

# National Household Travel Surveys: The Case for Australia

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## Abstract

This paper reviews a number of national household travel surveys that have been conducted elsewhere in the world, especially in Europe, the Middle East, North America, and New Zealand. The purposes of these surveys are described and the survey characteristics and related national statistics are provided and compared to the national statistics for Australia. These comparisons make it evident that there is a clear case for undertaking a nationwide household travel survey in Australia, based on both similar needs for national data in Australia and the fact that the attributes of the Australian population fit well within the parameters of national household travel surveys elsewhere. Further, a summary is provided of the metropolitan household travel surveys that have been conducted in Australia, demonstrating the lack of comparability between these surveys that leaves it as an impossibility to draw general conclusions about the demand for transport and the performance of the transport system in Australia, as well as documenting the almost total lack of planning data for regional towns in Australia. The paper concludes by suggesting parameters for an Australian National Household Travel Survey and indicates the likely cost of such a survey and the potential benefits that would arise from it.

## 1. Introduction

Over the past forty years, many countries around the world have undertaken a National Household Travel Survey (NHTS) for the entire country. Scanning across Europe, North America, Australasia, and the Middle East, it appears that the UK may have been the first country to undertake such a survey, having initiated this in 1965, followed the next year by France, and three years later by the USA. Since that time, many other countries have initiated National Travel Surveys, which have then been undertaken on a repetitive basis since inception. In this paper, the authors document the past National Travel Surveys from these parts of the world, and examine the purposes for which the surveys have been conducted, and the methods used to conduct them. It is notable that Australia is absent from the list of countries that have conducted National Travel Surveys and that continue to do so. To examine whether there may be some clear reasons for Australia not to undertake a National Travel Survey, the area, population, and population density of those countries that have conducted national travel surveys are compared to the same statistics for Australia.

It may, of course, be argued that Australia's population is concentrated so much into the eight capital cities (Sydney, Melbourne, Perth, Adelaide, Canberra, Brisbane, Darwin, Hobart) that surveys covering those cities would cover a large part of the total population of Australia. Therefore, the paper also documents the frequency and comparability of travel surveys in those different cities and also explores the extent to which each of these surveys covers the regional populations of the states concerned. We then assess whether or not it seems likely that pooling of the data from these regional household travel surveys could possibly substitute for the normal purposes of a National Household Travel Survey. For those who are knowledgeable about household travel surveys, it will probably come as no surprise that we conclude that the normal purposes of national travel surveys cannot be met from a pooling of existing regional household travel surveys. Hence, the paper concludes by laying out the purposes of a national household travel survey for Australia and also suggests some of the important parameters of such a survey.

## 2. History and Purpose of National Travel Surveys

### 2.1 A brief history

As noted in the Introduction, the earliest NHTS appears to have been the one conducted in the UK in 1965. The purposes of that survey were primarily to provide a description of travel throughout the nation, and secondarily to provide information on long-term trends in travel. The survey sample was 7,545 households drawn from across Britain and it was conducted by face-to-face interview, with a self-completion travel diary left with each household member. Two interviewer visits were normally made to each household, the first to recruit the household and deliver the self-completion diaries, and the second to collect the diary and any remaining ancillary data. The UK has since completed a further 5 surveys and has then run an annual survey since 1989.

The following year (1966-67), France conducted its first NHTS. The purposes of that survey were primarily to provide a description of travel throughout the nation, and secondarily to provide information for planning and sustainable development. The survey covered 22,000 households and was conducted by face-to-face interview, involving a minimum of two visits to sampled households. The survey was conducted by the French National Bureau of Statistics. The French NHTS was then repeated in 1973-74, 1981-82, 1993-94, and most recently in 2007-08. Thus, France has now conducted five NHTSs.

Following these two NHTSs, the US Bureau of the Census undertook a nationwide household travel survey across the United States in 1969. This survey had the same primary purposes as the French one in 1966-67, namely to describe travel across the nation, and secondarily to support planning and sustainable development purposes. It covered a sample of 15,000 households, drawn from every state in the USA. The survey was conducted in 1969, 1977, and 1983 as a face-to-face interview, but has since been conducted as a telephone-based computer-assisted survey. This survey was initially named the Nationwide Personal Travel Survey (NPTS) and was intended to be repeated every 5 years after 1969. In fact, the surveys took place in 1977, 1983, 1990, 1995, 2001, and 2008. In 2001, the name of the survey changed to the National Household Travel Survey (NHTS), which is how it has been known for the most recent two surveys. The US has now conducted seven such surveys since 1969.

