STATED PREFERENCE EVALUATION OF PASSENGER INFORMATION IN DUBLIN

Brian Caulfield, PhD Student, Centre for Transport Research, Department of Civil, Structural and Environmental Engineering, Trinity College Dublin, Dublin 2, Ireland *email:* caulfieb@tcd.ie

Margaret O'Mahony, Director of the Centre for Transport Research, Department of Civil, Structural and Environmental Engineering, Trinity College Dublin, Dublin 2, Ireland *email:* margaret.omahony@tcd.ie

Abstract

Over the last decade a considerable amount of research and investment has been conducted on new technologies to provide passengers with public transport information. This paper describes some of these systems and details the options offered to respondents of a planned Stated Preference (SP) survey to be conducted in Dublin.

The aim of this paper is to examine what type of information passengers require, and how much they might be willing to pay for it. To this extent the SP methodology has been devised to measure respondents' attitudes to public transport information and how this may impact upon their opinion of public transport. The following stages of a passenger's journey have been identified, 'pre-trip planning at origin', 'at-stop/station information', and 'pre-trip planning from destination'. At each of these stages, passengers have been asked to evaluate possible methods of information provision. The results can then be used to demonstrate that at each stage of a passenger's journey how they require their information and their willingness to pay for this information.

Introduction and Background

This paper describes a methodology, which has been developed to evaluate the use of public transport information via Stated Preference (SP) techniques. This study examines from which channels individuals require information to be delivered, be it via the internet, mobile phone, passenger information display (PID) or from a call centre. Considering each of these methods of information delivery, individuals are also asked to state at each stage of their journey ('pre-trip planning at origin', 'at-stop/station information', and 'pre-trip planning from destination'), which source of information for which they have the highest preference.

The public transport system in Dublin is made up of three modes: bus, light rail and heavy rail. The main bus operator Dublin Bus operates a fleet of 1,100 and provided 149 million passenger journeys in 2003 (Córas Iompair Éireann, 2004). The bus system consists of 12 radial Quality Bus Corridors (QBCs), providing passengers with a high quality of service and comparable transit time with that of a private car (Caulfield, O'Mahony, 2004a). The Dublin Area Rapid Transit (DART) system is a heavy rail suburban system, which in 2002 provided 22 million passenger journeys (Córas Iompair Éireann, 2004). In 2004, a new mode of transport was introduced when the light rail transit system, called Luas, became operational. The system to be launched in 2004 offers the first two lines of a planned light rail network.

This paper begins with the details of some of the various technologies used in public transport information provision, and how they have been implemented in Dublin and internationally. The following section details the results of a preliminary study undertaken to examine passengers' information requirements. The next section describes an SP model that has been included to examine the option of including advertisement space in public transport information messages to help fund the financing of passenger information. The following section details the SP design and the attributes and levels chosen. The final section addresses the methods of data collection used in this study and discusses the use of the internet as a means to collect SP data quickly and efficiently. The paper concludes with some discussion points.

Passenger Information Systems

A variety of public transport information systems are in use worldwide. Respondents to the web-based survey this is the first time you mention the web-based survey, you need to introduce it more fully were given a number of such systems to evaluate. The following sections detail some of the systems, which are currently available in Dublin, and it also includes examples from other countries.

The Internet

In Dublin, to date, no integrated website exists that provides passengers with an integrated source of passenger information. Thus, the internet use small i on internet throughout services provided by other public transport authorities, were used to derive the attributes of a passenger information website for this survey. In Gothenburg the public transport authority hosts a comprehensive website providing integrated passenger information and the real-time location of public transport vehicles across the network. Since the launch of the website in 1995 the number of visitors to the website has grown from 100,000 to 1,200,000 in 2001 (Gothenburg Traffic Information Centre, 2002). Transport for London also provides passengers with a comprehensive Internet service with a complete multi-modal, multi-operator journey planner, which is available on the Internet and to mobile phones (Bailey, 2003). Seattle also has an extensive Internet service, which since its launch in 2000 has had over 7,500,000 requests for real-time departure times with 79% of these requests occurring on weekdays (Maclean, and Dailey, 2004).

Real Time Passenger Information (RTPI) Displays

Real Time Passenger Information (RTPI) displays provide passengers with information on the estimated time of arrival of their vehicle via a passenger information display (PID). To date, in Dublin, all of the Luas and DART stops/stations provide RTPI as well as three of the twelve QBC routes – not a complete sentence. The current bus based system is part of a pilot project, and a decision on its extension is pending. However, research conducted by the authors on this system demonstrates the passengers are pleased with the information provided by this pilot service (Caulfield and O'Mahony, 2004b). All of the Luas stops are equipped with PIDs. The Luas PID provides information on the expected wait time, which is displayed on a screen and relayed via audio speakers (O'Mahony, 2004). This is similar to the DART system. However, the DART as yet does not provide audio announcements on wait times.

