over. One of the reasons for recurring underenumeration of trips in past surveys is undoubtedly due to the non-knowledge of one individual of trips made by household members. Pilot-testing has shown that even constant and careful probing of individuals may not produce total recall unless carefully structured.



66. AND NOW A FEW QUESTIONS ABOUT TRAVELLING TO WORK

67 (SHOW CARD) BY WHICH OF THESE MEANS OF TRANSPORT DO YOU USUALLY TRAVEL TO WORK (MAIN JOB)?	68. WHAT OTHER WAYS COULD YOU POSSIBLY USE IF YOU COULDN'T _____ TO WORK (MAIN JOB)?	69 WHY COULD YOU NOT _____ TO WORK (MAIN JOB)?	70. WHY DO YOU USUALLY NOT _____ TO WORK (MAIN JOB)?
	Couldn't work ☐		
CAR DRIVER ○	○	If ○ ○ Ask No car owned ☐ No car available ☐ No licence ☐ Physical disability ☐ Other _____ ☐	If ○ ✓ Ask Too expensive ☐ Too long ☐ Parking problems ☐ No car available ☐ Prefer pub. transp. ☐ Free FT pass ☐ Other _____ ☐
CAR PASSENGER ○	○	If ○ ○ Ask Know no one nearby going to same place ☐ Car pools don't match work times ☐ Other _____ ☐	If ○ ✓ Ask Time constraints if travel with other/s ☐ Currently no suitable pool ☐ Other _____ ☐
PUBLIC TRANSPORT ONLY ○	○	If ○ ○ Ask Too long ☐ Too far to access/ none available at all ☐ None available at time needed ☐ Physical disability ☐ Other _____ ☐	If ○ ✓ Ask Takes too long ☐ Timing inconvenient ☐ Too expensive ☐ Too many changes ☐ Lacks flexibility ☐ Other _____ ☐
PUBLIC TRANSPORT PLUS CAR ○	○	No questions	If ○ ✓ Ask Inconvenient for other household members ☐ Timing inconvenient ☐ Costs more ☐ Lacks flexibility ☐ Other _____ ☐
WALK ONLY ○	○	If ○ ○ Ask Too far ☐ Takes too long ☐ Physical disability ☐ Other _____ ☐	If ○ ✓ Ask Takes longer ☐ Other _____ ☐
OTHER (INCLUDING TAXI)			

71. If student ('2' in Q. 13) ask Q. 72
Otherwise go to Q. 57

FIGURE 2 CHOICE SET FOR MODE OF TRAVEL TO WORK

Much time has been spent developing this section of the questionnaire. It included extensive test interviews, sometimes tape-recorded, to analyse in detail the kind of prompts necessary to elicit total recall of all trips. The resultant series of introductory prompts as well as those needed throughout trip recall are shown in Figure 3. 'Trip' is carefully defined to all respondents to highlight the exact nature of the desired information. People who maintain no trips have been made are re-prompted and the definition of yesterday is also specified to all respondents. Finally, a series of prompts is built into the design of the trip questions. The critical prompt which evolved is "What did you do next?".

It has been shown to elicit recall of a series of activities rather than only trips thus ensuring good responses. For example, "I came home, began baking a cake. Oh, and then I needed some milk and walked to the corner store ..." Reinterviewing tests which included probing suggested that this is a highly efficient technique of trip data collection.

Figure 3 indicates the technique designed to collect all trips for all purposes.

Where respondents cannot recall all their trips they will be directed to a special multiple trip form. As discussed earlier the desire is to collect all commercial vehicle trips as part of the HIS. This particular technique is designed to achieve this aim and to avoid under-reporting of travel.

Residential Location: Reasons for moving and a measure of intention to move provide policy oriented data previously not common in home interview surveys.

Other Information: Educational qualification is asked with the aim of using it together with occupation and years of employment to obtain a surveyable income figure in cases of income refusal. Personal income data is also collected.

SUMMARY

The 1981 Sydney Travel Survey is part of a long term program to develop a complete disaggregate modelling system. Many innovative measures have been implemented to provide a consistent and well defined survey capable of filling the demanding role of assisting in transport policy making for Sydney in the 1980's.

57 I'M NOW GOING TO ASK YOU ABOUT TRIPS [illegible]
BY TRIP I MEAN ANY TRAVEL OR MOVEMENT [illegible]
WALKING ACROSS THE ROAD TO BUY A NEWSPAPER OR GOING TO THE STATION [illegible] OR CATCHING THE TRAIN [illegible]

58 DID YOU MAKE ANY TRIPS AT ALL YESTERDAY?

Yes
No

59. DON I FORGET THAT THIS INCLUDES EVEN WALKING DOWN THE STREET TO BUY A NEWSPAPER OR SOME MILK OR CIGARETTES [illegible] DID YOU STAY IN THE SAME PLACE ALL DAY YESTERDAY?

Yes *(Go to Q. 100)*
No *(Recode Q. 58)*

60. I WOULD NOW LIKE TO QUICKLY RUN THROUGH ALL THOSE TRIPS

Interviewer: Sort out people for Multiple Trip Forms (Form X)
Explain that the only problem is that some people may make so many trips that recall is impossible

All trips reported
Multiple Trip Form necessary *(Go to Q. 100)*

61 BY THE WAY, I MEAN FROM 4 A M YESTERDAY, THAT WAS [illegible] TILL [illegible] THIS MORNING.
FROM 4 O CLOCK YESTERDAY MORNING WHAT WAS THE FIRST TRIP YOU MADE?

62 Fill in date and day of trips (YESTERDAY)

S M T W T F S Date Month

	WHERE DID YOU MAKE YOUR TRIP?	WHERE WERE YOU?
01	Start Address	Purpose of Start
TRIP NUMBER		Home Work-1st job Work-other Empl Bus Med-Dent Visit Rec. Church Serve Pass No Change Mode Other

	WHEN DID YOU LEAVE?	WHAT DID YOU DO NEXT? WHERE DID YOU GO NEXT?	WHAT DID YOU DO THERE?	HOW DID YOU GET THERE?	WHEN DID YOU GET THERE?	
	Start Time	Destination Address	Destination Purpose	Mode of Travel	Arrive Time	Parking
			Home Work-1st job Work-other Empl Bus Shop – Ask HOW MANY SHOPS DID YOU VISIT? Med-Dent. Pers Bus Visit Rec. Church School Serve Pass No. Change Mode Other	Veh Dr-Car Pa. HOW MANY PEOPLE WERE IN THE CAR (VEHICLE)? Veh Pass-Car Pa Train Ferry Govt Bus Priv. Bus. Sch Govt Bus Sch Priv Bus Taxi Bicycle Motor Bike Walk Other HOW MUCH WAS THE SINGLE FARE? Free Pass / Paid Pass / Not Paid		If [X][X] Ask WHERE DID YOU PARK? Street Lot Res Prop Co. Park Not Pkd Other HOW MUCH DID YOU PAY TO PARK? Nothing Amount ¢

FIGURE 3 FORMAT FOR TRIP DATA COLLECTION