Table 1 shows a summary of other nations that have conducted national travel surveys, showing the year in which it was initiated, the number of times the survey has been conducted to date, and the initial sample size in households (Kunert et al., 2002; Bonnel and Armoogum, 2005; Armoogum et al., 2009). Countries are ordered by the year in which the survey was first conducted. As can be seen from Table 1, by the end of the 1970s, there were already eight countries conducting NHTSs, with another seven countries joining over the ensuing two decades. Five of these surveys are now running on an annual basis, and have done for 5 – 10 years in most cases. With the exception of the first two surveys in New Zealand, whose major purpose was to assess exposure of the travelling public to risk, all of the NHTSs have had as their major purpose the description of national travel. Determining long-term trends in travel has been a secondary purpose of the majority of these surveys, while collecting data for modelling purposes has been a primary objective of only Israel, Norway, Spain, and Sweden, and has not at all been an objective of those NHTSs conducted in Great Britain, New Zealand, and, until 2006 when it became a secondary objective, the USA. It can also be seen that the sample sizes have varied widely over the different countries, and, what is not shown in Table 1, is that the sample sizes also have varied quite widely within countries. For example, in the USA, the sample in 1969 was 15,000 households. However, with add-ons for local areas, it rose to as high as 150,147 in 2008. In the UK, it has been as low as 1,754 households (in 1988) to as high as 10,266 in 1985/86. Since 2002, the aim in the UK has been for 8,000 households per year.

**Table 1: Summary of National Household Travel Surveys Around the World in Chronological Order**

<b>Nation</b>	<b>Year first conducted</b>	<b>Initial Year Sample Size (households)</b>	<b>Number of times repeated</b>
UK	1965	7,545	6 + annual since 1989
France	1966-67	22,000	5
USA	1969	15,000	7
Israel	1973	56,000	4
Finland	1974	16,000 persons	6
Switzerland	1974	2,094	8
Denmark	1975	3,928	7 + annual !between 199? And ?! since 2006
Germany	1976	15,525	6
Norway	1984/85	4,320 persons	6
Netherlands	1985!1978?!	21,500	Annually until 2008 + 2010
New Zealand	1989/90	3,102	2 + annually since 2003
Sweden	1994	10,450	10\$continuous between ? and ?\$
Belgium	1999	3,064	2
Italy	2000	15,000 persons	Annually
Spain	2000-01	23,635	2

Most of these NHTSs have been conducted by drawing random or random stratified samples from throughout each nation. The methods of surveying run the gamut of methods used in person surveys, with many nations using face-to-face interviews, others using telephone interviews – more recently with computer-assistance – while yet others have used postal surveys. In the Netherlands, in 2010, the initial approach was a web-based survey, with telephone or face-to-face interviews being used for those without access to the Internet. So far as the authors have been able to ascertain, this is the first time that a web-based survey has been used as a primary approach in a NHTS.

Most of the surveys are of one day of travel for each household member or each person sampled. A few of the surveys, mainly Israel, New Zealand, and Spain, used two days, while a few, namely France, Great Britain, Italy, and the German Mobility Panel, collect data for a full week. Almost all of the surveys are conducted over an entire year and include travel on all days of the year, although one or two omit some holidays. However, most survey all days of the week and all days of the year, without exception. To date, only two surveys have experimented with collection of travel data by Geographic Positioning System (GPS) devices, (e.g., 500 weeks completed in France) although it has been indicated that many surveys intend to start doing so shortly. For example, the UK has been examining GPS extensively for several years and is now moving to adoption of a GPS component of their annual NHTS. Although not universal in the early years, all of the NHTSs now collect long-distance travel, usually by recall over a period of months prior to the actual survey interview.

It is interesting to note that, to date, there is no evidence of any country that has engaged in NHTSs terminating the process. Denmark and Sweden have interrupted their continuous data collection, but have started again. While there has been a great deal of variation in the frequency with which some countries have conducted these surveys, anecdotally probably as a result of budget issues at the national government level, all of those countries listed in Table 1 are continuing to collect data on an annual basis, or have most recently collected data within about the past one to four years.

Not included in Table 1 is the one and only National Travel Survey conducted in Australia in 1977-78 (Hirsch and Russell, 1981), subsequently analysed by Wigan (1987). It has not been included here because, unlike all of the other National Household Travel Surveys, this survey covered non-urban travel only. In other words, it was effectively the long-distance journeys component of what the other nations have been undertaking as their National Household Travel Surveys, and is therefore neither strictly comparable to them, nor is it actually an instance of the type of survey under discussion in this paper.