Internationally RTPI displays have been widely used to provide passengers with transport information for bus and rail. London Buses 'Countdown' system is one of the largest RTPI systems in the world with over 2,000 stops equipped with RTPI displays. This is expected to grow to 4,000 by 2005, resulting in 60% coverage of bus stops in London (Bailey, 2003). San Francisco also has an extensive system of on-street RTPI displays for bus, trolley bus and light rail. This system has been in development since the late 1990-s and operators have estimated that there has been a 5% increase in patronage on their rail services since the real-time systems came online (San Francisco Municipal Railway, 2001). In Dublin, on-board RTPI displays are currently provided on DART and Luas services. The DART provides a scrolling display detailing the name of the next stop, while the Luas provides the same information as well as details of connecting services (O'Mahony, 2004).

Mobile Phones

Mobile phones have been used internationally to send and receive passenger information via Short Message Service (SMS). Currently, in Dublin, two operators provide passenger information via mobile phones. Dublin Bus provides a service called 'BUSTXT', whereby passengers can receive static information on the departure times of buses from their terminus. The only real-time service is provided on the DART service. This system provides passengers with real-time information on the time of arrival of trains at the required stations. To receive real-time information, passengers simply send a message to the operator indicating which station they are at and within seconds they receive the departure times of the next three departures in each direction (south and north bound). Irish Rail launched this service in May 2004, and each SMS costs €0.30 (Irish Rail, 2004). In London, Transport for London provides similar real-time

information on vehicle arrival times and journey planners to mobile phones (Transport for London, 2003). In Seattle, it is also possible to access real-time information through Wireless Application Protocol (WAP) via mobile phones. Since the launch of this system in 2001 it has had on average 3,500 requests for departure times during the first few months in 2001 (Maclean, and Dailey, 2004).

Information Kiosks

Information kiosks are manned/unmanned structures that provide passengers information on public transport. They can be equipped with RTPI displays and route maps to provide passengers with an integrated source of information. On the recommendations of a public consultation in Gothenburg, unmanned kiosks with RTPI displays were installed in 1996; these kiosks received an upgrade in 2000 (Gothenburg Traffic Information Centre, (2002). In Gothenburg these kiosks have been strategically placed adjacent to transfer points, to facilitate passengers using more than one mode or service to complete their journey. San Antonio has also utilised information kiosks as a means to provide passenger information, and since 2000, 40 of these kiosks have been introduced in various locations around the city. These kiosks not only provide public transport information but they also provide passengers with information on traffic conditions (US Department of Transport, 2000).

Paper-based Information

In Dublin, paper-based timetables are available from all operators, detailing the departure time from the terminus of each of the services. These timetables are generally only available at stations or directly from the operators. On-board information in the form of maps on the side of the vehicle is available on all DART and Luas vehicles but this is not available on buses. Bus stops in Dublin provide passengers with time of departure from the origin stop of the service or the expected frequency of the service by time of day.

Preliminary Research Findings

One of the most important steps in conducting an SP study is to have completed a preliminary qualitative study to guide the subsequent phases of the study (Louviere, *et.al*, 2000). With this in mind, a preliminary exploratory study was completed to ascertain passengers preferences for public transport information.

This survey was conducted over a two-week period from the 23rd March – 6th April 2004 using web-based methods. The sampling method chosen was a form of non-probability convenience sampling called snowball sampling (Weisberg *et.al*, 1996). This method of sampling elicits responses from people with a common attribute, in this case those who work in Dublin City Centre and have Internet access. The first group of respondents complete the survey and then forward the survey on to their fellow colleges – colleges?. The process repeats and gathers momentum as the number of responses increases, and the snowball effect occurs. This effect was demonstrated in the results whereby the majority of the results from the survey were collected within the first three days of the survey being posted. In the case of this study, the survey was initially sent to 10 individuals working in Dublin City Centre with computer access, the survey remained open for two weeks; enough for a snowball affect to occur, resulting in 248 responses when the survey closed. As this is a convenience sample it is not representative of the larger population (Waerden and Timmermans, 2003). However, the research is exploratory and it is not intended to make generalisations for the population.

More females than males completed the survey (38% male and 62% female). The majority of respondents (78%) were aged 34 or under. The results for the current mode of transport used demonstrated that a high percentage of the group use public transport with 31% and 16% using bus and rail respectably. The results for other modes namely walking (25%) and car (21%) constituted a sizeable proportion of respondents. Far less used the other modes offered namely cycle (3%), motorbike (1%) and taxi (1%).

Table 1 outlines the respondents' current sources of passenger information. The findings indicate that the 35% of passengers use their existing knowledge to obtain information, while 30% use the Internet. Paper timetables were placed third with 20% of respondents using this method. The other options of SMS, TV/radio, and call centre were placed fourth, fifth and sixth respectively.

Passengers' opinions on the current information provided in Dublin are also displayed in Table 1. Passengers were first asked if they agreed that good information is provided and secondly they were asked if they would like to see more information provided. Respondents were divided on whether information provided was good: 42% either strongly agreed or agreed that it was good, 19% had no opinion and 39% either strongly disagreed or disagreed. Furthermore, although over 40% agreed that information provided was good, 73% of respondents either strongly agreed or agreed that more information should be provided. Whereas only 8% strongly disagreed/disagreed with this statement.

Respondents were also asked to rate the quality of passenger information currently provided at stops/stations. When asked about the quality of the timetables provided, 68% either strongly agreed or agreed that the quality was poor. Moreover, 73% either strongly agreed or agreed that the quality of maps provided was poor. Finally, respondents were asked if the lack of information deterred them from using public transport. The majority of respondents disagreed with this statement (59% strongly disagreed/disagreed). A further 21% of respondents either strongly agreed or agreed, that the lack of information deterred them from using public transport information. This 21% is a sizeable proportion of respondents and demonstrates that improvements to the system may attract more passengers. The results show that passengers found the current provision of information inadequate, however it was not a strong enough factor to deter them from using the services.

TABLE 1 Results detailing current information opinions

Which of the following sources do currently you use to obtain public transport information?

	No. of responses	*Percentage*
Existing Knowledge	**160**	**35%**
Internet	138	30%
Mobile Phone	23	5%
Paper Time Tables	91	20%
Call Centre	9	2%
TV/Radio	21	5%
None of these	14	3%

This question seeks your opinion on public transport information provision in Dublin. Please state your level of agreement with each of the following statements.

	Strongly Agree	Agree	No Opinion	Disagree	Strongly Disagree
Good information is provided	2%	**40%**	19%	32%	7%
I would like to see more information provided	31%	**42%**	19%	6%	2%
The quality of bus/rail time tables at stops/stations provided is poor	33%	**35%**	11%	19%	2%
The quality of bus/rail maps at stops/stations is poor	40%	**33%**	17%	7%	3%
The lack of information deters me from using public transport	6%	15%	20%	**49%**	10%

Preferences on Form of Public Transport Information by Stage of Trip

The following sections outline the respondents' preferences for the tools of information provision offered in the survey, at each stage of their trip.

Stage One: Pre-trip information from origin to destination

The information options offered to respondents for the first stage of a trip were: [1] the Internet, [2] paper-based timetables, [3] call centres, and [4] SMS. The results in Table 2 demonstrate that paper-based timetables are the most popular option with 48% of the first preference and 25% second preference responses. The Internet was ranked second with 30% and 27% of the first and second preferences respectively. The results show that mobile phone (17%) and call centres (5%) as the third and fourth preferred options, with relatively lower first and second preference responses – not a complete sentence, badly written. The lower rankings for SMS and call centres may be attributable to the cost associated with these forms of communication as discussed earlier.

Stage Two: At-stop information

The alternatives offered to respondents for this stage of a trip were: [1] information kiosks, [2] paper-based timetables, [3] call centres, [4] SMS, and [5] RTPI displays. The results for this stage indicate that the majority of respondents have a preference for RTPI displays with 74% of first preference responses as seen in Table 2. Paper-based methods had the next highest number of first preferences with 12% and 39% of second preferences. Information kiosks were ranked third with 5% of the first preferences and 36% of second. The remaining two options had similarly low first and second preferences with SMS indicated to be slightly preferred to the call centre option.

Stage Three: On-board vehicle information

The alternatives presented to respondents at this stage were: [1] paper-based information placed on the inside of the vehicle, [2] call centres, [3] SMS, [4] onboard RTPI displays, and [5] asking the driver. The results for this stage are quite similar to the results in the second stage, with the onboard RTPI system achieving the highest number of first preference responses (68%) as seen in Table 2. Similarly ?? to the previous results poor writing paper-based methods had the second highest preference with 12% of first and 57% of second preferences. The remaining options had lower levels of first and second preferences; asking the driver 12% and 13% SMS 6% and 15% and call centres 3% and 3% of first and second preferences respectively – needs editing, what are the 12% and 13% etc?.