## 2.2 Purposes of NHTSs

As has already been indicated, the major purpose of almost all of the NHTSs has been to collect data for the purposes of describing national travel. Usually, this means descriptions of such things as average journey times per person per day and for specific purposes, mainly the work trip, and also assessing the levels of mobility within the population. This is in direct contrast to most metropolitan data-collection activities, which are typically designed to collect data principally for the purposes of building models of travel demand. Only recently and in some countries have the purposes of some NHTSs extended to that of model estimation. Of those reviewed, five still do not include modelling as a possible purpose of the data collection, and three consistently indicate modelling as a primary purpose (Norway, Spain, and Sweden). Other NHTSs have indicated varying levels of interest in providing data for modelling purposes with Denmark, Germany, Israel, and Switzerland being among those showing at least some interest in modelling from the NHTS data.

The USA is a good example of the principle purposes of NHTSs. Over the years, the principle focus of the NPTS/NHTS in the USA has been to provide an ongoing description of travel across the nation, which has also given rise to a series of publications that summarise trends in travel in the USA (e.g., Santos et al., 2011; Hu and Reuscher, 2004; *inter alia*). In addition, there has been a series of, so far, three reports on Commuting in America based on the NHTS data from recent NHTSs (e.g., Pisarski, 2011; Pisarski, 1996). As a result of this focus of the US NHTS/NPTS, a central issue in the design of the surveys has been comparison of travel from one NHTS to another. Indeed, a large number of publications have been produced that examine various trends and statistics from the various surveys, as can be seen at the web site (USDOT, 2011).

This is quite typical of most countries undertaking national travel surveys. Description of travel and identification of long-term trends in travel are the primary or secondary purposes of almost every NHTS documented in this paper. For example, in France, Armoogum and Roux (2011) have analysed the four surveys conducted since 1973 to examine long-term trends in travel. Supporting the planning of sustainable transport, and modelling are the least frequently cited purposes, and are not considered a purpose of most NHTSs.

## 2.3 Add-on Samples to NHTSs

Many of the NHTSs have included the possibility of adding to the sample to serve the interests and purposes of local areas within each country. The USA appears to have been one of the earliest to offer local jurisdictions the possibility of purchasing additional sample to provide a significant sample for local area analysis. Essentially, the sample sizes of all NHTSs are too small to permit statements to be made for specific metropolitan areas in the countries conducting these surveys. However, beginning in 1990, the US Department of Transportation offered the opportunity to local and State jurisdictions in the USA to purchase additional samples for their areas. In 1993-94, France offered the option of purchasing additional sample, which was taken up only by the Metropolitan area of Lille at that time, but which represented about half of the sample collected in 2007-08 by over-sampling in five regions. In 1994, the Netherlands followed suit, with Sweden doing so in 1995, Norway in 1997-8, and subsequently Belgium, Denmark, and New Zealand have also offered additional sample for purchase by local jurisdictions.

In general, the purchase of add-on samples is costed at the unit cost of additional surveys in the NHTS, making such add-on samples cheaper than the cost per household of a standard metropolitan area survey. None of the fixed costs normally assumed to be part of survey costs are included, for example, costs of designing the survey instrument, pilot testing, development of administrative procedures, etc. Hence the costs are generally much lower than the local jurisdiction would incur for a full survey of their own. However, because modelling has generally not been a principal objective of most NHTSs, the restriction to the existing national survey questionnaire has sometimes been a limiting factor to the interest of local jurisdictions. At the outset, when add-on samples were first offered, the sample sizes were as low as 700 households in France, and only a few thousand in most other cases. However, the popularity of add-on samples has grown rapidly over recent years, so that the most recent NHTS in the USA had an add-on sample of 125,147 households, compared with the initial sample of the NHTS itself of 25,000 households. Enrichment of the national sample through these add-on surveys is a second benefit that arises in the process. Thus, in 2008, when the US Department of Transportation decided to undertake the most recent NHTS in that country, with a sample size of 25,000 households, the final sample, including add-ons, was 150,147 households, albeit with a non-random distribution throughout the country, but with the potential still to calculate weights for the add-on components that would allow the overall sample to be used for descriptive purposes for the entire country.

In those countries that have offered the potential for local jurisdictions to purchase add-on samples, there also appears to be something of a trend of increasing sample size. Thus, in Norway, which first offered add-ons in 1997-98, the initial add-ons totalled 2,777 households, which has grown with each survey to total 18,429 in the most recent (2009-10) NHTS. The US similarly increased over four surveys from 3,817 to 21,033, 43,799, and finally 125,147. The trend certainly appears to be emerging that local jurisdictions find the cheaper option of piggy-backing on to the NHTS increasingly appealing. However, because of different methodologies and survey periods, data from NHTSs show significantly different results than those from local mobility surveys.