Stage Four: Pre-trip information from destination to return to origin

The choices given to respondents at this stage were: [1] information kiosk, [2] paper-based timetables, [3] the Internet, [4] call centres, and [5] mobile phones. The results show that the Internet is the favoured option at this stage with 64% of the first preference responses, as seen in Table 2. Paper-based information again had the second highest number of first preferences with 26% and 31% of second preferences. A contributing factor to the Internet having the higher preference may be due to the sample taken, in that it was of office workers with access to the Internet. The next highest preference was for SMS with 7% of first and 19% of second preferences, followed by information kiosks with 6% and 18% of first and second preferences. The fifth placed option is the call centre, with 3% and 15% of first and second preferences.

Table Two – different numbering system to previous: Stage by stage passenger information preferences

	First Preference	Second Preference	Third Preference	Fourth Preference	Fifth Preference	Mean Score
Stage One: Pre-trip information from origin						
Paper Based	96 (48%)	46 (25%)	26 (15%)	22 (11%)		1.36
Call Centre	9 (5%)	45 (24%)	64 (37%)	69 (36%)		2.19
SMS	35 (17%)	44 (24%)	57 (34%)	48 (25%)		1.87
Internet	60 (30%)	48 (27%)	24 (14%)	54 (28%)		1.7
Stage Two: At-stop information						
Information Kiosk	11 (5%)	65 (36%)	66 (36%)	28 (17%)	14 (8%)	2.92
Paper-based	26 (12%)	70 (39%)	50 (27%)	23 (15%)	17 (10%)	1.89
Call Centre	6 (3%)	5 (3%)	29 (16%)	48 (27%)	93 (54%)	2.00
SMS	12 (6%)	27 (15%)	30 (16%)	66 (38%)	47 (27%)	2.51
RTPI Display	154 (74%)	16 (9%)	9 (5%)	3 (3%)	3 (1%)	0.98
Stage Three: On-board vehicle information						
Ask Driver	28 (13%)	23 (13%)	72 (41%)	23 (14%)	35 (20%)	2.21
Paper Based	25 (12%)	103 (57%)	41 (23%)	7 (4%)	3 (1%)	1.63
Call Centre	5 (3%)	5 (3%)	19 (11%)	54 (33%)	94 (55%)	3.0
SMS	8 (4%)	22 (12%)	33 (18%)	76 (47%)	39 (23%)	2.57
RTPI Display	139 (68%)	27 (2%)	12 (7%)	3 (2%)	3 (1%)	1.03
Stage Four: Pre-trip information from destination						
Information Kiosk	13 (6%)	34 (18%)	37 (22%)	41 (25%)	54 (30%)	2.53
Paper-based	52 (26%)	60 (31%)	28 (17%)	26 (16%)	18 (11%)	1.78
Call Centre	5 (3%)	25 (13%)	56 (34%)	43 (25%)	49 (28%)	2.48
SMS	13 (7%)	36 (19%)	34 (20%)	49 (29%)	47 (26%)	2.45
Internet	118 (64%)	36 (20%)	12 (7%)	8 (4%)	10 (5%)	1.22

Upon consultation with the preliminary research findings the following decisions were taken:

- Given the similarity in the results between stages two and three these stages have been combined and an additional SP game was introduced to examine possible alternative financing arrangements (discussed in greater detail in the next section).
- Although paper based information sources recorded high preference ratings, the proceeding stages of the analysis will concentrate on real-time information. This decision concentrates the focus of the study on a largely non-market good, measuring passenger's preferences for this form of information provision.

- As only real-time information provision options were chosen it was decided to examine three information provision options for each model (for SP design purposes) therefore at each stage the options with the lowest mean scores were chosen for analysis in the SP games.

Examining the Impact of Including Advertising with Public Transport Information

Internationally the type of information discussed in this paper is generally provided free of charge to passengers. However, given the considerable cost of providing such information it was decided to examine the possibility of recovering some of this cost via the sale of advertisement space. Advertisements in stations, at bus stops and inside and outside of vehicles have long been a source of revenue for public transport operators. The purpose of adding an attribute level with advertising to the SP games is to ascertain if respondents will accept some element of advertising with the information service in lieu of paying for the information. Preliminary work by Molin and Chorus (2004) found that with SMS information passengers were indifferent as to whether an advertisement was present or not. This study aims to contribute further to this field of knowledge by examining different information provision mediums, and also examining how varying the levels of advertisements will impact upon respondents' choices.

The impact of advertising will be analysed on the following information provision mediums, the Internet, receiving an SMS via a mobile phone and using a call centre. These were chosen because they were easily measurable with regards to including an advertisement space. The levels for this attribute were decided upon after the pilot study.

Stated Preference Design

The attributes and their levels for the SP design were chosen from consultation with the results of the preliminary study. Given that the introduction of real-time information is a key element of this project, any methods of static information provision such as paper timetables, maps etc have been excluded from the SP games. However, static means of information provision will be examined qualitatively from the results of the SP survey – editing needed.

One of the key considerations to be taken into account before deciding upon the design of SP is studies ??? the number of attributes to be presented to respondents. Smith and Desvouges, (1987) found that they achieved the most consistent results for ranking sets when respondents were given between 4 and 6 games, and concluded that more than 8 confused respondents. However Johnson and Desvouges (1997), found that for paired ratings respondents could evaluate upwards of 26 games. Brazell and Louivere (1997) demonstrated that response rates and model parameters were much the same when comparing respondents that had been given 24, 48 and 96 choice sets for a particular task. Brazell and Louivere demonstrated by using a test outlined in (Swait and Louivere, 1993) that after correcting for average variances between conditions, the values of the vectors were roughly the same. To conclude, a rule of thumb that can be applied is that respondents can answer between 1 – 16 choice situations, with an average of 8 (Carson *et.al* 1994). Given the empirical evidence, it was decided to provide respondents with 16 choice situations.

The design of this SP model allows for 3 variables to be examined with 2 attributes with 3 levels and 1 attribute with 2 levels. A collective factorial design was used to combine all attributes and attribute levels of each alternative into one design. The final factorial design generated 36 models to be examined. This design allows for all of the main effects between the attributes and their levels to be examined. Empirically this accounts for between 80 and 90% of explained variance (Dawes and Corrigan, 1974).

To complete the project, respondents will be asked to evaluate 4 SP models representing the three stages of a passenger's trip and the financing model. Therefore given that the 4 models need to be evaluated there are 144 (36*4) games to be measured. This is obviously too much for every respondent to evaluate, therefore 144 games will be distributed between the 9 versions of the SP survey. This will result in each respondent considering 16 games, with 4 games from each model. The results from each of the surveys will be combined and an analysis of the different attributes may be examined collectively. This splitting of SP games is quite common especially when it is deemed that evaluating the whole model is too much for one respondent as described in Louviere *et.al* 2000 and Ben-Akiva and Lerman 1985.

All SP studies require that each decision maker *n* make a choice among *J* alternatives. The utility derived from *j* alternatives needs to be ascertained, therefore:

$$Unj, \qquad \varepsilon_{nj} \forall j \;\; j = 1, ..., J. \tag{1}$$

It is assumed the decision maker is rational and will only choose the alternative that maximises utility, therefore:

$$U_{ni} > U_{nj} \forall j \neq i \tag{2}$$

Where: U_{ni} is the utility individual *n* derives from good i $\varepsilon_{nj} \forall j$

U_{nj} is the utility individual *n* derives from good j

One cannot observe all of the aspects of utility, therefore it may be broken into two sections, $U_{nj} = V_{nj} + \varepsilon_{nj}$, where ε captures the components of utility that are not captured by the researcher. Whereas cannot start a sentence with whereas V_{nj} is termed representative utility, which may be defined as something that is measurable and where ε_{nj} is treated as a randomly distributed term.

It is possible to observe some attributes of the alternatives as faced by the decision maker labelled $x_{nj} \forall j$, and some attributes of the decision maker labelled s_n, and this specifies a function that relates these observed factors to the decision makers utility.

$$V_{nj} = V(x_{nj}, s_n) \forall j \tag{3}$$

See Louivere *et.al* (2000) or Ben Akiva and Lerman, (1985) for more detail on the construction of random utility models.

The alternatives ($x_{nj} \forall j$) faced buy the decision maker over the four models are as follows;

Model one: Pre-trip planning from home to work

Public transport web site:	Reduced waiting time at the stop/station (3 levels), Information why start information with a capital letter? provided (2 levels) and time taken to access the information (3 levels).
Call Centre:	Reduced waiting time at the stop/station (3 levels), Information provided (2 levels) and cost (3 levels).
Mobile phone (SMS):	Reduced waiting time at the stop/station (3 levels), Information provided (2 levels) cost (3 levels).

Model two: Information available at stop

PID:	Reduced waiting time at the stop/station (3 levels), Information provided (2 levels) cost (3 levels).
Call Centre:	Reduced waiting time at the stop/station (3 levels), Information provided (2 levels) and cost (3 levels).
Mobile phone (SMS):	Reduced waiting time at the stop/station (3 levels), Information provided (2 levels) cost (3 levels).