### **3. National Statistics and NHTSs**

It seems useful to look at whether there are any particular national attributes that suggest undertaking NHTSs. The authors have looked at population, area, and population density as potential characteristics that might indicate which countries would be most likely to undertake NHTSs. Table 2 shows the results of this comparison, taking the countries in alphabetical order from Table 1 and adding, for comparison purposes, Australia.

From Table 2, it is clear that NHTSs cover a wide range of both population and area of country, as well as population densities. With the USA as the largest by both population and area at over 311 million population and an area of over 9.5 million square kilometres, to New Zealand, with a population of 4.4 million people and a land area of just over 270,000 square kilometres, the range of country size for NHTSs is very large indeed. On a measure of population density, the Netherlands is the most densely populated at over 446 persons per square kilometre, while the lowest density is Norway at just over 15 persons per square kilometre. However, density can be a misleading figure, because some countries, such as Switzerland and Norway have vast areas that are not inhabitable, whereas others, like the Netherlands have very little land that is not inhabitable. Therefore, the “real population density”, defined as the population per square kilometre of arable land, is probably a better measure. This shows a very different picture, with the Netherlands as the most densely populated in these terms, to the USA as the least densely populated of the NHTS countries, while Australia sits below even the USA.

While it is clear that Australia sits at one extreme with respect to both population density and real population density, it is neither the largest country in area of those listed in Table 2, nor does it have the smallest population, both of which might be raised as arguments for Australia not to engage in a National Household Travel Survey. While it is second only to the

USA in area, out of those listed in Table 2, it is the seventh largest in population out of a total of 16 nations, with all of the other fifteen undertaking regular nationwide household travel surveys. It seems appropriate to wonder why Australia has not seen the need to understand national travel patterns and trends, through conducting a nationwide survey.

**Table 2: Population, Area, and Population Density for NHTS Countries and Australia**

Country	Population <sup>1</sup>	Area (km <sup>2</sup> ) <sup>2</sup>	Population Density (persons/km <sup>2</sup> )	Real Population Density (persons/km <sup>2</sup> of arable land) <sup>3</sup>
Australia	22,659,825	7,692,024	2.946	43
Belgium	10,918,405	30,528	357.652	1,248
Denmark	5,564,219	43,094	129.118	244
Finland	5,386,820	338,424	15.917	262
France	65,821,885	640,294	102.799	332
Germany	81,802,000	357,114	229.064	712
Israel	7,740,900	22,072	350.711	2,147
Italy	60,626,442	301,336	201.192	748
Netherlands	16,681,400	37,354	446.576	2,205
New Zealand	4,410,600	270,467	16.307	272
Norway	4,956,200	323,782	15.307	553
Spain	46,148,605	505,992	91.204	297
Sweden	9,440,588	450,295	20.965	369
Switzerland	7,866,500	41,277	190.578	1,900
UK	62,435,709	242,900	257.043	1,077
USA	311,732,000	9,629,091	32.374	179

#### 4. Metropolitan Household Travel Surveys

One possible defence of the lack of a National Travel Survey in Australia could be that there are surveys undertaken in each of the major metropolitan areas on a frequent basis and that national statistics can be readily aggregated from these surveys. However, this is not a good description of the actual situation, as a little examination of the state of metropolitan surveys in Australia shows. First, aggregation of metropolitan area surveys to produce credible national statistics requires that certain conditions be met. The data from each different area must be comparable. It is well known in the survey profession that there are statistical differences according to methodology used to collect data. Thus, data from a face-to-face interview are not comparable to data from a self-administered survey, nor to data from a web-based survey, nor from a telephone survey (Bonnell, 2003). Different survey forms will also compromise comparability, especially when different ranges of categories are used to record information on certain attributes of travel, and of people and households. There are numerous other issues that compromise comparability among different surveys. Second, comparability requires that the surveys are conducted at approximately the same time as one another. If the surveys have been carried out in different years, then comparability is again compromised, especially when there are significant differences in the economy between different years.

<sup>1</sup> From Wikipedia: List of Countries by Population, [http://en.wikipedia.org/wiki/List\\_of\\_countries\\_by\\_population](http://en.wikipedia.org/wiki/List_of_countries_by_population) , accessed on 11/07/11.

<sup>2</sup> From Wikipedia: List of Countries and Outlying Territories by Total Area, [http://en.wikipedia.org/wiki/List\\_of\\_countries\\_and\\_outlying\\_territories\\_by\\_total\\_area](http://en.wikipedia.org/wiki/List_of_countries_and_outlying_territories_by_total_area) , accessed on 11/07/11.