Model three: Pre-trip planning from work to home

Public transport web site:	Reduced waiting time at the stop/station (3 levels), Information provided (2 levels) and time taken to access the information (3 levels).
Call Centre:	Reduced waiting time at the stop/station (3 levels), Information provided (2 levels) and cost (3 levels).
Mobile phone (SMS):	Reduced waiting time at the stop/station (3 levels), Information provided (2 levels) cost (3 levels).

Model Four: Passenger information options, with advertisements

Public transport web site:	Reduced waiting time at the stop/station (3 levels), Information provided (2 levels) and amount of advertising with the information (3 levels).
Call Centre:	Reduced waiting time at the stop/station (3 levels), Information provided (2 levels) and amount of advertising with the information (3 levels).
Mobile phone (SMS):	Reduced waiting time at the stop/station (3 levels), Information provided (2 levels) and amount of advertising with the information (3 levels).

The attributes of the decision maker labelled (S_n) should this be superscript? to be examined will be as follows;

- Gender
- Income
- Occupation
- Car availably
- Opinions of public transport
- Proximity to frequent public transport
- Geographical location
- Amount of time spent in Dublin
- Access to technology to access the information
- Working hours

The values for the attribute levels were decided upon after consultation with the literature, the results from the piloting stages of the project and some of the preliminary background research (Caulfield and O'Mahony, 2004b). As yet it has not been determined to what extent any of the attributes of the decision maker may be significant. However, based on empirical studies general demographic attributes of a respondent, typical of the majority of SP studies, which have been included, plus some attributes that the authors feel may prove to impact significantly over respondents SP choices – sentence is badly written – unclear what is meant.

Data collection

The data collection technique for the SP study is the same as that used for the preliminary study via a web-page survey. The use of web-based surveys has increased dramatically which is mainly due to their ability to collect large amounts of data without interviews, to process results without data entry and the elimination of stationery and postage costs (Witt, 1998). However one must also take into account the biases that a web-based survey introduces, that is, that not all individuals have access to the Internet. However, in Ireland the rates of Internet usage is ever increasing; in 2003, 39.4% of households in Dublin had access to the Internet (Central Statistics Office, 2004) and in 2004, 43% of Irish adults currently use the Internet from any location (work or home etc) (Commission for Communications Regulation, 2004).

Web-based surveys have been increasingly adapted for transport studies, for example, in SP, travel diaries and travel behavioural studies (DeSalle, 2003; Marca, 2003; Fayish, 2004; Stinson, 2004). The benefits (as discussed) of web-based surveys are becoming more widely known and therefore their use is increasing. In the area of SP survey implementation the use of web-based surveys is also growing, where along with the disadvantages of survey bias and coverage error there can be considerable advantages when using a web-page approach. Such as you cannot start a sentence with Such as the elimination of response coding and digitising error, and the possibility of including images and sound. Another significant benefit is the possibility to randomise automatically the games presented in each situation enabling the avoidance of *sequence effect* (Iraguen and Ortuzar, 2004).

The population under consideration in this study includes individuals that work in the Dublin 2 area, which is the postal zone of the city centre. This area was chosen because it is a key destination location for work trips. People travelling into the city centre thereby encounter all methods and means of transport in the city, This area is one of high employment density. Having established the population, it was divided into those companies in an office based environment and those not in an office based environment. This was done because the sub-population of interest are those individuals that use the Internet each day. As it was felt to properly and fairly examine all badly written of the technologies, that respondents should have daily access all of the methods of information delivery which are presented to them in the SP games – cannot understand meaning of

this sentence. From this sub-population a simple random sample was taken and the companies selected were contacted and asked to distribute the survey via email to their employees.

The survey construction was completed using SPSS Data Entry builder, which enables the creation of a HTML based surveys. As previously mentioned, 9 versions of the survey were constructed and therefore a random generator had to be constructed to randomly assign one of the 9 versions to each respondent when they clicked on the survey URL. Therefore a programme was written using a normal random function in Java script, which enables the user when clicking on the survey URL to be randomly assigned to one of the 9 versions of the survey. The data collected will be automatically stored in a database, which will be transferred into LIMDEP (Econometric Software) for discrete choice modelling as seen in Figure 1.

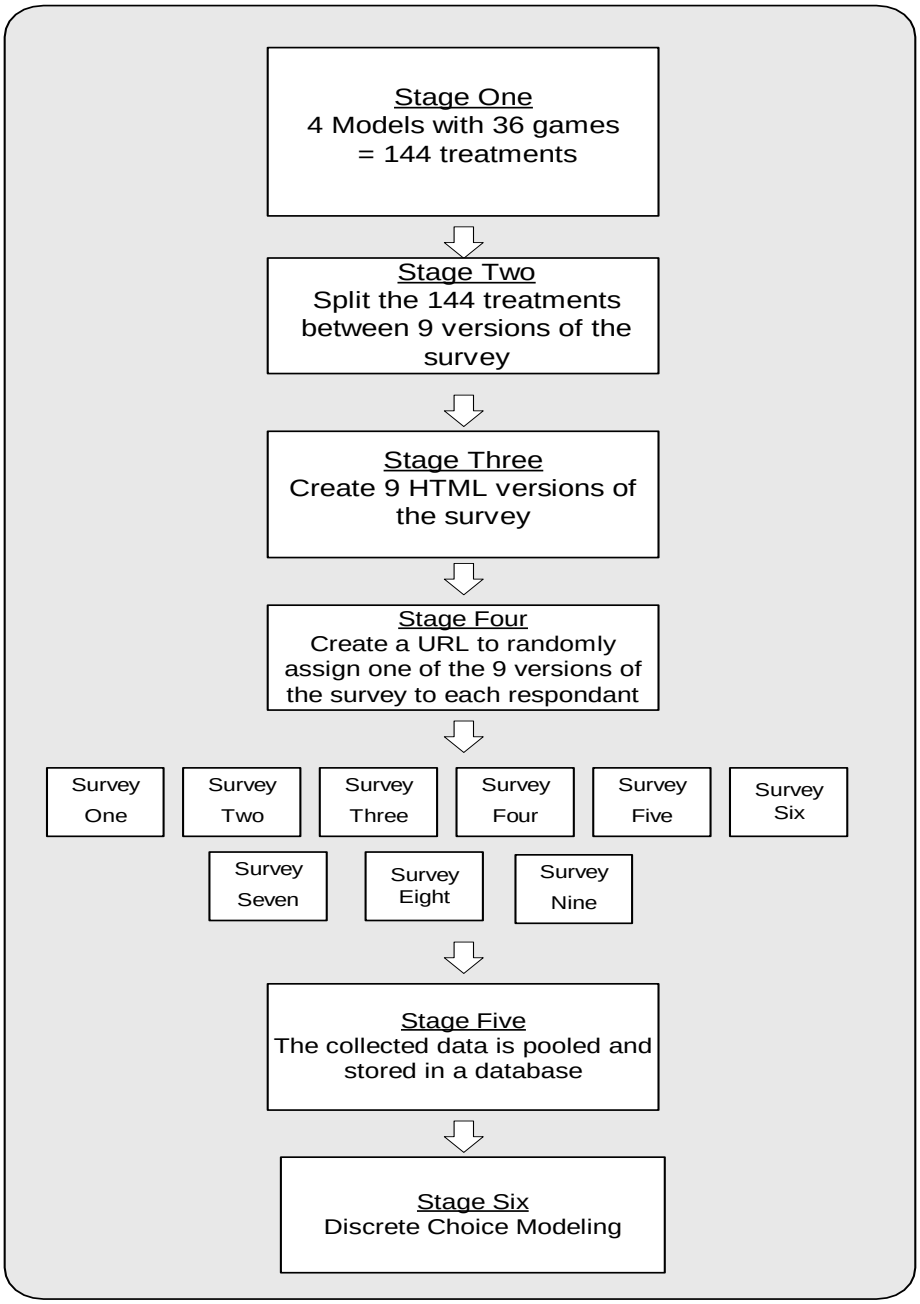

Figure 1. Data collection stages

When the data has been collected and pooled, it shall be imported into LIMDEP for discrete choice modelling. The results will be presented at a later stage.

Conclusions

The results from the preliminary study demonstrate that passengers in Dublin have a desire for an improvement in the means by which public transport information is provided. It is also apparent from the results that they would like to see real-time information options available.

By combining the snowball sampling technique and the web-based survey approach it allowed the data to be collected quickly and continently ???, as demonstrated in the preliminary exploratory research.

Given the defined population for this study the authors feel that the delivery of the survey via web-based methods best suits the project for both the efficiencies associated with this method and the ability of the method to reach the desired population.

The introduction of a SP game to examine the impact of including advertisements in public transport information will, it is hoped provide an interesting results and contribute to the debate as to the best possible method for funding real-time passenger information.

The analysis of the different stages of a passenger's journey and the information they require, will inform policy makers as to how best to invest funding in information provision, based upon passengers demand.

Acknowledgment

The research is supported by the Department of Transport under the Pilot Transport Research Programme, administered by the Higher Education Authority.