<sup>3</sup> From Wikipedia: List of Countries by Real Population (based on food growing capacity), [http://en.wikipedia.org/wiki/List\\_of\\_countries\\_by\\_real\\_population\\_density\\_%28based\\_on\\_food\\_growing\\_capacity%29](http://en.wikipedia.org/wiki/List_of_countries_by_real_population_density_%28based_on_food_growing_capacity%29) , accessed on 11/07/11.

Third, the goals of most metropolitan surveys in Australia are principally to serve the needs of modelling and policy formulation, whereas it has been documented in this paper that the major purposes of most NHTSs is to provide information for describing national travel and elucidating long-term trends in travel patterns. These are not the primary goals of most metropolitan area surveys. Fourth, to truly reflect national travel trends and patterns, a NHTS must cover both urban and rural populations. While some of the larger metropolitan surveys in Australia can be described as covering regional populations (e.g., the Sydney Continuous Household Travel Survey covers the Sydney metropolitan area, plus the Illawara and the Hunter regions, and extends from the coast to the Blue Mountains), there are vast areas of the country, including many regional towns and cities that are not covered in these metropolitan surveys, which are therefore unable to provide information on regional travel patterns and trends.

Table 3 provides a summary of the household travel surveys that have recently been conducted in Australia, or are currently underway.

**Table 3: Summary of Recent Household Travel Surveys in Australia**

Metropolitan Region	Year Last Conducted	Data Collection Method	Period Covered	Sample Size	Area Covered
Sydney	Continuous since 1997	Face-to-face Interview	365 days	3,500 per year	Greater Sydney + Wollongong and Newcastle
Melbourne	2009-10	Interviewer drop-off and pick-up of a self-administered diary	365 days	10,000 in Melbourne, 1,000 elsewhere	Melbourne, Geelong, Ballarat, Bendigo, Shepparton, and LaTrobe
Brisbane	2009	Interviewer drop-off and pick-up of a self-administered diary	10 weeks in school terms, weekdays only	10,000 households	Brisbane, Sunshine Coast, and Gold Coast
Adelaide	1999	Face to face, using Memory Joggers	9 months	5,886 households	Adelaide Statistical Division
Perth	2002-2006	Interviewer drop-off and pick-up of a self-administered diary	Every Day from 20/10/02 to 30/09/06	10,947 households	Perth Metropolitan Region and the Shires of Mandurah and Murray
Hobart	2008-9	Self-administered diary	365 days	2,400 households	Derwent Valley, Brighton, Glenorchy, Clarence, Hobart, Kingborough and Sorell
Canberra	1997	Self-administered diary	8/02/1997-23/04/1997 excluding weekends, school holidays, and public holidays	3,054 households	Canberra and Quenbeyan
Darwin	2003	Telephone	Sample spread equally over 7 days	1,000	Darwin, Litchfield, and Palmerston LGAs

As can be seen clearly from this table, there is a lack of consistency among the different surveys, with different methods used to undertake the surveys, different periods of time

covered, and radical differences in sample sizes. The total areas covered by these surveys also fall far short of the populated areas within Australia. It must be concluded, therefore, that any effort to pool the data from these individual metropolitan areas to form some sort of national travel data source is unlikely to be practical or feasible. Further, from a review of the sixth column of Table 3, it is apparent that the regional areas of Australia are not represented in the travel data that have been collected. For example, towns in NSW, such as Bathurst, Orange, Dubbo, Coffs Harbour, Armidale, etc., towns in Queensland such as Townsville, Mackay, Cairns, Rockhampton, etc., as well as similar regional towns and cities in Victoria, South Australia, Western Australia, Tasmania, and the Northern Territory are all excluded from current data collection.

Another omission in the existing data collection that is usually a significant component of the National Travel Surveys discussed earlier in this paper is that of long-distance travel. Because of the modelling focus of the metropolitan surveys, the travel of interest is principally concerned with travel within the metropolitan areas concerned and, at most, between areas listed in column 6 of Table 3. One wonders if the omission of long-distance travel inventories in Australia might have something to do with the general lack of investment in transport facilities between states and major cities within states in Australia, compared to the situation in such countries as the USA, the UK, and many European countries. Certainly, if long-distance travel were measured in a periodic national travel survey in Australia, this would help significantly with the potential to plan better transport facilities to link Australian cities and states.

Finally, while not a National Household Travel Survey, the Australian Census does collect some very limited journey-to-work information. Such data, while providing some useful statistical input, falls far short of what a National Household Travel Survey would provide. First, it is only about journey to work and does not cover any other travel. Second, it provides no information on the origins and destinations of such travel, nor on the attributes of the travel, such as travel times and travel costs. Third, it provides, at best, a snapshot of means of travel used on one day throughout Australia. In fact, it can also be pointed out that similar journey-to-work data are collected in a number of other countries that also conduct National Household Travel Surveys, such as the USA, among others. Census journey-to-work data are useful but are no substitute for a National Household Travel Survey. Expansion of the Census questions to satisfy the data demands that are encapsulated in a National Travel Survey would undoubtedly be unacceptable to the Australian Bureau of the Census.

## **5. A Proposed Australian National Household Travel Survey**

Assuming that one were to accept that there is a need for an Australian National Household Travel Survey, then a number of aspects of such a survey can be proposed. These aspects should be based on a careful review of what has been learnt from the National Household Travel Surveys conducted in other countries, and from a review of what is missing in the travel system inventory of Australia itself.

### **5.1 Survey Attributes**

There is no consistency in the survey methodology adopted in the various NHTSs reviewed in the earlier sections of this paper, although there are indications of some convergence in methodology. Because of cultural and other differences among countries (including costs), some countries are able to undertake their surveys using face-to-face interviewing techniques, whilst others rely on telephone interviews and other methods. Table 4 shows the survey methodologies currently being used in the most recent survey of each country. In Table 4, several abbreviations are used to describe survey methodology. These are: CATI, which is computer-assisted telephone interviews; CAPI, which is computer-assisted personal interviews; and CAWI, which is computer-assisted web interviews.

As can be seen in Table 4, there is a wide variation in survey methodologies. Anecdotally, several countries have indicated that they are now considering a GPS option and, in some cases, even a complete replacement of diary methods with GPS. However, to date, only France and Israel have actually used GPS as part of their NHTS, although the UK is considering using GPS extensively in 2012 and has been executing a pilot of this in 2011. For Australia, given the vastness of the area of the country, it would probably be necessary to rely principally on telephone interviewing, using CATI, although use of GPS might also be considered as a worthwhile methodology to pilot test at this point.

Referring back to Table 1, it can be seen that sample sizes vary widely across the different countries. It is important to keep in mind that the overall population size has no effect on the precision of a sample (in terms of the size of sampling errors arising from a sample survey), so that estimating the sample size as some proportion of the population is not useful. New Zealand shows the smallest sample size for recent NHTSs, with a sample of just over 3,250 households, while the USA has the largest at 150,147. These sample sizes, however, include add-ons where these were permitted. The USA NHTS aims for 25,000 households for the core survey, before any add-ons are included. The issue of sample size is probably the one that offers the greatest scope for negotiation. From a purely statistical point of view, a national sample of around 3,000 households is probably sufficient. However, if it is desired to have a sufficient sample to be able to make statistically sound statements about travel in each of the six states and two territories in Australia, it would probably be desirable to ensure that the minimum sample in any state or territory is about 650, which would require a total sample of at least 5,200 households.

**Table 4: Selected Attributes of Current NHTSs**

Country	Survey Methodology	Sampling Methodology	Response Rate	Proxy Reporting	Survey Cost	Most Recent Sample Size
Belgium	Self-administered + phone call reminder (CATI)	Stratified random sample	N/A	No	N/A	3,928 households
Denmark	Web + telephone survey (CATI)	Stratified random sample	59%	No <sup>1</sup>	€28/ interview	24,000 persons
Finland	Telephone Interview (CATI)	Random sample	67%	No <sup>1</sup>	N/A	20,100 individuals
France	2 visits, face-to-face (CAPI)	Stratified random sample	78%	No	N/A	20,178 households
Germany	Telephone and post (CAWI and CATI)	Stratified random sample	21%	Under 9 yes; 10-14 optional	N/A	50,910 households
Israel	Home Interview, Telephone and GPS	Stratified random sample	60%	No <sup>1</sup>	N/A	25,000 households
Italy	Telephone (CATI)	Stratified random sample	N/A	N/A	€9/ interview	15,000 individuals
Netherlands	Mixed mode: web, telephone, face-to-face	Stratified random sample	60%	No	N/A	42,100 individuals
New Zealand	Face-to-face (CAPI)	Stratified cluster sample	68%	Children under 9	N/A	3,283 households
Norway	Telephone (CATI)	Random sample	N/A	No	€47/ individual	28,429 individuals
Spain	Face-to-face (CAPI) and telephone (CATI)	Stratified random sample	55%	No	N/A	49,027 households
Sweden	Telephone (CATI)	Stratified random sample	N/A	N/A	N/A	41,225 individuals
Switzerland	Telephone (CATI)	Stratified random sample	N/A	N/A	N/A	31,950 households
UK	2 visits, face-to-face (CAPI)	Stratified random sample	59%	Children under 11	N/A	8,000 households/yr
USA	Telephone (CATI)	Stratified random	N/A	5-14 yes;	US\$175/	150,147

		sample		15-18 optional	household	households
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<sup>1</sup> No, but children may be helped by parents