References:

Bailey, G. (2003), Implemented Travel Information Strategies, Delivering customer information to Londoners using new technology, Proceedings of the 3rd UITP Conference on Travel Information, Gothenburg, Sweden

Ben-Akiva, M and Lerman, S. R. (1985), Discrete Choice Analysis: Theory and Application to Travel Demand, MIT Press, USA.

Brazell, J. and Louviere, J. (1997): 'Respondents' help, learning and fatigue', paper presented at INFORMS Marketing Science Conference, University of California at Berkeley, March 1997

Carson, R.T., Mitchell, R.C., Haneman, W.M., Kopp, R.J., Presser, S. and Ruud, P.A. (1994): 'Contingent valuation and lost passive use: damages from the Exxon Valdez', Resources for the future discussion paper, Washington, DC.

Caulfield. B, and O'Mahony, M., (2004a), Evaluating the success of Quality Bus Corridors in Dublin using an Automatic Licence Plate Recognition System, *Transport Research Record*, In Press

Caulfield. B, and O'Mahony. M.M, (2004b), The provision of on street passenger information via real-time methods; A case study of Dublin, RTIC IEE, 501, 1-10.

Central Statistics Office, http://www.cso.ie/pressreleases/prelcen02pser.html. Accessed 13th of April 2004

Commission for Communications Regulation, (2004), Irish Communications Market, Quarterly Key Data, June 2004, Dublin, Ireland

Córas Iompair Éireann (2004), CIE Group Annual Report and Financial Statements 2003, Dublin, Ireland

DeSalle, B. R. and Tarko, A. P., (2003), Quality of Highway Safety Information Collection with an Internet-Based Survey Tool, (CD-ROM) 82nd Annual Meeting of the Transportation Research Board. Washington DC, January 2003

Fayish. A. C. and Jovanis. P. P., (2004), Usability study of state wide web-based roadway weather information systems, (CD-ROM) 83rd Annual Meeting of the Transportation Research Board. Washington DC, January 2004

Gothenburg Traffic Information Centre (2002), 'Effects of real-time information in Gothenburg, 19th GoTiC Report, 2002

Irish Rail, http://www.irishrail.ie/dart/home/, Accessed 22nd June 2004

Johnson, F.R. and Desvouges, W.H. (1997) 'Estimating stated preferences with rated-pair data: environmental, health and employment effects of energy programmes', Journal of Environmental Economics and Management, 34(1), 79-99

Louviere, J. J., D. A. Hensher, J.D. Swait (2000) Stated Choice Methods: Analysis and Application, Cambridge University Press

Maclean, S.D. and Dailey, D.J., (2004), Wireless Internet Access to Real-Time Transit Information, (CD-ROM) 83rd Annual Meeting of the Transportation Research Board. Washington DC, January 2004

Marca, J. E., (2003), The Design and implementation of an on-line travel and activity survey, (CD-ROM) 82nd Annual Meeting of the Transportation Research Board. Washington DC, January 2003

O'Mahony, M., (2004), Light Rail Transit in Dublin, (CD-ROM) 83rd Annual Meeting of the Transportation Research Board. Washington DC, January 2004

San Francisco Municipal Railway, (2001), Short Range Transit Plan, 2002-2021, San Francisco, USA

Swait, J., and Louviere, J. (1993): 'The role of the scale parameter in the estimation and use of multinomial logit models', Journal of Marketing Research 30: 305-14

Smith, V.K. and Desvouges, W.H. (1987) 'An empirical analysis of the economic value of risk changes', Journal of Political Economy, 95(1), 89-114

Stinson, M. A. and Bhat, C. R., (2004) An Analysis of the Frequency of Bicycle Commuting Using and Internet-Based Survey, (CD-ROM) 83rd Annual Meeting of the Transportation Research Board. Washington DC, January 2004

Transport for London, (2003), Annual Report 2002/03, London, UK

US Department of Transport, (2000), Metropolitan Model Development Initiative, San Antonio Evaluation Report, Washington DC

Weisberg, H. F., Krosnick. J. A. and Bowen, B. D., (1996), An Introduction to Survey Research, Polling, and Data Analysis, Third Edition, *Sage Publications*

Waerden, V. and Timmermans, H., (2003), Key Events and Critical Incidents Influencing Transport Mode Choice Switching Behaviour: An Exploratory Study, (CD-ROM) 82nd Annual Meeting of the Transportation Research Board. Washington DC, January 2003

Witt, K., (1998), Best Practices in Interviewing Via the Internet, Proceedings of Sawtooth Software Conference, Sawtooth Software, Inc Sequim, Washington, pp. 15-37