Like many of the existing NHTSs, however, Australia could also offer the option for individual states and territories, and even individual cities and towns, or regions, to purchase add-on sample at a competitive rate. In turn, this could significantly increase the overall sample for the nation, which, with proper weighting, could allow statistically much superior results to be obtained.

Almost all of the NHTSs have used geographic stratification in drawing their samples as shown in Table 4. Only Norway and Finland appear to have used a simple random sample, and New Zealand has used a stratified cluster sample, with the cluster sampling being a more efficient way in which to implement a sample when the survey methodology is face-to-face. Given a recommendation to use telephone interviewing, and possible couriering of GPS devices to all or a subsample of households, in Australia, a geographically stratified sample would appear to be the best option. The geographic stratification would be used to ensure that there is an appropriate split of sample to all of the major jurisdictions of the nation, and that capital cities, regional towns and cities, and rural areas are all included in the sample, which would not be dominated by the capital cities, themselves.

Table 4 also shows that there is some variation in response rates attained, but the goal in Australia should be to get between 40 and 60 per cent response to a telephone interview survey. It should be noted that the highest response rates generally occur with the use of face-to-face surveys, but that the cost of this in the Australian context may be prohibitive, so that the lower response rate may have to be accepted.

Proxy reporting has been shown to result in substantial underreporting of travel (Stopher and Jones, 2003). Therefore, without exception as shown in Table 4, all of the existing NHTSs mandate either no proxy reporting or proxy reporting only for young children and, in certain cases, for adults who may have an intellectual or communication disability. For an Australian NHTS, it would be recommended to use the general no proxy rules, with the exception of young children and those who are unable to complete the survey because of disability.

Many of the early NHTSs relied, as did early HTSs for metropolitan areas, on the ability of respondents to recall their travel from a previous day, collecting data retrospectively. However, with only one or two exceptions, almost all NHTSs have moved to prospective data collection, in which either a diary or a memory jogger is provided at the time of recruitment and the respondents are asked to complete the diary or memory jogger on a specific future day, following which, the data are retrieved by one method or another. Following this format, it is recommended that an Australian NHTS should collect data prospectively, preferably using a diary format, where the diary is provided in advance of the travel day(s) and the data are collected through a subsequent telephone interview.

The majority of HTSs also collect data for one day, although a few collect two days (e.g., New Zealand and France), and one or two collect 7 days (e.g., the UK). Experience with a two-day diary in Australia (Stopher et al., 2006) suggests that there may be a substantial fall-off in reporting completeness on the second day, so it is suggested that an Australian NHTS should use a one-day format, unless it is decided to use GPS as the main method of collecting data, in which case it is recommended that 7 or even 15 days be collected.

In addition to the collection of data about all travel on a specific day, all NHTSs have in common the separate and specific collection of long-distance travel. Usually, long-distance is defined as one-way travel that exceeds some threshold distance or that entails at least one night away from home. The distance thresholds vary from as little as 50 kms in some cases, to 300 kms in others. Increasingly, and perhaps suitably for Australia, long-distance travel is defined as travel covering a greater distance than 100 kms, but not including commuting (or other regularly undertaken travel). The surveys then have a separate and special collection

of data about such trips, usually based on recall and specifying all such trips carried out in some substantial period prior to the survey, such as 3 or 6 months. While there is considerable variability among the NHTSs on this, there seems to be a tendency to move towards a period of 3 months by several of the existing surveys. This collection of long-distance travel is an important feature of NHTSs that is usually missing from metropolitan area HTSs. It is, therefore, very appropriate that an Australian NHTS should include specific collection of long-distance travel and it is recommended that this should be over the preceding 3 months and should include all trips of longer than 100 kms that are not part of a regular commute.

## **5.2 Costs**

It is unfortunate that costs are not more widely reported. However, cost is also more variable from country to country, and clearly also is highly dependent on the methods used for sampling, surveying, etc. It appears likely that the cost of a CATI survey in Australia would be on the order of AU\$150-200, in which case, the sample of around 3,000 households might be expected to cost on the order of \$600,000, while a larger sample of 5,200 households might come at a total cost of a little more than \$1 million. Compared to the costs of infrastructure investments in transport, these are quite trivial sums of money. Face-to-face surveys would be likely to cost upwards of \$350 per household, with a significant increase to cover more remote regional areas. Therefore, this methodology is not recommended for a NHTS in Australia. If GPS is added, this is a more complex issue, since GPS affords the possibility of collecting multiday data, which also offers the potential for significant decreases in sample size (Stopher et al., 2008). GPS is more expensive on a per household or per individual basis, but is significantly cheaper on a per person-day basis. It is estimated that a 15-day collection of GPS data would cost around \$300 per household, whereas a 7-day collection would cost about \$290. The sample size savings of these two multiday options are considerable.

## **5.3 Potential Benefits**

There are a number of potential benefits that would accrue from conducting a National Household Travel Survey in Australia and repeating such a survey periodically over a number of years. First and foremost, it would permit ready comparison of travel patterns, travel trends, and levels of transport service between and among different regions of the country. This could be a means of informing national and local policy and investment in transport. It could also identify where there are serious gaps in funding transport improvements that could be addressed at the State or even Commonwealth level. Second, it would provide a clear indication of the overall level of transport service across the nation, and would allow the identification of trends in service levels, were the data to be collected consistently at some interval such as every 5 years, or even continuously, as is done in the UK, New Zealand, and other nations.

A third benefit would be that the survey would allow the identification and assessment of travel in regional towns and cities that is not currently measured. On the one hand, this could be used to support policies that are attempting to persuade people to move into regional areas from the capital cities, such as the Evocities program in New South Wales. It would also allow the regional cities to assess their own needs for transport investment and have these needs recognised better by state governments. Fourth, the NHTS would offer the opportunity for states and localities to purchase add-on samples that would allow them, at very little cost and without significant overheads, to obtain sufficient data for local planning purposes. For example, a city like Cairns, with a population of over 150,000 people, might have only 50 or so households from the national sample from within its area. However, by spending a modest, say, \$50,000, it might be able to purchase an add on of a further 300 or so households, thereby giving a total sample of 350 households, with some potential to draw

statistically useful conclusions about transport in and around Cairns. Similarly, an expenditure of \$100,000 might allow the addition of over 700 households to the sample.

Fifth, there have been several times in the past in which it has been suggested that investment should be put into very fast trains, or other similar technologies, to provide improved access between cities within Australia. However, there has never existed in Australia a consistent database that would allow such investments to be examined appropriately. Collection of a National Household Travel Survey with its long-distance travel component would clearly aid the examination of such proposals and policies. It would also allow a better assessment to be made of the benefits of improving the quality of intercity and interstate roads and air services.

Many other benefits would accrue as a longitudinal database is built up over time (Ortuzar et al., 2010). However, the benefits suggested here are significant and substantial against the potential cost of such a survey as an Australian NHTS.

## 6. Summary of Recommendations

It is recommended that Australia should join many other countries of the world in conducting either a continuous or a periodic National Household Travel Survey. The survey should be based on drawing a geographically stratified random sample from the entire nation, with sample being drawn from capital cities, regional towns and cities, small towns, and rural areas. It is recommended that the survey be conducted by telephone interview, using CATI procedures, and that it should use prospective data collection for one day, aided by a diary or memory jogger that is sent to each person participating, or that would use GPS devices to collect data for 7 to 15 days, with this latter approach permitting smaller sample sizes to be used. Apart from children under a certain age, proxy reporting of travel should not be permitted. A core sample ranging from around 3,000 to as much as 5,200 or more households should be the aim of the survey, with larger sample sizes being used if budget permits. Local, state, and territory jurisdictions should be allowed to purchase add-on samples for their own areas, with the cost being set at the marginal costs of adding additional sample. The survey should also include a retrospective long-distance travel component, for which the definition of long-distance would be travel that has a one-way distance greater than 100 kms, but is not repeated regularly as part of a commute.

It is expected that the total cost of such an Australian National Household Travel Survey would be around \$1 million, although if a larger budget was felt to be justified, the sample size could be increased, in line with some of the NHTSs currently conducted elsewhere around the world. The potential benefits of conducting such a NHTS would far outweigh the costs of so doing. Finally, it is recommended that, if such an endeavour were to be undertaken, it should be managed by the Bureau of Infrastructure, Transport, and Regional Economics (BITRE) which clearly has an interest in the use of data from such a survey, and appears to be an appropriate Commonwealth organisation housing the expertise needed to select appropriate consultants to carry out the survey, to manage the consultants, and to be a repository for the data after the survey is completed.

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